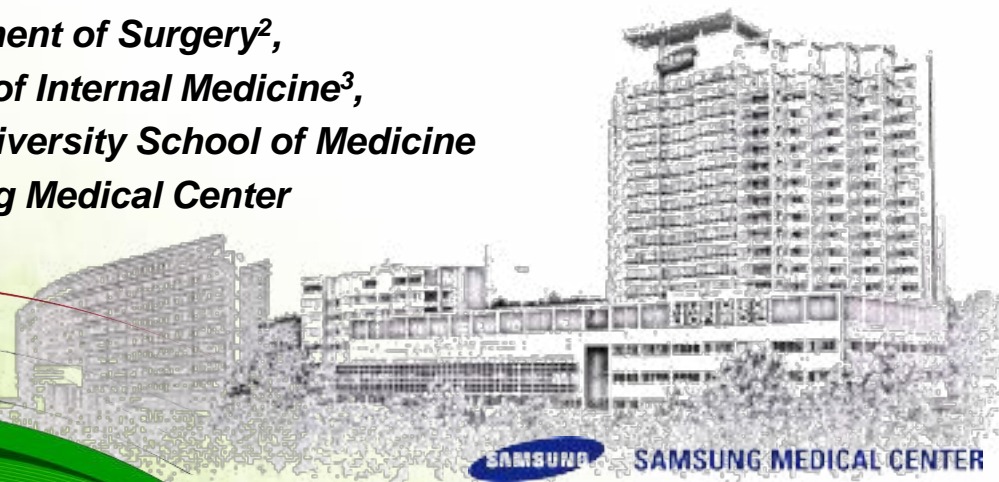




# ***Risk Factors of ICU Readmission within 48hrs in the Critically Ill Cancer Patients***

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# Background

- ✓ ICU readmission
  - ✓ Poor outcome
  - ✓ Higher medical cost
  - ✓ Indicators of healthcare quality
- ✓ The criteria used to decide the patients' ICU discharge are extensive and quite subjective, contributing to undue indications and risks for patients.
- ✓ Cancer itself affect the patient prognosis.
- ✓ The risk factors of ICU readmission for medical cancer patients may be different compared with non-cancer patients.

# Background

## Purpose

- ✓ To identify risk factors for ICU readmission within 48 hours following ICU discharge in critically ill cancer patients

# Methods

## Retrospective observational cohort study

### Patients selection

- Between Jan. 2011 and Dec. 2012
- Medical oncologic patient
- **Unplanned** ICU admission
- 18 years or older
- Exclusion
  - patients who died during 1<sup>st</sup> ICU admission
  - patients who discharged from ICU for palliative care
  - Patients who transferred directly other institution from ICU

### Event – ICU readmission

- ICU readmission within 48 hours after ICU discharge

# Methods

## Variables

- **Baseline characteristics**
  - Age, sex, BMI, Comorbidity
  - Reason of ICU admission
  - Severity score: SAPS3, SOFA
  - Length of stay (ICU, hospital)
- **Status of malignancy**
  - type of malignancy (hematologic or solid)
  - disease status (relapsed/refractory)
  - extensiveness (extent of the tumor or major organ involvement)
  - Recent chemotherapy
- **Intensive care intervention during 1<sup>st</sup> ICU admission**
  - Mechanical ventilator, CRRT, vasopressor
- **Clinical status on ICU admission/discharge**
  - Vital sign, laboratory data
- **Outcomes**
  - Mortality
  - Additional Tx following ICU discharge (CTx, RT, BMT)

# Methods

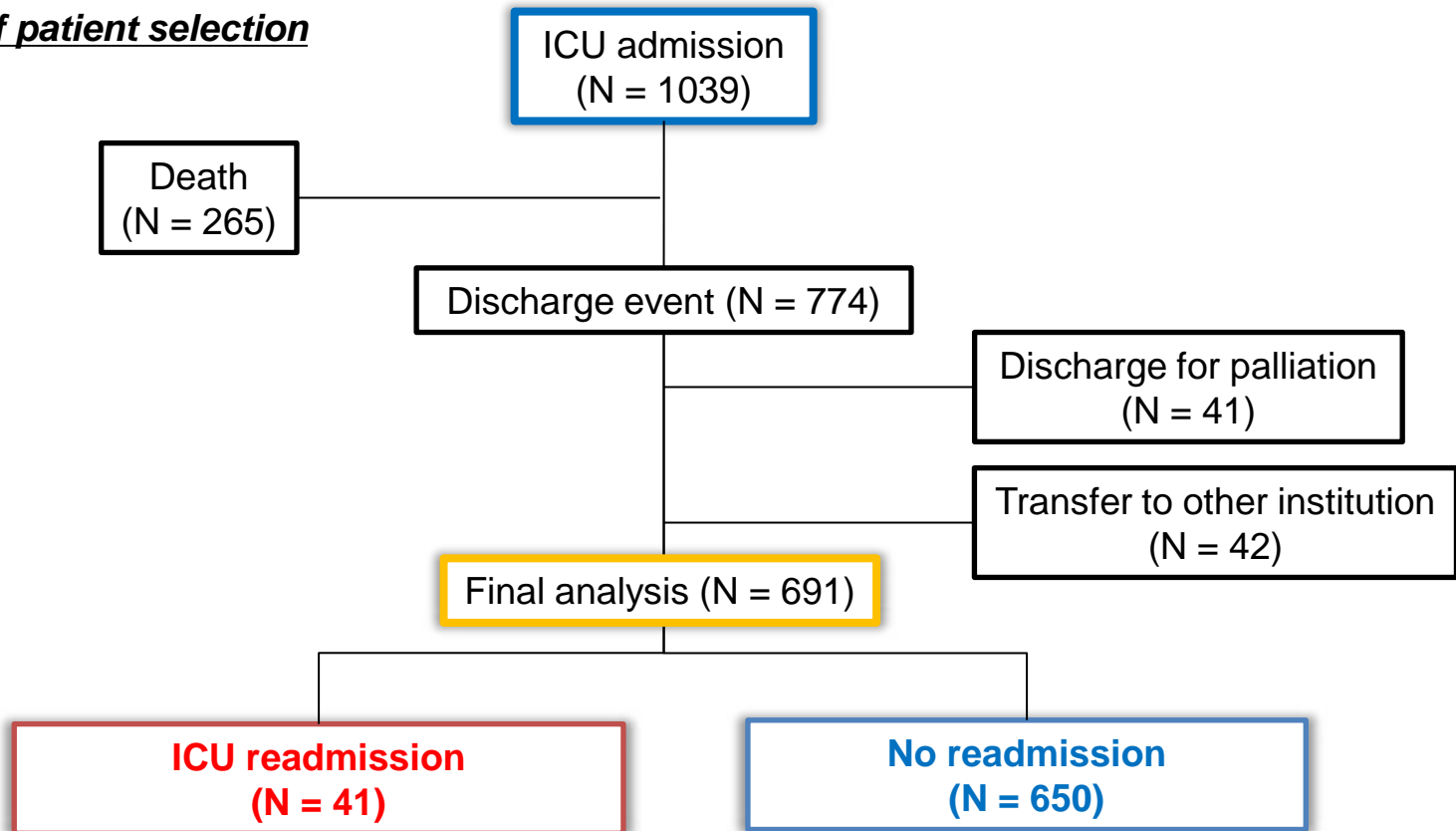
## Study analysis

- Median and interquartile ranges (IQRs) or as the number (percentage) of patients
- To identify the risk factor for the unplanned ICU readmission
  - logistic regression analysis
- All tests were 2 sided, and  $P < 0.05$  was considered statistically significant.
- Data were analyzed using IBM SPSS statistics 20 (IBM, Armonk, NY).

# Methods



Flowchart of patient selection



# Result - Admission characteristics

	No readmission (n = 650)	Readmission (n = 41)	<i>p</i>
Age (yrs)	63 (51 - 70)	61 (51 - 71)	0.76
Gender (Male)	429 (66.0)	27 (65.9)	0.99
<b>ECOG</b>			<b>0.019</b>
0	420 (64.6)	17 (41.5)	
1	77 (11.8)	8 (19.5)	
2	67 (10.3)	5 (12.2)	
3	61 (9.4)	8 (19.5)	
4	25 (3.8)	3 (7.3)	
BMI (kg/m <sup>2</sup> )	21.5 (19.3 - 23.7)	20.5 (19.1 - 23.9)	0.39
Comorbidity			
Renal failure	48 (7.4)	4 (9.8)	0.54
Congestive heart failure	49 (7.5)	4 (9.8)	0.55
History of IHD	39 (6.0)	2 (4.9)	>0.99
Cerebrovascular disease	50 (7.7)	4 (9.8)	0.55
COPD	30 (4.6)	4 (9.8)	0.14
Cirrhosis	60 (9.2)	2 (4.9)	0.57
DM	147 (22.6)	10 (24.4)	0.79



# Result - Cancer status

	No readmission (n = 650)	Readmission (n = 41)	<i>p</i>
<b>Hematologic malignancy</b>	<b>222 (34.2)</b>	<b>21 (51.2)</b>	<b>0.026</b>
State of cancer			
Duration of cancer (months)	5.6 (1.2 - 22.1)	4.3 (0.9 - 20.8)	0.80
First presentation	133 (20.5)	9 (22.0)	0.82
Relapsed or refractory state	229 (35.2)	16 (39.0)	0.62
Extensiveness of cancer	323 (49.7)	24 (58.5)	0.27
Major organ involvement of cancer*	169 (26.0)	15 (36.6)	0.14
Stem cell transplantation	48 (7.4)	6 (14.6)	0.12
CTx prior to 1 <sup>st</sup> ICU admission within 4 wks	297 (54.3)	19 (46.3)	0.32
CTx prior to 1 <sup>st</sup> ICU admission within 6 months	405 (62.3)	29 (70.7)	0.27

Major organ: brain, lung, heart, kidney, liver

# Result - Intensive care related variables

	No readmission (n = 650)	Readmission (n = 41)	<i>p</i>
Reason for 1 <sup>st</sup> ICU admission			
Respiratory failure	190 (29.2)	11 (26.8)	0.74
Sepsis/septic shock	222 (34.2)	18 (43.9)	0.20
Cardiovascular	140 (21.5)	7 (17.1)	0.50
Bleeding	42 (6.5)	1 (2.4)	0.50
Decreased level of consciousness	18 (2.8)	1 (2.4)	>0.99
Others	38 (5.8)	3 (7.3)	0.73
<b>SAPS3 Initial ICU admission</b>	<b>65 (55 - 75)</b>	<b>76 (64 - 86)</b>	<b>&lt;0.001</b>
<b>SOFA of Initial admission</b>	<b>5 (3 - 8)</b>	<b>8 (6 - 10)</b>	<b>&lt;0.001</b>
<b>SOFA of 1<sup>st</sup> ICU discharge</b>	<b>3 (1 - 6)</b>	<b>5 (4 - 7)</b>	<b>&lt;0.001</b>
Intensive care interventions during 1 <sup>st</sup> ICU			
Hemodialysis	60 (9.2)	4 (9.8)	0.79
Use of vasopressors,	286 (44.0)	24 (58.5)	0.070
<b>Mechanical ventilation</b>	<b>230 (35.4)</b>	<b>26 (63.4)</b>	<b>&lt;0.001</b>
<b>Length of 1st ICU stay (days)</b>	<b>3 (2 - 6)</b>	<b>5 (2 - 11)</b>	<b>0.002</b>

# Result - Vital signs and laboratory findings at the time of ICU discharge

	No readmission (n = 650)	Readmission (n = 41)	p
Physiologic state at 1 <sup>st</sup> ICU discharge			
Heart rate (per/min)	92 (79 - 104)	101 (88 - 118)	0.002
Respiratory rate (per/min)	20 (16 - 24)	21 (17 - 27)	0.091
Systolic blood pressure (mmHg)	121 (108 - 138)	128 (111 - 146)	0.23
SpO2 (%)	97 (95 - 99)	97 (96 - 99)	0.51
Glasgow Coma Scale	15 (15 - 15)	15 (14 - 15)	<0.001
Laboratory data at 1st ICU discharge			
PaO <sub>2</sub> /FiO <sub>2</sub>	409 (362 - 485)	430 (344 - 516)	0.89
PaCO <sub>2</sub> (mmHg)	33.6 (30.2 - 38.4)	35.4 (32.1 - 40.8)	0.038
pH	7.472 (7.443 - 7.501)	7.461 (7.418 - 7.498)	0.28
WBC (x10 <sup>3</sup> /μl)	7.29 (4.21 - 11.49)	6.91 (1.91 - 13.12)	0.47
Hgb (g/dl)	9.9 (9.0 - 11.2)	9.6 (8.9 - 10.3)	0.053
Platelet (x10 <sup>3</sup> /μl)	113 (42 - 218)	49 (22 - 93)	<0.001
Albumin (g/dl)	2.9 (2.6 - 3.2)	2.8 (2.5 - 3.0)	0.25
CRP (mg/dl)	6.64 (3.53 - 13.33)	7.78 (2.48 - 12.5)	0.82
Procalcitonin (μg/dl)	0.94 (0.23 - 5.89)	1.30 (0.38 - 7.92)	0.47
BUN (mg/dl)	20.4 (13.1 - 29.9)	24.3 (12.0 - 34.7)	0.23
Cr (mg/dl)	0.71 (0.52 - 1.01)	0.61 (0.51 - 0.97)	0.52
Na (mmol/l)	137 (134 - 141)	139 (135 - 143)	0.107
Lactate (mmol/l)	1.36 (1.00 - 1.93)	1.73 (1.30 - 2.51)	0.001
HCO <sub>3</sub> (mmol/l)	24.8 (22.0 - 28.1)	26.1 (23.7 - 29.5)	0.062
NT-proBNP (pg/ml)	1303 (485 - 5375)	4233 (1336 - 17252)	0.002
Total bilirubin (mg/dl)	0.7 (0.5 - 1.5)	1.1 (0.6 - 2.9)	0.017

# Result - Clinical outcome

	No readmission (n = 650)	Readmission (n = 41)	<i>p</i>
Length of hospital stay (days)	22 (12 - 42)	37 (21 - 67)	0.001
Additional treatment after initial ICU discharge			
Chemotherapy after 1st ICU discharge	273 (42.3)	10 (25.0)	0.031
Radiation	109 (19.8)	2 (5.0)	0.021
Stem cell transplantation	12 (6.3)	2 (9.1)	0.65
Hospital mortality	141 (21.7)	22 (53.7)	<0.001
30 days mortality after 1st ICU discharge	117 (18.0)	17 (41.5)	<0.001
90 days mortality after 1st ICU discharge	218 (33.5)	23 (56.1)	0.003
1 year mortality after 1st ICU discharge	319 (49.1)	29 (70.7)	0.007

# Result - Multivariate logistic regression analysis

	Odd ratio	95% CI	p-value
<b>COPD</b>	4.96	1.41-17.46	0.013
<b>Major organ involvement</b>	2.20	1.05-4.64	0.038
<b>Mechanical ventilation during 1<sup>st</sup> ICU admission</b>	2.33	1.12-4.85	0.023
<b>ECOG<math>\geq</math>1</b>	2.13	1.05-4.35	0.037
<b>SOFA <math>\geq</math>4 *</b>	2.74	0.93-8.04	0.068
<b>Heart rate &gt;115/minute *</b>	4.05	1.91-8.61	<0.001
<b>Respiratory rate &gt;25/minute *</b>	2.53	1.15-5.56	0.022
<b>GCS <math>\leq</math>14 *</b>	1.94	0.93-4.01	0.076
<b>Platelet &lt;106 (<math>\times 10^3/\mu\text{l}</math>) *</b>	2.82	0.97-8.25	0.058

\* Data at 1<sup>st</sup> ICU discharge

- Only high-quality, at least 95% complete, variable ( $p < 0.2$  in univariate analysis) were used for the analysis. Missing data were imputed by averaging the non-missing values for continuous variables.
- Major organ: brain, lung, heart, kidney, liver

# Summary

- ✓ Early (<48hrs) ICU readmission (6%, n=41)
- ✓ The patients experienced with ICU readmission showed poorer outcomes (higher mortality, low chance of additional anti-cancer therapy).
- ✓ Status of cancer, such as ***duration of cancer, type of cancer, relapse/refractory, extensiveness, and recent chemotherapy*** were not **associated** with the ***early ICU readmission***.

Factors affecting ICU readmission within 48hrs after ICU discharge

- ✓ ***COPD***
- ✓ ***Cancer involvement to the major organ***
- ✓ ***Mechanical ventilation during 1<sup>st</sup> ICU***
- ✓ ***ECOG***
- ✓ ***Tachycardia (>115 per/min)***
- ✓ ***Tachypnea (>25 per/min)***

# Conclusion

- *If the patients have **tachycardia(>115 per/min)** or **tachypnea (>25 per/min)**, physician should **reconsider** before deciding the ICU discharge to prevent early ICU readmission.*
- *The patients who got other risk factors, **such as major organ involvement, COPD**, should be monitored with **great care after ICU discharge** to prevent early ICU readmission.*



*Thank you  
for your attention*