

# Building an AIoT-Driven Tele-ICU Improving Clinical Outcomes and Operational Efficiency



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HealthTech Asia  
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# Building an AIoT-Driven Tele-ICU

## Improving Clinical Outcomes and Operational Efficiency

Top-down vision. Bottom-up change. Team transformation.

- **Healthcare Challenge: the Need for Transformation**
- **CMUH Digital Transformation : HiThings AIoT Command Center**
- **From Clinical Impact to an AIoT Healthcare Ecosystem**

## Outline



# An Urgent Crisis

**Shortage of  
nearly 10 million  
healthcare  
workers by 2030.**

— WHO

Occupation	2013	2020	2030 (Forecast)
Dentists	0.49	0.26	0.22
Physicians	3.05	2.66	1.94
Midwives	0.36	0.41	0.31
Nursing Personnel	9.89	7.07	4.50
Pharmacists	0.33	0.29	0.19
Other Health Workers	6.02	4.69	3.08
<b>Total</b>	<b>20.15</b>	<b>15.37</b>	<b>10.23</b>

Boniol M, Kunjumen T, Nair TS, et al.  
BMJ Global Health 2022

**Estimated Global Health Workforce Shortage  
by Occupation (Unit: million people)**



# Aging Society, Shrinking Workforce

Taiwan became a *super-aged society* in 2025

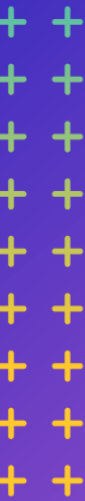
Population  $\geq 65$  exceeds 20%

Children  
**-62.6%**

Working-age  
population  
**-56.9%**

Older adults  
**+55.2%**

Source: National Development Council (Taiwan), Population Projections



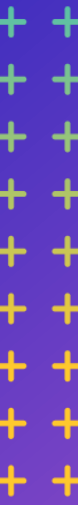
# Digital Maturity as a Predictor of Quality and Safety Outcomes

**3.25 ×**

Higher odds of achieving  
**Leapfrog Hospital Safety Grade**

EMRAM Stage 6–7 hospitals  
OR 3.25 (95% CI 2.33–4.55)

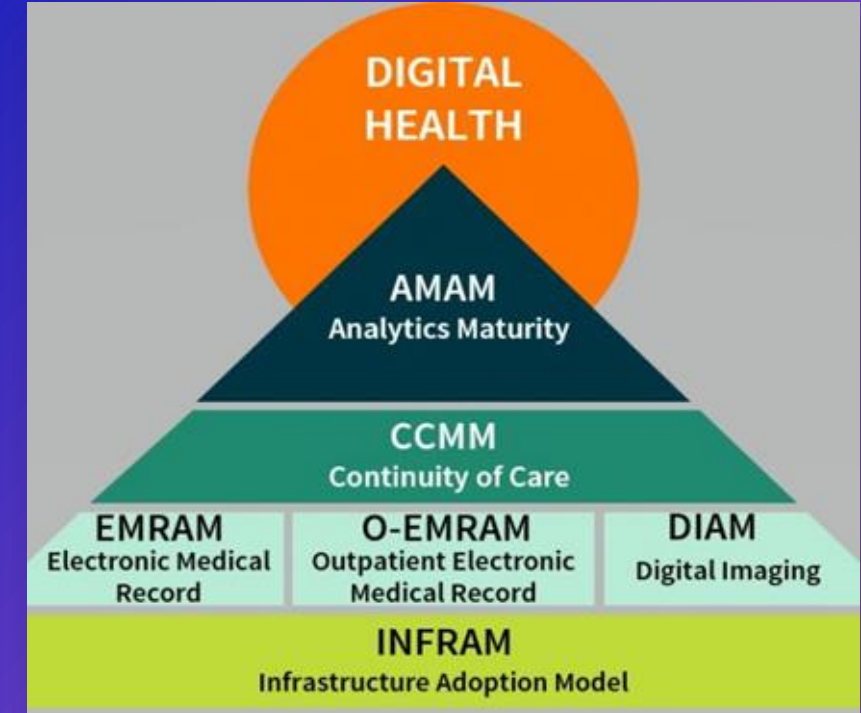
Snowdon A, et al. J Med Internet Res 2024



# China Medical University Hospital (CMUH), Taiwan



## Four Highest HIMSS Certifications and Two-Time Top DHI Score



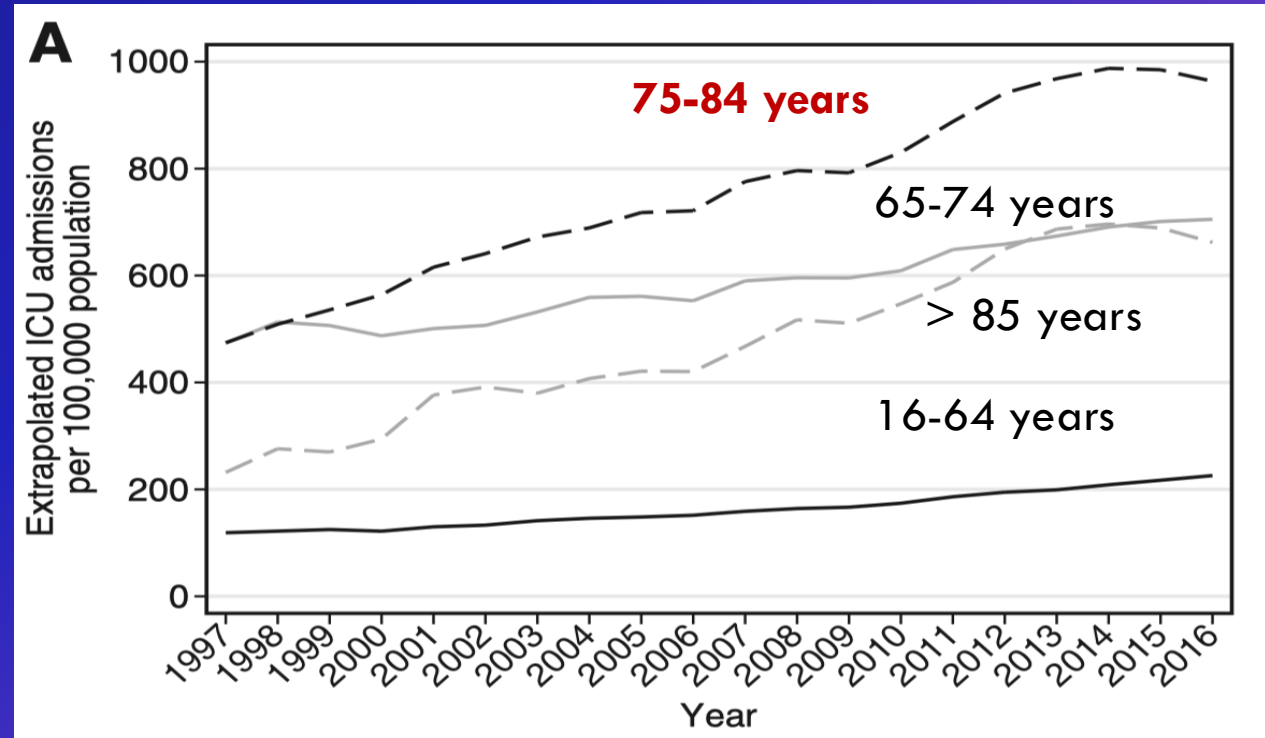
- EMRAM 7, INFRAM 7, AMAM 7, and DIAM 7 (2025)
- Davies Award of Excellence (2023)
- Top Global Digital Health Indicator Score (2023 & 2025)

## HIMSS

Healthcare Information & Management System Society

# The ICU Reflects the Complexity of Healthcare

- Aging population
- Complex diseases
- Information overload
- Staff pressure



Jones A, et al. Crit Care Med. 2020 Apr;48(4):466-474.



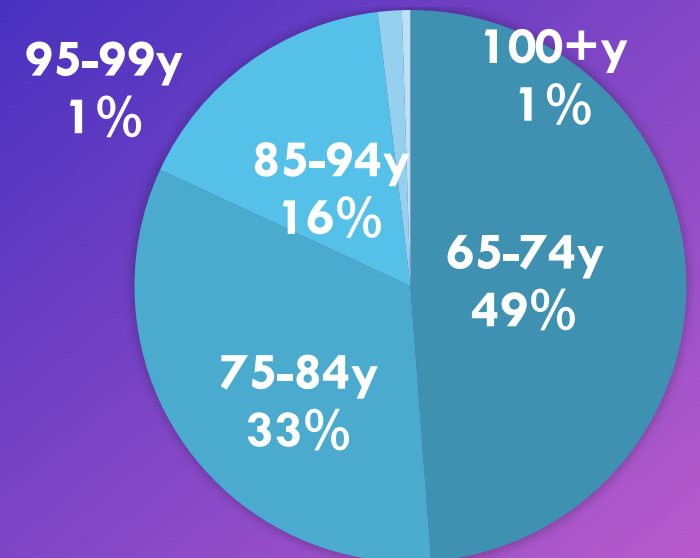
# The ICU Reflects the Complexity of Healthcare

- Aging population
- Complex diseases
- Information overload
- Staff pressure

Medical ICU at CMUH

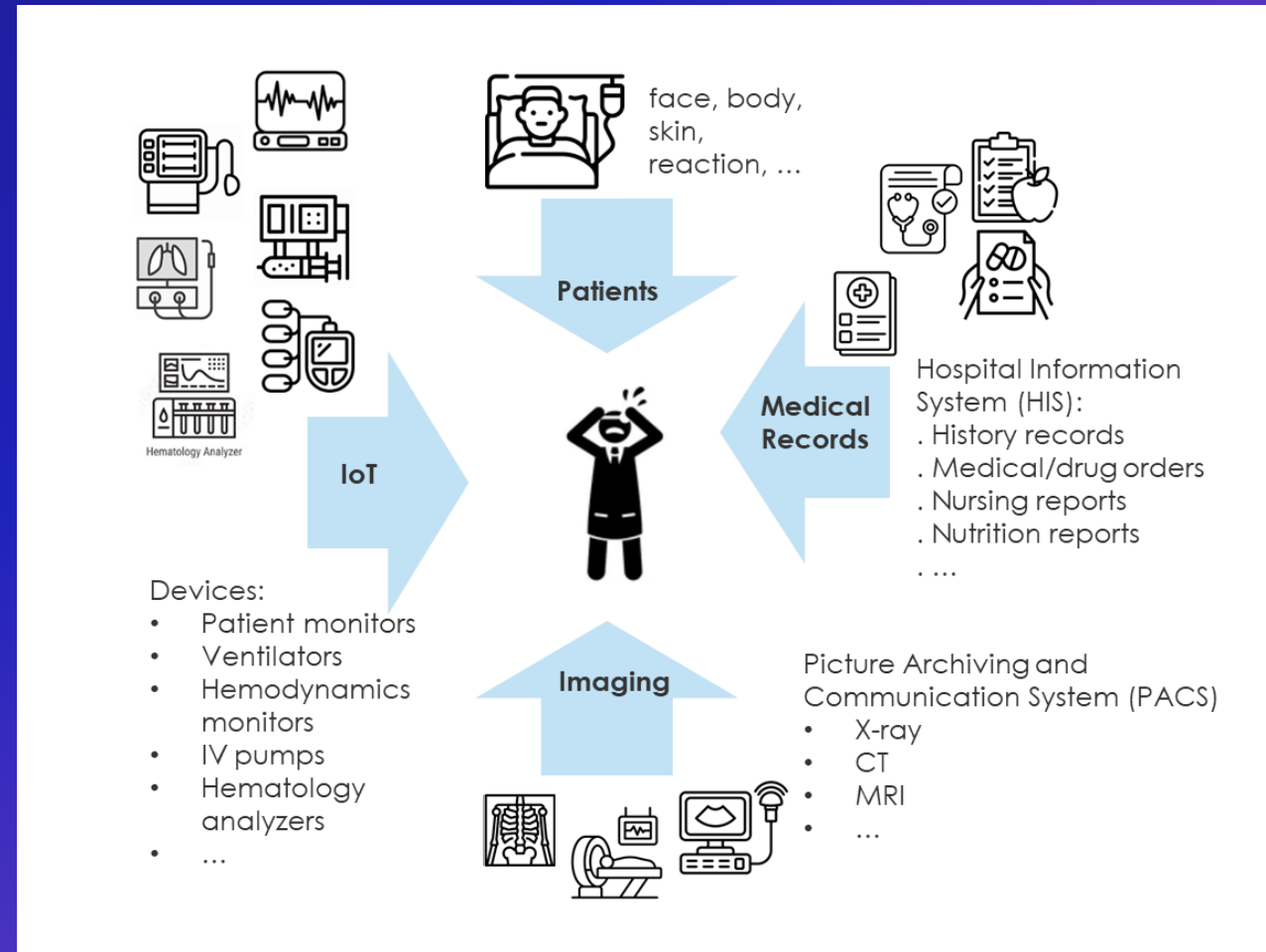
40 beds · Majority of patients aged  $\geq 65$

**59.1%**



# The ICU Reflects the Complexity of Healthcare

- Aging population
- Complex diseases
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- Staff pressure



# The ICU Reflects the Complexity of Healthcare

- Aging population
- Complex diseases
- Information overload
- Staff pressure



## SYSTEMATIC REVIEW

High-level burnout in physicians and nurses working in adult ICUs: a systematic review and meta-analysis



Laurent Papazian<sup>1,2,3\*</sup>, Sami Hraiech<sup>2,4</sup>, Anderson Loundou<sup>5</sup>, Margaret S. Herridge<sup>6</sup> and Laurent Boyer<sup>5</sup>

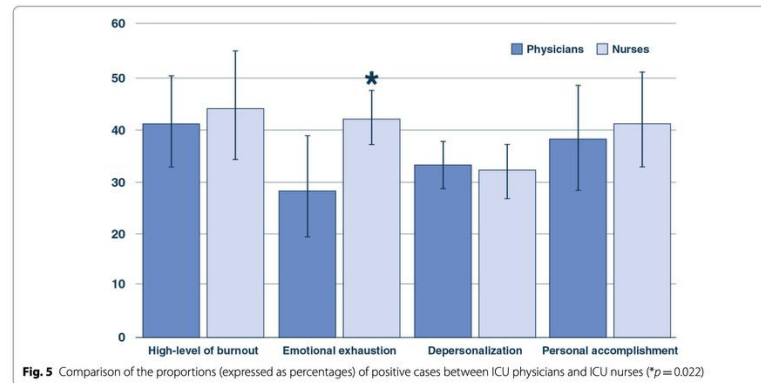


Fig. 5 Comparison of the proportions (expressed as percentages) of positive cases between ICU physicians and ICU nurses (\* $p=0.022$ )

**BURN\_OUT**

More than

**40%**

Laurent et al., Intensive Care Med (2023) 49:387–100



# Breaking Points in Critical Care Delivery

## Administrative Overload

Don't ask me  
I'm tied up with rounds



Nurse

## Knowledge Gaps

I'm not sure about  
the delirium status



Resident

## Team Fragmentation

Has respiratory training  
started ?



Pharmacist

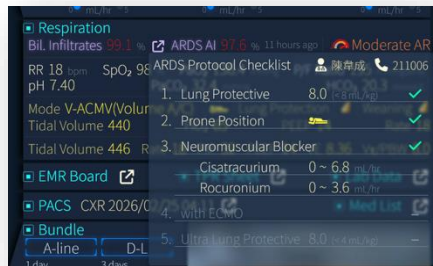
## Data–Action Gap

Is the patient getting  
enough nutrition?



Attending physician

# Feature 2: Six Key AI-Human Collaboration Approaches



## ARDiTeX

- H.-Y. Tseng; et al. Critical Care (2022) 26:253.

ARDS AI

Gen AI

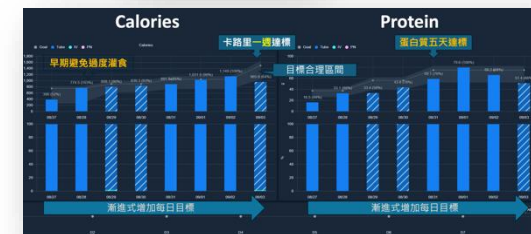
## MAGI

Voice recognition and Gen AI Medical and nursing record



## NutriPilot

From Reactive to proactive



## i.A.M.S

- J. Yu; et al. Clinical Isolates. Microbiol Spectr . 2022 Apr 27;10(2):e0048322.
- L.-C. Ho; et al. International Journal of Antimicrobial Agents 63 (2024) 107142.

## Smart Herat Platform

ST-elevation Myocardial Infarction

- K.-W Chen.; et al. Frontiers in Cardiovascular Medicine, 14 October, 2022.
- Y.-C. Wang; et al. Mayo Clin Proc. December 2022;97(12):2291-2303.

Sepsis MDRO AI

AI Applications

Nutrition AI

## iCARE-PAD StrokeVista

- W.-C. Wang; et al. Biomedical Signal Processing and Control. Volume 93, July 2024.



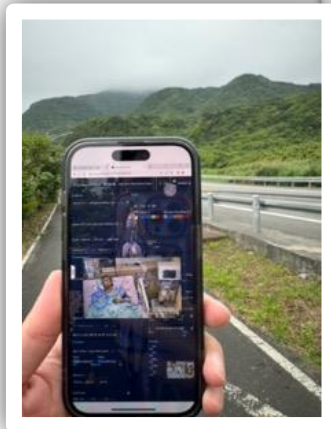


# Feature 3: Teleconsultation — Anywhere, Anytime, on Any Device



Ward Round

Patient's Bedside



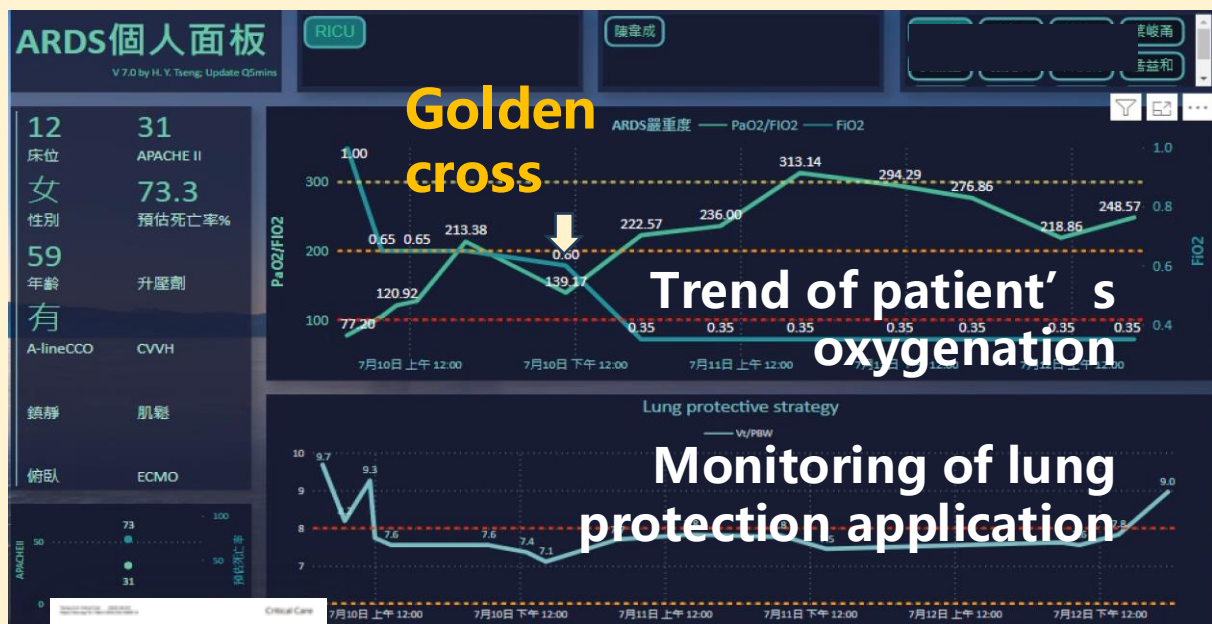
Remote site



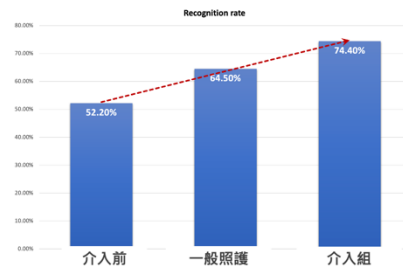
# 1 ARDiTeX for Acute Respiratory Distress Syndrome

Visualized data integration boosts team awareness, sharpens diagnosis, and drives timely treatment —ultimately enhancing patient outcomes.

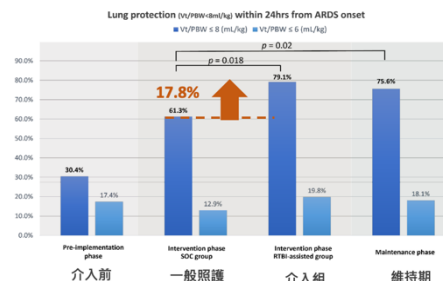
## Screening and monitoring of therapy



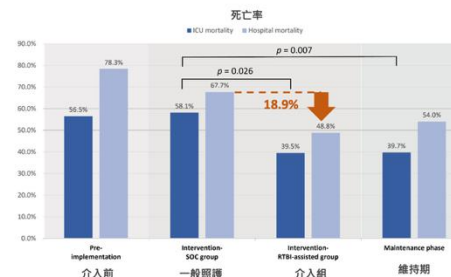
Tseng HY, et al. Crit Care. 2022 Aug 22;26(1):253.



Increased diagnostic rate 22%



Increased lung protection implementation 17.8%



Reduced mortality rate

# 18.9%

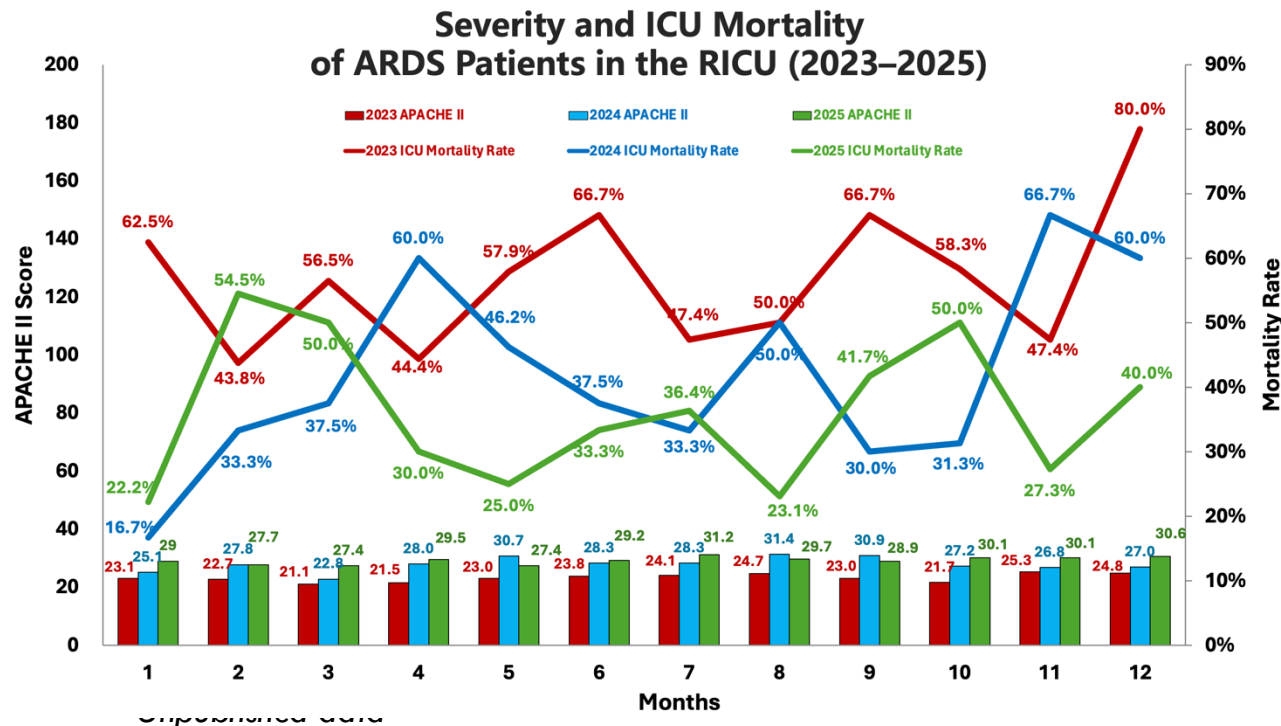


2023 HIMSS  
Davies Award of Excellence

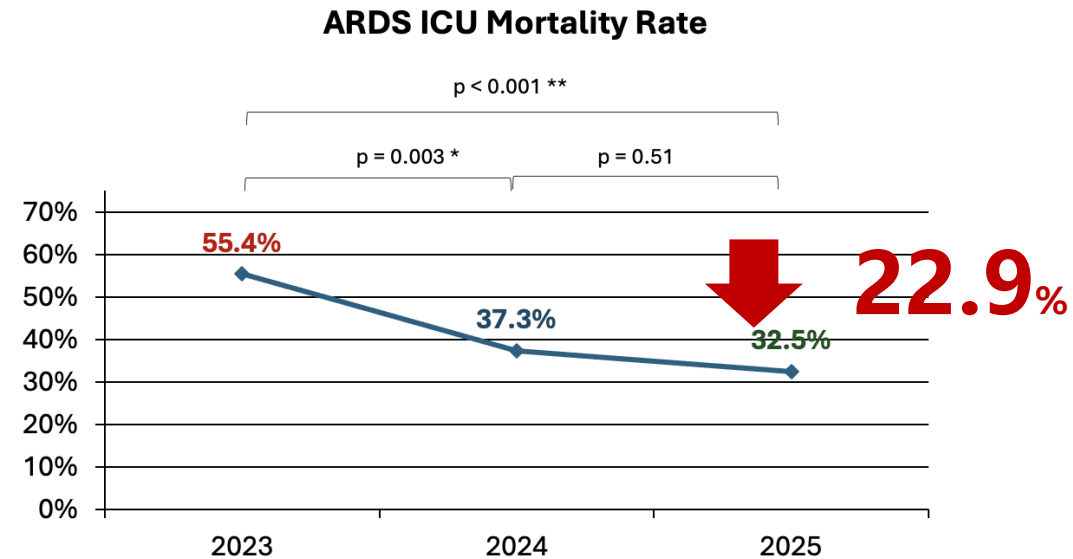


# 1 AIoT Collaboration to Enhance Interdisciplinary Patient Care

Despite increasing disease severity, smart healthcare solutions strengthened team performance and reduced mortality (22.9%) in patients with ARDS.



ICU Mortality Rate in RICU ARDS Patients (2023–2025)



# 2 Intelligent Antimicrobial System (i.A.M.S)

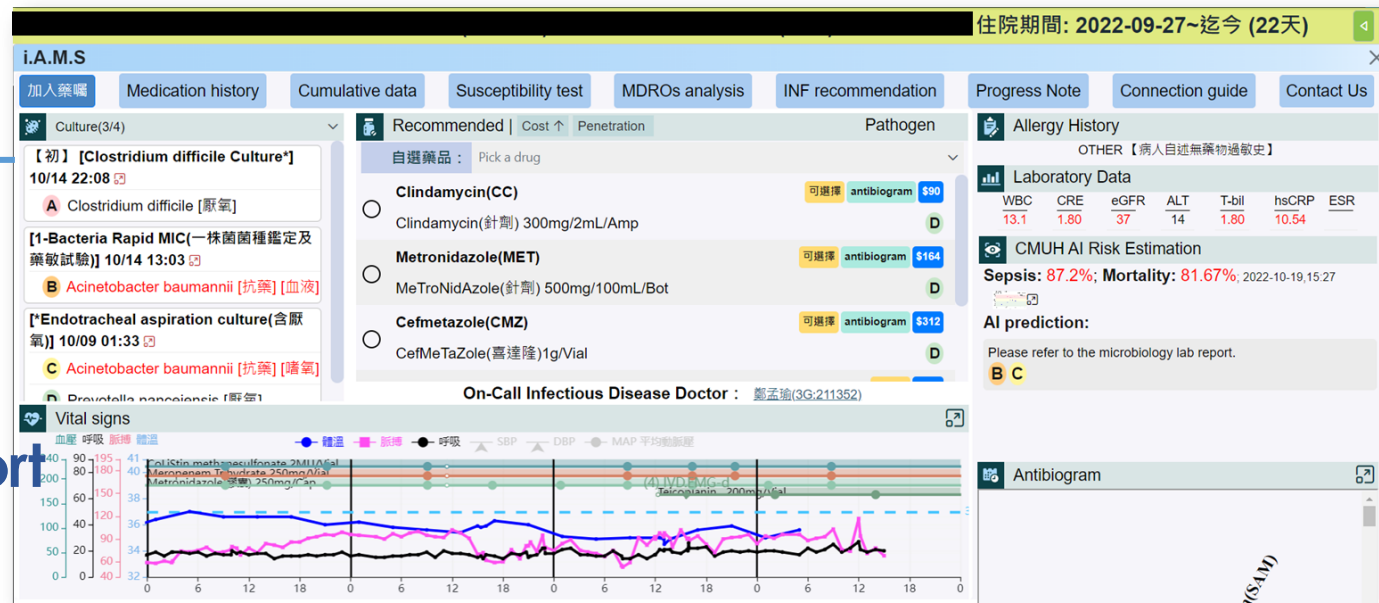


## for Infection, sepsis, and Multi-Drug Resistance Pathogens

Predictive    Diagnostic    Descriptive    Prescriptive

A system with data integration, predicting sepsis and antimicrobial resistance to enforce timely correct intervention and improve patients prognosis.

Intelligent antibiotics decision support system

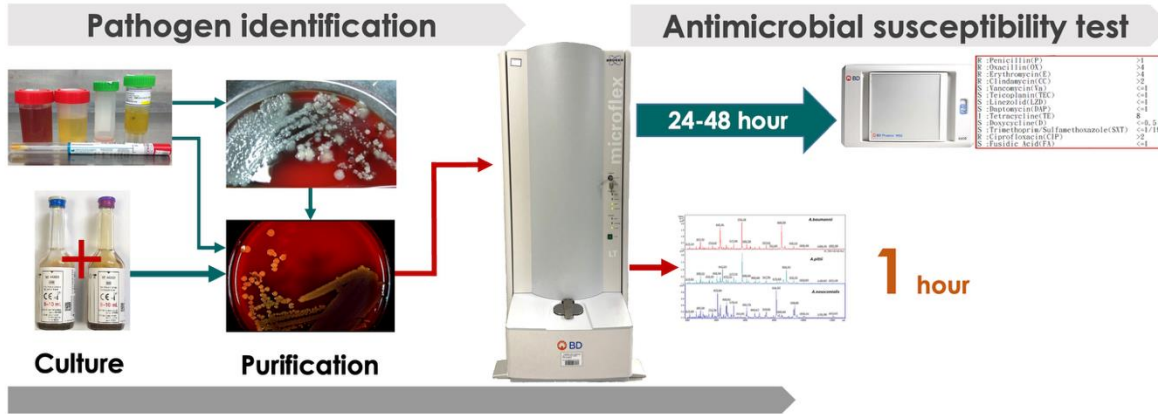


AI risk prediction of sepsis & mortality  
AI prediction of antimicrobial resistance  
Personalized antibiogram

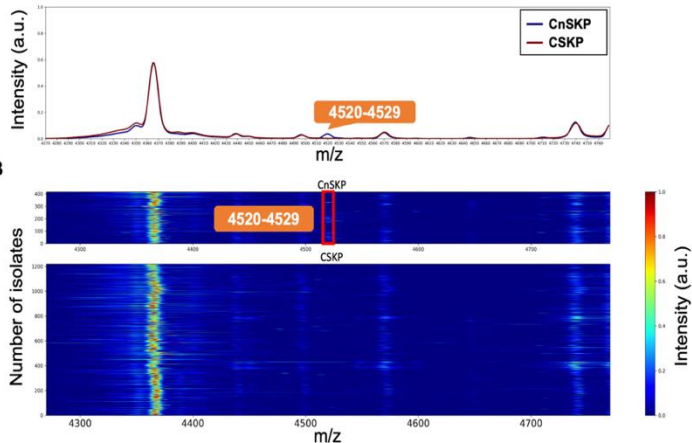
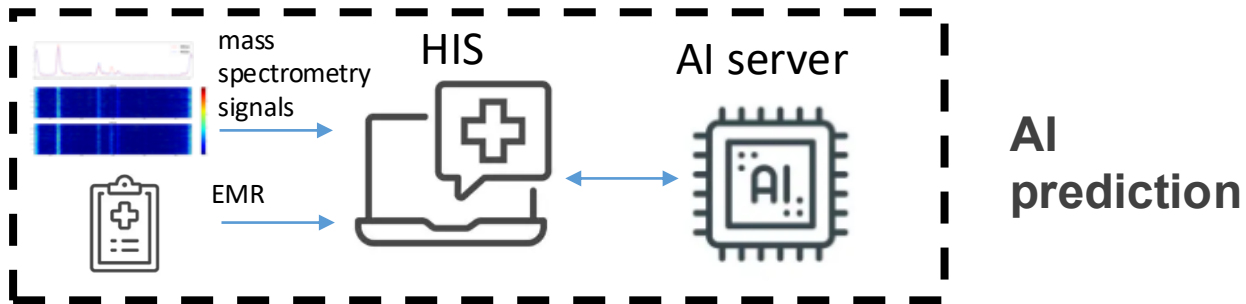
2023 HIMSS  
Davies Award of Excellence

# 2

## AI prediction of antimicrobial resistance (AMR)

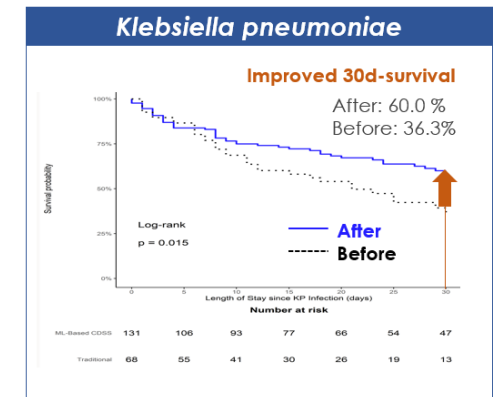
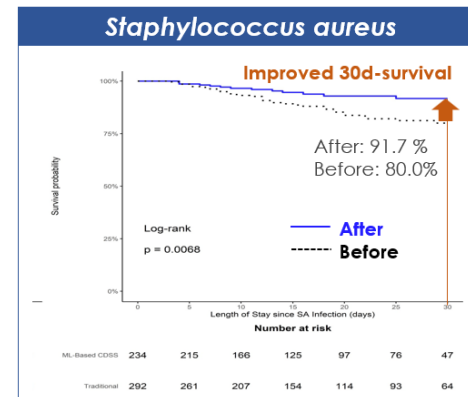


**+17.6%** improvement in patient survival after implementing i.A.M.S



7) R ICU-06, 檢體 SET, 1150000  
採檢, 智抗菌預測為  
Carbapenem-resistant K.pn

eumoniae (CRKP); 僅供參考, 用藥疑問請洽感染科



2

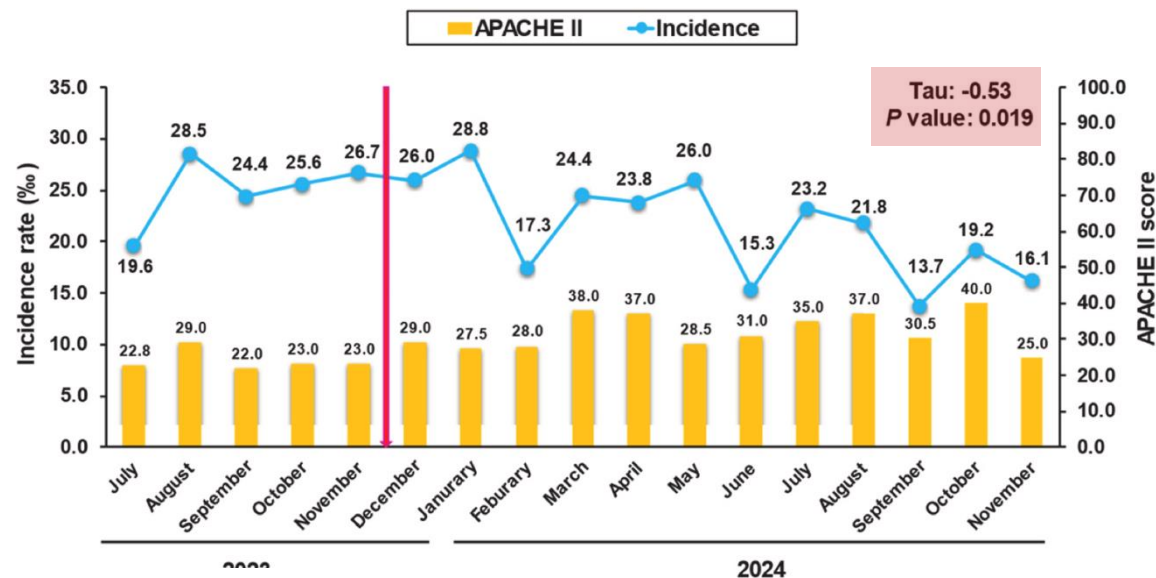
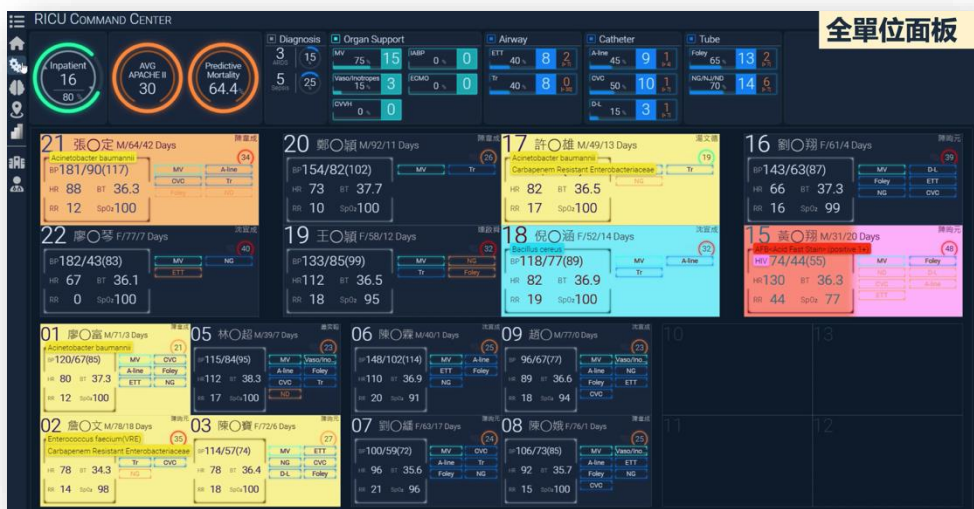
# Infection Control Map (ICM)

Descriptive



## Prevention is always better than cure.

Visualized Data Integration Enhances Team Awareness and Reduces MDRO Incidence and 30-Day Mortality **40%**



Phase	Net ICU mortality			30-day all-cause mortality		
	Odds ratio	Confidence interval	p value	Odds ratio	Confidence interval	p value
Pre-Intervention period (as reference)	1.0	Reference	-	1.0	Reference	-
Intervention period	0.8	0.5 – 1.2	0.277	0.6	0.4 – 0.9	0.007

# AIoT Empowering Clinical Workflow Efficiency

## Physicians

41.8% ↓

data collection

(40.5 min saved)

+2.1%

data accuracy

## Nurses

72.4% ↓

shift handover

(42.6 min saved)

## Dietitians

66.6% ↓

assessment time

(120 min saved)

H.-Y. Tseng; et al. Sci Rep. 2025;15:35374



# Improving patient outcomes and the quality of care

**ARDS**  
22.9% ↓  
ICU mortality

**MDRO**  
40% ↓  
30-day mortality risk

**Over all ICU**  
2.4% ↓  
mortality

- [1] W.-S. Feng; et al. Design and Implementation of an Intensive Care Unit Command Center for Medical Data Fusion. *Sensors* 2024, 24, 3929.
- [2] J. Yu; et al. Rapid Identification of Methicillin-Resistant Staphylococcus aureus Using MALDI-TOF MS and Machine Learning from over 20,000 Clinical Isolates. *Microbiol Spectr* . 2022 Apr 27;10(2):e0048322.
- [3] L.-C. Ho; et al. Impact of the implementation of the Intelligent Antimicrobial System (iAMS) on clinical outcomes among patients with bacteremia caused by methicillin-resistant Staphylococcus aureus. *International Journal of Antimicrobial Agents* 63 (2024) 107142.
- [4] Chen K.-W.; et al. Artificial intelligence-assisted remote detection of ST-elevation myocardial infarction using a mini-12-lead electrocardiogram device in prehospital ambulance care. *Frontiers in Cardiovascular Medicine*, Oct 14, 2022.
- [5] Y.-C. Wang; et al. Implementation of an All-Day Artificial Intelligence Based Triage System to Accelerate Door-to-Balloon Times. *Mayo Clin Proc.* December 2022;97(12):2291 -2303.
- [6] H.-Y. Tseng; et al. Using real-time visualization system for data-driven decision support to achieve lung protective strategy: a retrospective observational study. *Critical Care* (2022) 26:253.
- [7] W.-C. Wang; et al. Automated delineation of acute ischemic stroke lesions on non-contrast CT using 3D deep learning: A promising step towards efficient diagnosis and treatment. *Biomedical Signal Processing and Control*. Volume 93, July 2024.
- [8] C.-H. Chen; et al. Visualized and Integrated Online Information System Tailored Infection Control Policy and Its Role in Lowering the Incidence Rate of Multidrug-Resistant Organisms in the Medical Intensive Care Unit. *Journal of Microbiology, Immunology and Infection*. 2026
- [9] H.-Y. Tseng; et al. Performance of data gathering using an AIoT-enabled system in the intensive care unit. *Sci Rep*. 2025;15:35374



# From Local Innovation to Global Exchange



USA  
Las Vegas  
HIMSS  
Conference

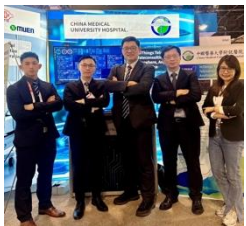
USA Orlando  
HIMSS  
Conference

Germany  
Düsseldorf  
MEDICA

Korea  
HIMSS  
APAC

Philippine  
APSR

Indonesia  
HIMSS  
APAC





# Global Engagement & Collaboration



**USA**  
Mayo Clinic

**Germany**  
TU Dresden  
HIMSS

**Slovakia**

**Italy**  
Policlinico of Milan

**Brazil**  
Folks

**Paraguay**  
MPHSW



**Malaysia**  
Putra Medical Centre  
Sarawak General Hospital  
UNIMAS Teaching Hospital

HIMSS APAC

**Singapore**  
National University  
Health System

HIMSS  
Tengah Hospital  
Kuo Teck Pauh Hospital

**Australia**  
HIMSS  
Fisher & Paykel





# Reducing Nursing Workload by 30% by Addressing Clinical Pain Points



Ward rounds



Vital sign detection



Health education



Teleconsultation



Inventory



Alerting



Meal delivering



Elder comfort



**Powering the Agentic AI Era with AIoT and Generative AI Robots—Transforming Decisions into Better Care**

**AI transformation isn't just technology—it's a shift in decision-making culture, measured by its impact on frontline care.**



## Connected Infrastructure

AIoT sensing · Data integration

## AI Intelligence

Predictive analytics

AI-guided clinical decision support

## Human-AI Collaboration

Physicians · Nurses · Pharmacists · Dietitians

AI-assisted workflows · Care robots

## Care Beyond Hospital

Remote monitoring · Home hemodialysis

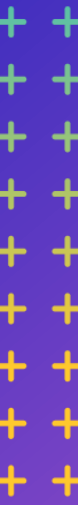
# Key Takeaways

Taiwan Society of Critical Care Medicine



# Youth Innovation Workshop

Design Thinking | Clinical Ideation and Process Redesign



Process First x Organizational Resilience

Building Sustainable Smart Healthcare with Reduced Workload

## Key Takeaways

# It's a shift in decision-making culture, measured by its impact on frontline care.



## Key Takeaways



2021 2022 2023, 2025  
NHQA

2023, 2024  
SNQ

