Regional Traumatic Brain Injury Experience

Chong Shu-Ling MBBS, MRCPCH, MCI, MPH
Senior Staff Physician, Emergency Medicine, KKH
Clinical Associate Professor, Duke-NUS
On behalf of PACCMAN and LARed

Perspectives
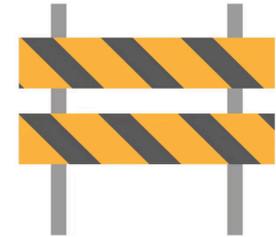
| What is PACCMAN? | → | Lessons from our paediatric TBI journey | → | Systems of care | → | Barriers to research |

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Perspectives
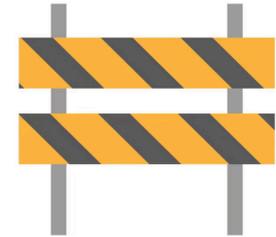
| What is PACCMAN? | → | Lessons from our paediatric TBI journey | → | Systems of care | → | Barriers to research |

Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN)

- Formed in 2015 by paediatric intensive care providers aiming to improve the quality and coordination of paediatric ICU research in Asia

- Increasing recognition that the initial resuscitation of critically ill children starts in the ED!

- PACCMAN serves as a platform to support and stimulate research into effective strategies to improve survival in critically ill children

https://www.scri.edu.sg/paccman/about-paccman/

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Major Opportunities for TBI

- Asia has a great need!
  - Poor functional outcomes are prevalent in Asia
  - Among children with moderate-severe TBI, 104 of 324 survivors (32.1%) had poor functional outcomes (moderate disability, severe disability and vegetative state/coma).

  Pediatr Crit Care Med. 2021;22:401-411

- Clinicians in PACCMAN want to move beyond research to benchmarking exercises and improving care

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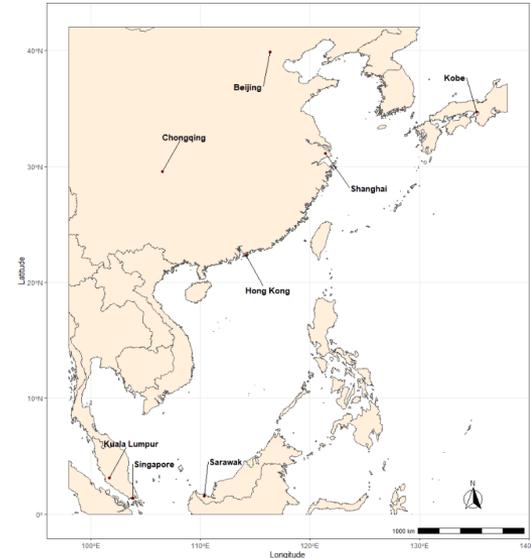
BEGINNINGS…

Pediatric Critical Care Medicine. 2020

Traumatic Brain Injury Outcomes in 10 Asian Pediatric ICUs: A Pediatric Acute and Critical Care Medicine Asian Network Retrospective Study

Shu-Ling Chong, et al. The Pediatric Acute & Critical Care Medicine Asian Network (PACCMAN)

Predictors for Poor Functional Outcomes Among Children with Traumatic Brain Injury in Asia
Oral Presentation at SCCM 2020

Early coagulopathy in pediatric traumatic brain injury: A Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN) retrospective study

Shu-Ling Chong, et al. *Neurosurgery* 2021

Early Coagulopathy in pediatric TBI: A PACCMAN retrospective study
Oral Presentation at SCCM 2021

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Shu-Ling Chong, MPH [ORCID]*‡
Gene Yong-Kwang Ong, MRCPCH*‡
Charles Qishi Zheng, MSc§
Hongxing Dang, MD¶
Meixiu Ming, MD‖
Maznisah Mahmood, MPaed#
Lawrence Chi Ngong Chan, FHKAM**
Soo Lin Chuah, MRCPCH‡‡
Olive Pei Ee Lee, MRCPCH§§
Suyun Qian, MD¶¶
Lijia Fan, MRCPCH‖‖##
Yoshihiko Konoike, MD***
Jan Hau Lee, MRCPCH‡‡‡†††
on behalf of the Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN)

Early Coagulopathy in Pediatric Traumatic Brain Injury: A Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN) Retrospective Study

BACKGROUND: Although early coagulopathy increases mortality in adults with traumatic brain injury (TBI), less is known about pediatric TBI.
OBJECTIVE: To describe the prothrombin time (PT), activated partial thromboplastin time (APTT), and platelet levels of children with moderate to severe TBI to identify predictors of early coagulopathy and study the association with clinical outcomes.

In our study population, 53/370 (14.3%) children died, and 127/370 (34.3%) had poor functional outcomes.

PT was commonly deranged in both isolated TBI (30.6%) and multiple trauma with TBI (51.3%).

TABLE 1. Demographics, Clinical Presentation, Management and Outcomes of the Study Population

	Early coagulopathy present (n = 206)	No early associated coagulopathy (n = 164)	P-Value
Age, yr	5.1 (4.0)	5.8 (4.3)	.116
Male gender	128 (62.1)	115 (70.1)	.134
Mechanism of injury			.048
Road traffic collision	100 (48.5)	69 (42.1)	
Fall	90 (43.7)	67 (40.9)	
Child abuse	9 (4.4)	18 (11.0)	
Others	7 (3.4)	10 (6.1)	
Multiple trauma	129 (62.6)	68 (41.5)	<.001
Time to arrival (hs)	10.0 (19.4)	12.0 (31.6)	.467
GCS	7.0 [4.0, 9.0]	9.0 [5.0, 12.0]	<.001
Emergency intubation	175 (85.0)	110 (67.1)	<.001
Blood products administered	155 (75.2)	76 (46.3)	<.001
Hyperosmolar therapy	140 (68.0)	73 (44.5)	<.001
Neurosurgical intervention	88 (42.7)	71 (43.3)	.996
Death	48 (23.3)	5 (3.0)	<.001
Hospital length of stay (d)	30.5 (34.9)	19.5 (22.3)	.001
Poor functional outcome among survivors	85 (53.8)	42 (26.4)	<.001

The countries involved in this network study were China (Mainland) (n = 185), China (Hong Kong) (n = 40), Japan (n = 9), Malaysia (n = 91), and Singapore (n = 45).
GCS: Glasgow coma Scale; Poor outcome is defined as Pediatric Cerebral Performance Category (PCPC) discharge rating of moderate disability, severe disability, vegetative state, or coma.
Age, time to arrival and hospital length of stay are presented using mean and standard deviation while GCS is presented with median and IQR.

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What more do we know about coagulopathy in paediatric TBI

- Independent predictors for early coagulopathy
 - Young Age
  - GCS < 8
  - Presence of multiple trauma

Predictors	Unadjusted OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
TABLE 4. Univariate and Multivariable Logistic Regression Identifying Risk Factors for Mortality				
Early coagulopathy	9.67 (4.11, 28.38)	<.001	7.56 (3.04, 23.06)	<.001
Age	0.95 (0.88, 1.02)	.147	1.00 (0.91, 1.09)	.995
Gender (male)	0.64 (0.35, 1.16)	.135	0.58 (0.29, 1.15)	.118
Mechanism				
Fall (ref)	1.00		1.00	
Road traffic collision	1.06 (0.58, 1.96)	.853	1.02 (0.51, 2.04)	.965
Child abuse	0.73 (0.16, 2.31)	.627	2.33 (0.41, 10.86)	.298
Others	0.36 (0.02, 1.92)	.338	0.73 (0.04, 4.74)	.776
GCS < 8	5.80 (2.86, 13.05)	<.001	5.00 (2.29, 12.05)	<.001
Multiple traumas	2.27 (1.23, 4.35)	.010	1.42 (0.68, 3.09)	.363
Presence of intracranial bleeding	0.60 (0.33, 1.11)	.097	0.85 (0.42, 1.76)	.666
Hyperosmolar therapy	3.26 (1.67, 6.87)	.001	1.41 (0.64, 3.27)	.408
Neurosurgical intervention	0.38 (0.19, 0.72)	.004	0.33 (0.15, 0.71)	.006

CI: confidence interval; GCS: Glasgow coma Scale; OR: odds ratio.

Perspectives
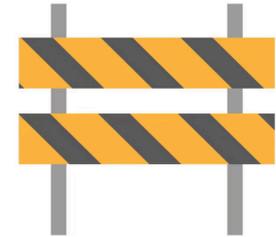
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Shu-Ling Chong, et al. *Neurosurgery* 2021

Early Coagulopathy in pediatric TBI: A PACCMAN retrospective study
Oral Presentation at SCCM 2021

SALTY (Saline in Asia and Latin-America neuroTrauma in the Young) Study:
Is the use of 3% hypertonic saline associated with decreased mortality and improved long-term neurological outcomes among children with traumatic brain injury?

SALTY (Saline in Asia and Latin-America neuroTrauma in the Young)

Prehospital and emergency management of pediatric traumatic brain injury: a multicenter site survey

Gawin Mai, BS,[1] Jan Hau Lee, MBBS,[2] Paula Caporal, MD,[3,4] Juan D. Roa G, MD, MS,[4,5] Sebastián González-Dambrauskas, MD,[4,6] Yanan Zhu, PhD,[7] Adriana Yock-Corrales, MD,[8] Qalab Abbas, MBBS,[9] Yasser Kazzaz, MPH,[10–12] Dianna Sri Dewi, BS,[13] and Shu-Ling Chong, MPH,[14] on behalf of PACCMAN and LARed

Variation in centres

- Variability in resource availability even among "designated trauma centres"
- Variability in physician practices
- Variability in prehospital practices
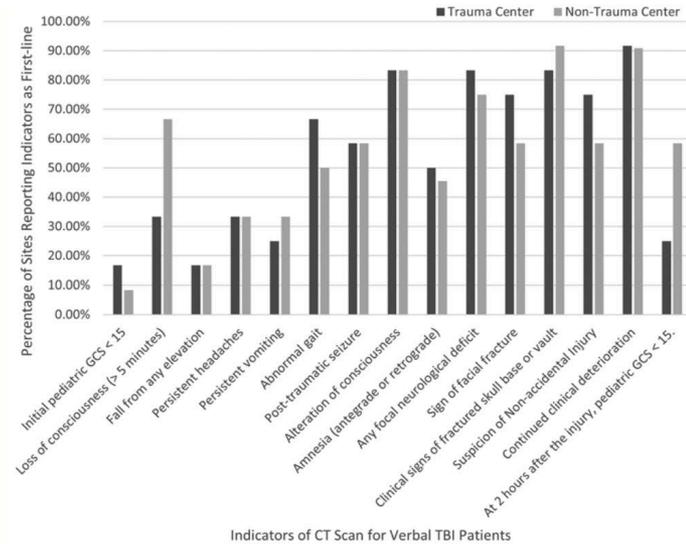
FIG. 4. Bar graph showing neuroimaging indications for verbal pediatric patients with TBI in DTC and NTC (n = 12 each) EDs.

Mai G, Lee JH, Caporal P, et al. Prehospital and emergency management of pediatric traumatic brain injury: a multicenter site survey. *J Neurosurg Pediatr*. 2023;31(6):598-606. Published 2023 Mar 3. doi:10.3171/2023.1.PEDS22456

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SALTY (Saline in Asia and Latin-America neuroTrauma in the Young)

Motivation: Use of **hypertonic saline (HTS)** versus **mannitol** in the control of raised intracranial pressure (ICP) secondary to neurotrauma is debated.

Aims: We sought to compare **mortality** and **functional outcomes** among children with moderate to severe traumatic brain injury (TBI) at risk of raised ICP who received 3% HTS compared to those who received 20% mannitol.

Original Investigation | Neurology

Clinical Outcomes of Hypertonic Saline vs Mannitol Treatment Among Children With Traumatic Brain Injury

Shu-Ling Chong, MD, MPH; Yanan Zhu, PhD; Quan Wang, MD; Paula Caporal, MPH; Juan D. Roa, MD; Freddy Israel Pantoja Chamorro, MD; Thelma Elvira Teran Miranda, MD; Hongxing Dang, MD; Chin Seng Gan, MD; Qalab Abbas, MD; Ivan J. Ardila, MD; Mohannad Ahmad Antar, MD; Jesús A. Domínguez-Rojas, MD; María Miñambres Rodríguez, PhD; Natalia Zita Watzlawik, MD; Natalia Elizabeth Gómez Arriola, MD; Adriana Yock-Corrales, MD; Rubén Eduardo Lasso-Palomino, MD; Ming Mei Xiu, MD; Jacqueline S. M. Ong, MD; Hiroshi Kurosawa, MD; Gabriela Aparicio, MD; Chunfeng Liu, MD; Rujipat Samransamruajkit, MD; Juan C. Jaramillo-Bustamante, MD; Nattachai Anantasit, MD; Yek Kee Chor, MD; Deborah M. Turina, MD; Pei Chuen Lee, MD; Marisol Fonseca Flores, MD; Francisco Javier Pilar Orive, PhD; Jane Ng Pei Wen, BSc; Sebastián González-Dambrauskas, MD; Jan Hau Lee, MCI; for the Pediatric Acute and Critical Care Medicine in Asia Network (PACCMAN) and the Red Colaborativa Pediátrica de Latinoamérica (LARed)

Design We performed a prospective multi-center observational cohort study between June 2018 and December 2022.

Setting Participating pediatric intensive care units of the Pediatric Acute & Critical Care Medicine in Asia Network (PACCMAN) and Red Colaborativa Pediátrica de Latinoamerica (LARed) network.

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Methods

Design We performed a prospective multi-center observational cohort study between June 2018 and December 2022.

Setting Participating pediatric intensive care units of the Pediatric Acute & Critical Care Medicine in Asia Network (PACCMAN) and Red Colaborativa Pediátrica de Latinoamerica (LARed) network.

Participants Children < 18 years old with moderate to severe TBI (Glasgow Coma Scale, GCS ≤13)

Exposure 3% HTS compared to 20% mannitol

Main Outcome(s) and Measure(s)

1. Multiple log-binomial regression for **mortality**

2. Multiple linear regression for **hospital discharge Pediatric Cerebral Performance Category (PCPC) scores** and **3 -month Glasgow Outcome Score-Extended Pediatrics (GOS-E Peds) scores.**

   – We also performed inverse probability of treatment weighting (IPTW) using the propensity score method to control for baseline imbalance between groups.

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Results

28 PICUs participated in the study: 14 from PACCMAN and 14 from LARed.
455 children met the eligibility criteria.

Variable	Patients who received Hypertonic Saline (N=184)	Patients who received 20% Mannitol (N=82)	P value
Mortality	13 (7.1)	9 (11.0)	0.336
Poor PCPC (Defined as 3-6)	57/181 (31.5)	20/81 (24.7)	0.306
3-month GOS-E Peds Score, (median, [IQR])	3.00 [1.00, 6.00]	5.00 [1.00, 6.00]	0.111
Poor GOS-E Score (3-8)	96/180 (53.3)	46/73 (63.0)	0.166
Duration of mechanical ventilation (median, [IQR])	5.00 [2.50, 8.00]	4.00 [3.00, 6.75]	0.685
Duration of hospital stay (median, [IQR])	16.00 [8.00, 29.00]	17.00 [9.50, 27.00]	0.766
Duration of ICU stay (median, [IQR])	7.00 [4.00, 13.00]	7.00 [4.00, 10.00]	0.441
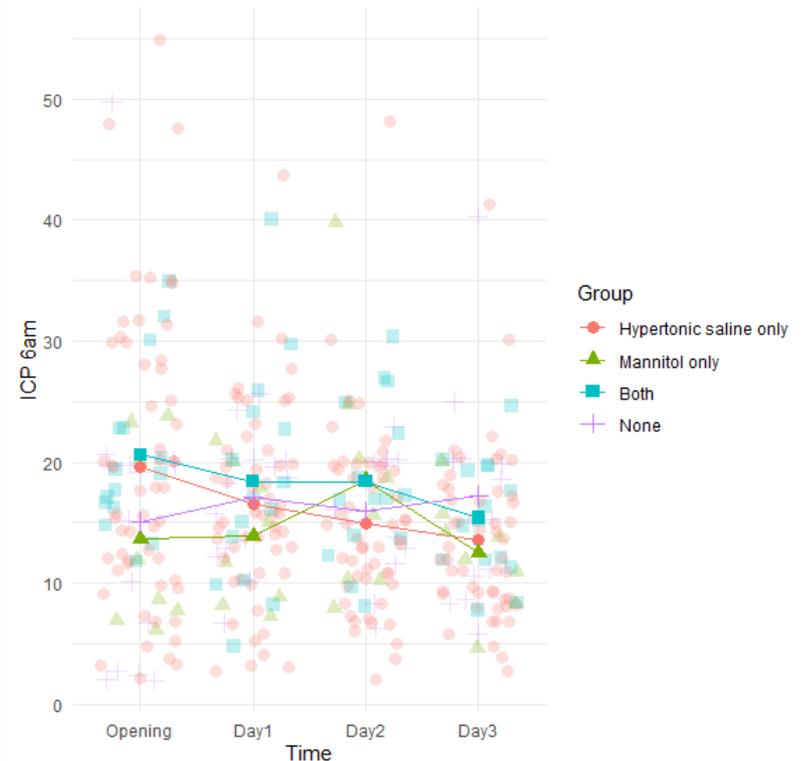
Individual and mean of 6am intracranial pressure (ICP) readings by day

- After adjustment for confounders, there was **no difference in mortality or hospital discharge PCPC scores.**
- We found a marginal association between use of mannitol and poorer 3-month GOS-E Peds outcomes in the multivariable linear regression and the propensity score models

Table 4. Association of Functional Scores With Hyperosmolar Agent Type and Covariates in Univariate, Multivariable, and IPTW-Adjusted Linear Regression Analyses[a]

Variable	Univariate model		Multivariable model		IPTW-adjusted model	
	Coefficient (SE)	P value	Adjusted coefficient (SE)	P value	Adjusted coefficient (SE)	P value
PCPC score on hospital discharge						
Hyperosmolar therapy						
3% HTS only	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
20% Mannitol only	0.001 (0.21)	>.99	−0.02 (0.19)	.91	−0.10 (0.19)	.62
Age	0.001 (0.01)	.93	NA	NA	NA	NA
Sex						
Female	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Male	−0.002 (0.15)	.99	NA	NA	NA	NA
Child abuse	0.46 (0.31)	.14	0.45 (0.35)	.19	0.17 (0.36)	.63
Time between injury and hospital arrival, h	<−0.001 (0.004)	.90	NA	NA	NA	NA
Lowest GCS score in first 24 h	−0.20 (0.02)	<.001	−0.20 (0.03)	<.001	−0.20 (0.03)	<.001
Extradural hemorrhage	−0.64 (0.18)	<.001	−0.39 (0.23)	.09	−0.40 (0.23)	.08
GOS-E-Peds score at 3 mo						
Hyperosmolar therapy						
3% HTS only	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
20% Mannitol only	0.61 (0.35)	.09	0.56 (0.33)	.09	0.64 (0.33)	.05
Age	−0.03 (0.03)	.20	NA	NA	NA	NA
Sex						
Female	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Male	−0.21 (0.26)	.42	NA	NA	NA	NA
Child abuse	1.25 (0.50)	.01	0.93 (0.57)	.11	1.02 (0.60)	.09
Time between injury and hospital arrival, h	0.001 (0.009)	.95	NA	NA	NA	NA
Lowest GCS score in the first 24 h	−0.27 (0.04)	<.001	−0.23 (0.05)	<.001	−0.23 (0.05)	<.001
Extradural hemorrhage	−1.32 (0.29)	<.001	−1.20 (0.38)	.002	−1.19 (0.38)	.002

Abbreviations: GCS, Glasgow Coma Scale; GOS-E-Peds, Glasgow Outcome Scale–Extended Pediatric Version; HTS, hypertonic saline; IPTW, inverse probability treatment weight; NA, not applicable; PCPC, Pediatric Cerebral Performance Category.

[a] Multivariable and IPTW-adjusted coefficients (SEs) and P values are presented for hyperosmolar agents and other variables with univariate significance of <.15.

Conclusions

1. Use of HTS was not associated with improved survival or better discharge functional scores, when compared to mannitol.

2. There was a higher proportion of children who received mannitol with poorer GOS-E Peds scores at 3 months, but the difference was small.

2023/2024 publications

A Multicenter Study on the Clinical Characteristics and Outcomes Among Children With Moderate to Severe Abusive Head Trauma

Adriana Yock-Corrales [a, *], Jan Hau Lee [b], Jesús Ángel Domínguez-Rojas [c], Paula Caporal [d], Juan D. Roa [e], Jaime Fernandez-Sarmiento [f], Sebastián González-Dambrauskas [g], Yanan Zhu [h], Qalab Abbas [i], Yasser Kazzaz [j], Dianna Sri Dewi [k], Shu-Ling Chong [l, 1], on behalf of Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN) and Red Colaborativa Pediátrica de Latino America (LARed) Networks

A multicenter observational study on outcomes of moderate and severe pediatric traumatic brain injuries—time to reappraise thresholds for treatment

Syeda Kashfi Qadri[1,2] · Jan Hau Lee[1,2] · Yanan Zhu[3] · Paula Caporal[4,5] · Juan D Roa G[6,7] · Sebastián González-Dambrauskas[8,9] · Adriana Yock-Corrales[10] · Qalab Abbas[11] · Yasser Kazzaz[12] · Luming Shi[3,13] · Dianna Sri Dewi[3] · Shu-Ling Chong[2,14] · On behalf of Pediatric Acute, Critical Care Medicine Asian Network (PACCMAN) · Pediatric collaborative Latin American network (LARed)

Differences in clinical outcomes and resource utilization in pediatric traumatic brain injury between countries of different sociodemographic indices

Keith Wei Han Liang, MBBS, MRCPCh,[1,2] Jan Hau Lee, MBBS, MRCPCh, MCI,[2,3] Syeda K. Qadri, MD, MRCPCh,[2,3] Janani Nadarajan, BSc,[4] Paula Caporal, MD, MPH,[5,6] Juan D. Roa G, MD, MSc,[7,8] Sebastián González-Dambrauskas, MD,[9,10] Qalab Abbas, MBBS,[11] Yasser Kazzaz, MD, FRCPC, MPH,[12] and Shu-Ling Chong, MBBS, MRCPCh, MCI, MPH,[2,13] on behalf of Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN) and Red Colaborativa Pediátrica de Latinoamérica (LARed Network)

Initial dysnatremia and clinical outcomes in pediatric traumatic brain injury: a multicenter observational study

Gawin Mai[1] · Jan Hau Lee[2,3] · Paula Caporal[4,5] · Juan D. Roa G[5,6] · Sebastián González-Dambrauskas[5,7] · Yanan Zhu[8] · Adriana Yock-Corrales[9] · Qalab Abbas[10] · Yasser Kazzaz[11,12,13] · Dianna Sri Dewi[14] · Shu-Ling Chong[15,16] · on behalf of the Pediatric Acute & Critical Care Medicine Asian Network (PACCMAN) and Red Colaborativa Pediátrica de Latinoamérica (LARed Network)

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Is moderate TBI really moderate?
## 'high' mTBI GCS 11-13 vs 'low' mTBI GCS 9-10
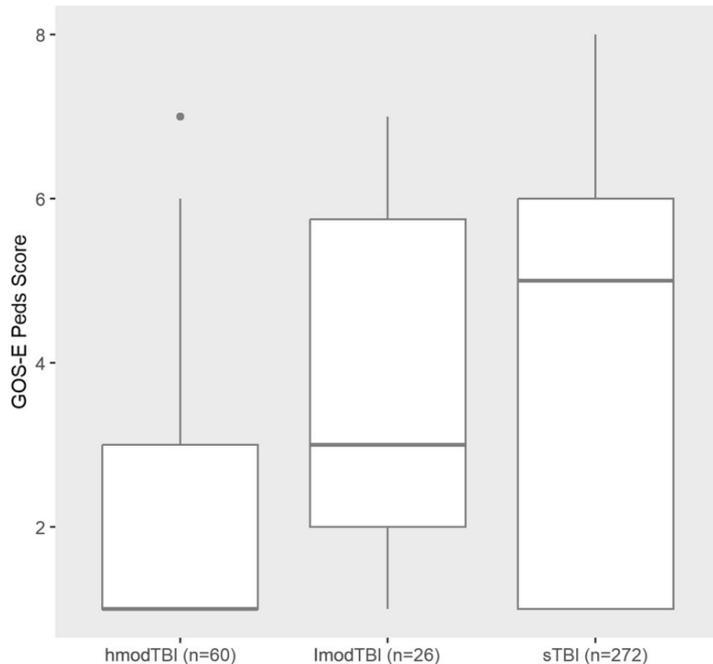
Fig. 3 Box plots comparing the main outcome (GOS-E Peds at 3 months) according to group (high moderate, low moderate, and severe traumatic brain injury (TBI)). Legend: hmodTBI (median [IQR]): 1.00 [1.00, 3.00], lmodTBI (median [IQR]): 3.00 [2.00, 5.75], sTBI (median [IQR]): 5.00 [1.00, 6.00]). Test of significance was by Kruskal Wallis test, p value < 0.001. The dot above the first "box and whiskers" is a value which is more than 1.5*IQR from the upper hinge. Footnote: hmodTBI, high moderate traumatic brain injury; lmodTBI, low moderate traumatic brain injury; sTBI, severe traumatic brain injury; GOS-E Peds, Glasgow Outcome Scale-

Patients with low modTBI (vs. high modTBI) were more likely to have;

- **Invasive ICP monitoring** (32.3% vs. 4.5%, *p* < 0.001)

- **Longer PICU stay** (days, median [IQR]; 5.00 [4.00, 9.75] vs 4.00 [2.00, 5.00], *p* = 0.007), and **longer hospital stay**

- **Median GOS-E Peds scores** were significantly different

- After adjusting for age, sex, presence of polytrauma and cerebral edema, lmodTBI, and sTBI remained significantly associated with higher GOS-E scores

Qadri SK, Lee JH, Zhu Y, et al. A multicenter observational study on outcomes of moderate and severe pediatric traumatic brain injuries-time to reappraise thresholds for treatment. *Acta Neurochir (Wien)*. 2023;165(11):3197-3206.

A Multicenter Study on the Clinical Characteristics and Outcomes Among Children With Moderate to Severe Abusive Head Trauma

Adriana Yock-Corrales [a,*], Jan Hau Lee [b], Jesús Ángel Domínguez-Rojas [c], Paula Caporal [d], Juan D. Roa [e], Jaime Fernandez-Sarmiento [f], Sebastián González-Dambrauskas [g], Yanan Zhu [h], Qalab Abbas [i], Yasser Kazzaz [j], Dianna Sri Dewi [k], Shu-Ling Chong [l,1], on behalf of Pediatric Acute and Critical Care Medicine Asian Network (PACCMAN) and Red Colaborativa Pediátrica de Latino America (LARed) Networks

When should I suspect Abusive Head Trauma?

Table 4
Mutivariable logistic regression of variables associated independently with Abusive Head Trauma.

	Multivariable adjusted OR (96% CI)	P value
Age Younger than 2 years (1)	4.96 (1.77–13.95)	<0.001
Glasgow Coma Scale	1.07 (0.96–1.18)	0.231
Presence of seizures	3.43 (1.60–7.36)	0.002
Presence of subdural hemorrhage	8.26 (3.51–19.47)	<0.001

OR: odds ratio; CI: Confidence Interval.
Bold: Variables with p-values statistically significant.

- 47/392 (12%) were diagnosed with AHT.

- Compared to those with accidental injuries, children with AHT were more frequently **< 2 years old** (42, 89.4% vs 133, 38.6%, p < 0.001), but **less likely to have multiple injuries** (14, 29.8% vs 158, 45.8%, p = 0.038).

- The AHT group was more likely to suffer subdural hemorrhage (SDH), require antiepileptic medications, and neurosurgical interventions.

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Resource Perspective

CLINICAL ARTICLE

Liang et al.

Differences in clinical outcomes and resource utilization in pediatric traumatic brain injury between countries of different sociodemographic indices

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TABLE 1. Baseline characteristics of study population stratified by income status

Baseline Characteristic	Non-LMIC Sites, n = 426	LMIC Sites, n = 345	p Value
Male sex	284 (66.7)	219 (63.7)	0.384
Age, yrs, mean (SD)	5.1 (4.5)	6.5 (5.1)	<0.001
Mechanism of injury			<0.001
Road traffic collision	159 (37.3)	180 (52.3)	
Fall	190 (44.6)	131 (38.1)	
Child abuse	39 (9.2)	12 (3.5)	
Other	38 (8.9)	21 (6.1)	
Time to arrival, hrs, median (IQR)	2.0 (0.8–7.0)	5.0 (2.0–12.0)	<0.001
Transported by ambulance	309 (72.5)	290 (84.8)	<0.001
Presenting GCS score, median (IQR)	8 (6–11)	7 (5–11)	0.028
Presenting GCS-motor score, median (IQR)	4 (3–5)	4 (2–5)	0.002
Presenting GCS score <8	203 (47.8)	186 (54.1)	0.082
Multiple trauma	196 (46.0)	186 (54.1)	0.026
Posttraumatic seizures	91 (22.5)	80 (26.3)	0.236

Values are presented as number of patients (%) unless otherwise indicated. Data were missing for some patients.

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Time to arrival, hrs, median (IQR)	2.0 (0.8–7.0)	5.0 (2.0–12.0)	<0.001
Transported by ambulance	309 (72.5)	290 (84.8)	<0.001
Presenting GCS score, median (IQR)	8 (6–11)	7 (5–11)	0.028
Presenting GCS-motor score, median (IQR)	4 (3–5)	4 (2–5)	0.002
Presenting GCS score <8	203 (47.8)	186 (54.1)	0.082
Multiple trauma	196 (46.0)	186 (54.1)	0.026
Posttraumatic seizures	91 (22.5)	80 (26.3)	0.236

Values are presented as number of patients (%) unless otherwise indicated. Data were missing for some patients.

TABLE 2. Mortality, hospital stay, and functional outcomes

Outcome Measure	Non-LMIC Sites, n = 426	LMIC Sites, n = 345	p Value
Hospital mortality	55 (12.9)	33 (9.6)	0.146
Intubation duration among survivors, days	4 (1–7)	4 (2–7)	0.745
ICU stay duration among survivors, days	5 (2–10)	7 (4–12)	<0.001
Hospital stay duration among survivors, days	11 (6–22)	16 (8–29)	<0.001
14-day ventilation-free days	9 (3–13)	10 (5–12)	0.277
14-day ICU-free days	8 (0–11)	6 (0–10)	0.004
28-day hospital-free days	13 (0–20)	9 (0–18)	0.007
Baseline PCPC score			0.550
1	383 (97.2)	325 (98.2)	
2	7 (1.8)	4 (1.2)	
3	2 (0.5)	2 (0.6)	
4	2 (0.5)	0 (0.0)	
5	0 (0.0)	0 (0.0)	
Discharge PCPC score among survivors			<0.001
1	191 (52.8)	138 (44.5)	
2	94 (26.0)	77 (24.8)	
3	28 (7.7)	52 (16.8)	
4	43 (11.9)	25 (8.1)	
5	6 (1.7)	18 (5.8)	
Poor PCPC outcome among survivors	77 (21.3)	96 (31.0)	0.004

Liang KWH, Lee JH, Qadri SK, Nadarajan J, Caporal P, Roa G JD, González-Dambrauskas S, Abbas Q, Kazzaz Y, Chong SL; PACCMAN and LARed Network. Differences in clinical outcomes and resource utilization in pediatric traumatic brain injury between countries of different sociodemographic indices. J Neurosurg Pediatr. 2024 Feb 16;33(5):461-468. doi: 10.3171/2024.1.PEDS23306. PMID: 38364231.

TABLE 1. Baseline characteristics of study population stratified by income status

Baseline Characteristic	Non-LMIC Sites, n = 426	LMIC Sites, n = 345	p Value
Male sex	284 (66.7)	219 (63.7)	0.384
Age, yrs, mean (SD)	5.1 (4.5)	6.5 (5.1)	<0.001
Mechanism of injury			<0.001
Road traffic collision	159 (37.3)	180 (52.3)	
Fall	190 (44.6)	131 (38.1)	
Child abuse	39 (9.2)	12 (3.5)	
Other	38 (8.9)	21 (6.1)	
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TABLE 3. Predictors of poor functional outcome

Predictor	Unadjusted OR (95% CI)	p Value	aOR (95% CI)	p Value
LMIC	1.66 (1.17–2.35)	0.004	1.53 (1.04–2.26)	**0.033**
Age, yrs	1.03 (0.99–1.06)	0.150	1.02 (0.98–1.06)	0.397
Male sex	1.21 (0.84–1.76)	0.310	1.14 (0.75–1.71)	0.544
Time to arrival	1.01 (1.00–1.01)	0.051	1.01 (1.00–1.01)	0.187
Total GCS score	0.81 (0.77–0.86)	<0.001	0.83 (0.78–0.88)	**<0.001**
Mechanism of child abuse	1.49 (0.78–2.85)	0.223	1.75 (0.79 –3.88)	0.170
Presence of multiple trauma	2.05 (1.44–2.92)	<0.001	1.49 (1.01–2.19)	**0.046**

Boldface type indicates statistical significance.

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Perspectives

| What is PACCMAN? | → | Lessons from our paediatric TBI journey | → | Systems of care | → | Barriers to research |
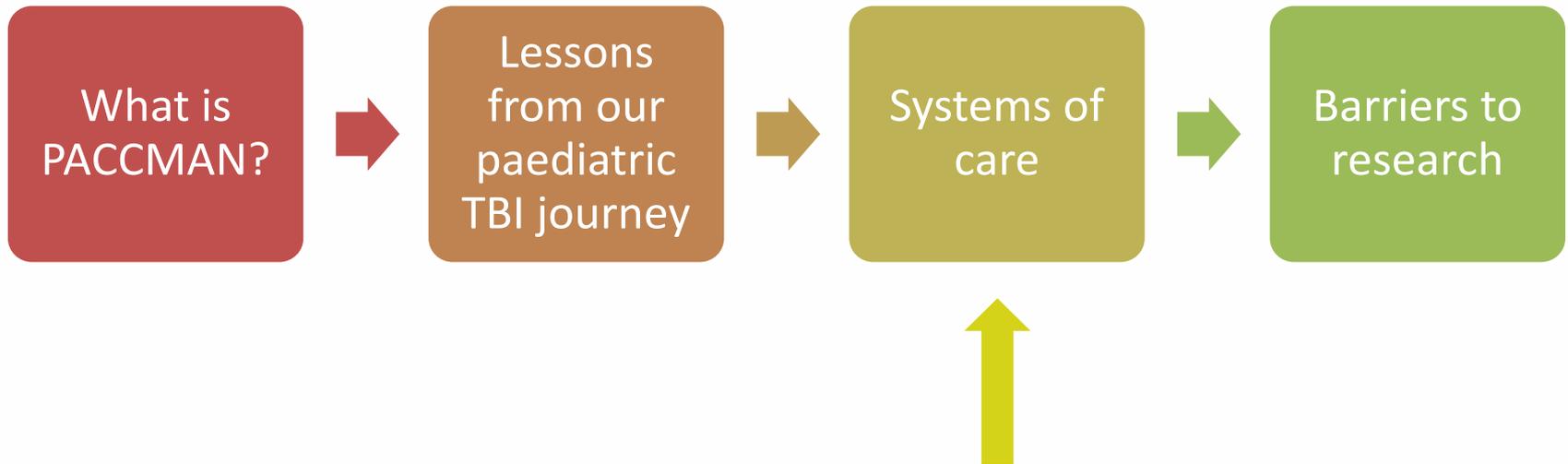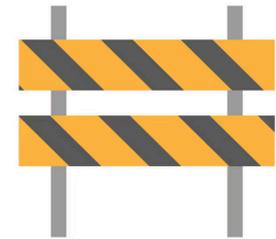
SYSTEMS OF CARE

Pre-hospital Phase

- Majority of TBI-related deaths come from LMICs: mainly due to road traffic events, conflict, terrorism, and interpersonal violence.

- The Excellence in Prehospital Injury Care for Children Study (EPIC4Kids), demonstrated an improvement in survival-to-discharge for children with severe TBI when prehospital guidelines were implemented in Arizona in the United States of America.

- However, there are substantial variations in pre-hospital trauma systems worldwide, including response time, on-scene and travel time, and interventions on site.

Lancet. 2024;403(10440):2133-2161. doi:10.1016/S0140-6736(24)00757-8
Ann Emerg Med. 2021;77(2):139-153. doi:10.1016/j.annemergmed.2020.09.435
Lancet Neurol. 2022;21(11):1004-1060. doi:10.1016/S1474-4422(22)00309-X

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Acute Care

- Multifactorial contributions to poorer TBI outcomes in LMICs: delays to CT scan, tertiary care, intensive care, and high barriers to ICP monitoring.

- A comparative study between an LMIC paediatric cohort and the TRACK-TBI paediatric cohort at Massachusetts General Hospital (MGH) in the United States
  - HIC status correlated with shorter time to consult, imaging and surgery, shorter hospitalisation and better outcomes among severe cases.

Rolle ML, Pascual JSG, Williams AL, et al. Time to Care: Analysis of Time Differences and Outcomes in the Management of Pediatric Traumatic Brain Injury for a High-Income and Lower-Middle-Income Country. *World Neurosurg*. April 2023.

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Post Acute Care

- Current systems of care are inconsistent across the spectrum of TBI severity, resulting in gaps in service delivery post-hospital discharge.

- There is a need to establish standards for systematic transition back to school and community, and coordination between multiple specialties[10][11].

- There is need for longer-term maintenance of rehabilitation and to systematically involve parents and caregivers in goal-setting and action planning of interventions[12].

Arch Phys Med Rehabil. 2020;101(6):1072-1089. doi:10.1016/j.apmr.2020.01.013
J Head Trauma Rehabil. 2017;32(6):367-377. doi:10.1097/HTR.0000000000000287
Dev Med Child Neurol. 2024;66(7):836-848. doi:10.1111/dmcn.15773

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National Injury Prevention Conference 2025

1 April 2025, Tuesday

8.30am – 4.30pm

NUHS Tower Block Auditorium, Level 1 1E Kent Ridge Road, Singapore 119228

Scan QR code to register

for.sg

Injuries may occur at any time and anywhere, including on roads, in workplaces, from falls, and through drowning. These incidents are preventable.

Join the first national conference that brings together stakeholders from across the government, including ministries, statutory boards, and safety councils, to engage in discussions and create a national injury prevention framework for Singapore.

Guest-of-Honour

Prof Kenneth Mak
Director-General of Health
Ministry of Health

Event Leads

Clin Asst Prof Ronald Tan
Senior Consultant
Department of Emergency Medicine
KK Women's and Children's Hospital

Adj Asst Prof Raj Menon
Centre Director
Senior Consultant
National University Centre for Trauma
National University Hospital

Speakers

Ms Jolene Cheng
Assistant Director
National Trauma Unit
Ministry of Health

Adj Asst Prof Teo Li-Tserng
Senior Consultant
Head of Service (Trauma Surgery),
Director, Trauma Centre,
Tan Tock Seng Hospital
Regional Director,
Central Region Trauma Services,
National Healthcare Group

Dr Ross Davenport
Clinical Lead for Trauma Surgery
Consultant Vascular & Trauma Surgeon
Yeoh Ghim Seng Professorship

Clin Asst Prof Angelina Ang
Senior Consultant
Department of Emergency Medicine
KK Women's and Children's Hospital

Dr Lynette Loo
Senior Consultant
National University Centre for Trauma
National University Hospital

Organised by:

National University Hospital | National University Centre for Trauma

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NATIONAL TRAUMA UNIT

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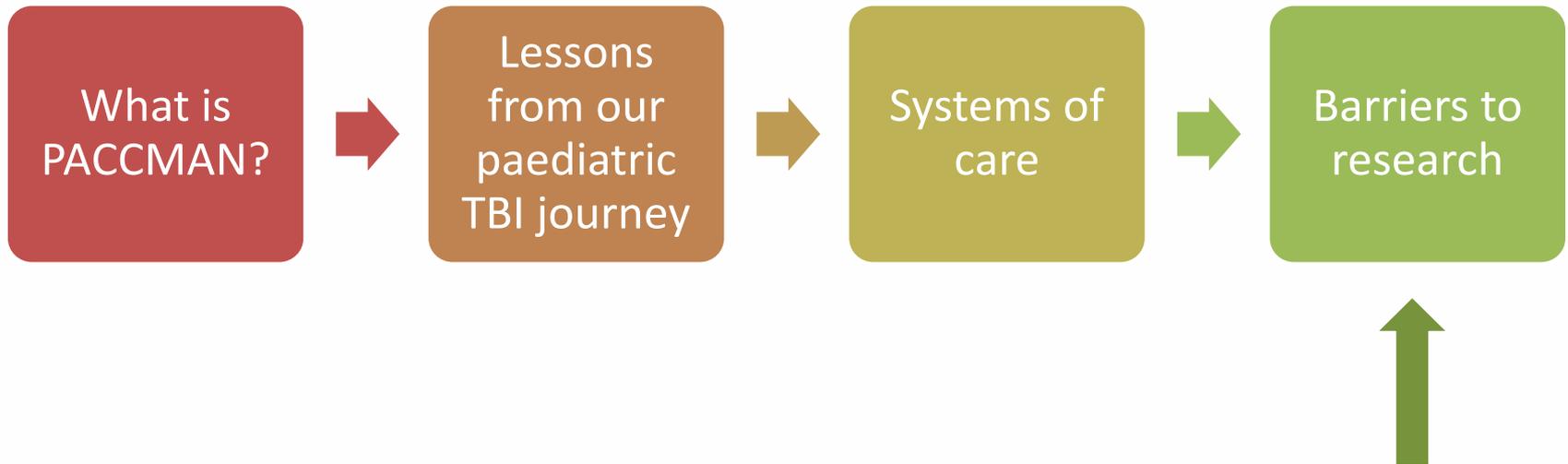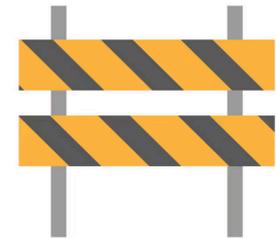
Regional Perspectives

- TBI research in Asia
  - Developing research infrastructure
  - Difficulties without legal team support e.g. Signing of research agreements
  - Not all sites have electronic health records
  - Time = a matter of "good will"

PEDIATRIC TBI
SYMPOSIUM

NOVEMBER 24TH, 2021

COL 7-8.30am / ARG 9-10.30am / MEX 7-8.30am 6-7.30am (DST regime) / UK 12-1.30pm / SG MY PH CN HK 8-9.30pm / TH VT ID 7-8.30pm / JP KR 9-10.30pm / IN 5.30-7pm / PK 5-6.30pm

SALTY STUDY

LA Red
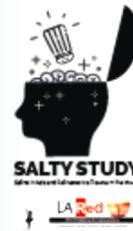
AGENDA

- **The importance of multicenter studies in TBI research** *Robert C Tasker, MD, FRCP*
- **Use of hyperosmolar agents: SALTY evidence versus reality** *Shu-Ling Chong, MPH*
- **Fluids in TBI: How much is too much?** *Suyun Qian, MD*
- **ICP monitor: Bane or boon?** *Edgar Guadarrama Granados, MD*

Meeting link

- **Join Zoom Meeting click here**
 **Meeting ID:** 816 4423 7767
  Passcode: 956385

GLOBAL COORDINATORS

America – Europe
Juan David Roa MD MSC jdroag@fucsalud.edu.co
Paula Caporal MD caporalpaula@gmail.com

Asia Pacific
Shu Ling Chong MD chong.shu-ling@kkh.com.sg
Dianna Sri Dewi Dianna.Sri.Dewi@kkh.com.sg

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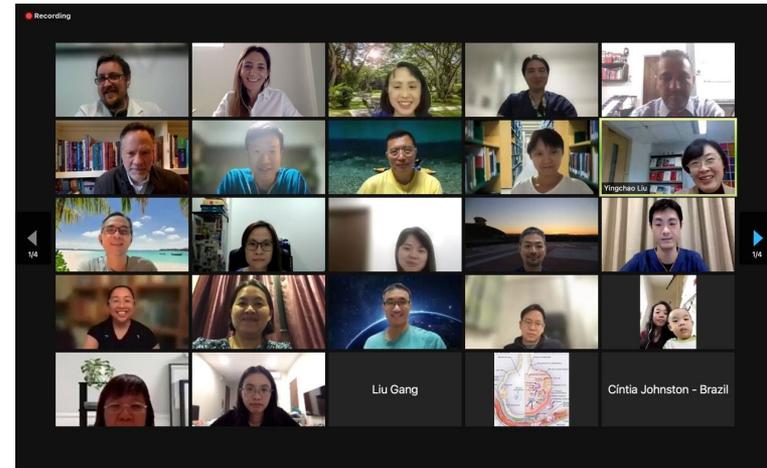
Barriers to regional collaborations

- Increasing need to fund multi-country collaborations = vital for sustainability

- Data sharing

- Recruitment difficulties

  - No dedicated time and no dedicated research assistants in many countries in Asia

- Research ideas, analysis and sub-analysis heavily reliant on a small number of individuals

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Steps forward

- Provide context and platforms for networking and collaboration
- Guidance to troubleshoot specific known pitfalls in international research
  - Regular huddles
  - ? Mentorship programs

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Acknowledgements

- KKH Children's Emergency and Children's Intensive Care Unit
- Mentorship by Professor Marcus Ong
- KKH research coordinators: Jane Ng and Dianna Sri
- A/Prof Jan Hau Lee and PACCMAN site PIs
- LARed leadership: Sebastián González-Dambrauskas, Paula Caporal, Juan D Roa; LARed site PIs
- Singapore Clinical Research Institute
  - Epidemiologists: Julie Zhu, Charles Zheng, Brendon Zhou
  - Coordinator: Ms Patricia Tay

Chong.Shu-Ling@kkh.com.sg

THANK YOU

CALL FOR USE CASES:
EM-RADAR

Submit your Research Proposals!

*Write to **emed.acp@singhealth.com.sg** for the Data Request Application form*

SingHealth Emergency Medicine Real–world Anonymised DAta Repository (EM–RADAR)

Data Scope
- Phase 1: SGH and SKH ED data
- Period: 1 June 2016 – 31 December 2022

Timeline
- Call for proposals are open!
- Data access on ODySSEy begins: Q2/Q3 2025 (after necessary approvals)

Selected teams will access
- 27 ED Datasets for SGH (De-identified) and/or
- 26 ED Datasets for SKH (De-identified)
- Comprehensive and robust ED Data: Include demographics, clinical information, lab results, outcome data etc