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Letter to the Editor

Reply to: Potential selection bias in the baseline

To the Editor,

We thank the authors, Li Yifang et al., for their interest in our paper: Pre-hospital airway management and survival outcomes after paediatric out-of-hospital cardiac arrests.[1]

We agree that resuscitation time bias had been studied using time-dependent propensity score and risk-set matching in a paediatric airway management study.[2] We did not perform time-dependent propensity score matching as the data on time of advanced airway insertion was not consistently available for all patients.

To adjust for resuscitation time bias in our analysis, we performed sensitivity analysis including presence of pre-hospital return of spontaneous circulation (ROSC) as a confounder in the multivariate logistic regression model. The result had been reported and published as supplementary data.[1] The baseline characteristics of the propensity score matched cohort are presented in Table 1. The advanced airway management (AAM) group, consisting of patients who received endotracheal intubations (ETI) and supraglottic airways (SGA) were associated with lower survival with favourable neurological outcome (Cerebral Performance Category (CPC) 1 or 2) [AAM: 8/396 (2.0%) versus BVM: 19/396 (4.8%); adjusted odds ratio (aOR), 0.39 (95% CI 0.17–0.91); p = 0.03] though not in 1-month survival [AAM: 28/396 (7.1%) versus BVM: 40/396 (10.1%); aOR 0.67 (95% CI 0.41–1.12); p = 0.126] when compared with bag-valve-mask (BVM) ventilations (Table 2).

There were 282 patients that achieved pre-hospital ROSC in our study, and the data on duration of resuscitation at scene/en-route was only available for 140 patients with pre-hospital ROSC.[1] It cannot be assumed that the duration of resuscitation calculated would be representative of the whole cohort of patients that achieved pre-hospital ROSC. The proportions of patients that achieved pre-hospital ROSC in the AAM group was higher than in the BVM group. [AAM: 43/452 (9.5%) versus BVM: 239/2679 (8.9%); p = 0.002]. However, lower 1-month survival and survival with CPC 1 or 2 was observed in the AAM group compared to BVM group for the whole unmatched cohort.[1] The median (IQR) scene time (available for 745 patients) was also longer in the patients that received AAM compared to BVM [AAM: 13 min (9–18) versus BVM: 7 min (4–11); p < 0.001]. An observational study had evaluated the effect of resuscitative time at the scene on survival outcomes and found that longer on-scene resuscitation was associated with decreased 1-month survival, adjusted for AAM and other confounders.[3]

Our results are similar to two large paediatric observational studies[4,5] Le Bastard et al.[5] observed a lower 1-month survival in ETI compared to the supraglottic procedure group (BVM and SGA), propensity-adjusted odds ratio [paOR], 0.39; 95% CI, 0.25–0.62; p < 0.001. The 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR) for paediatric life support, suggest the use of bag-mask ventilation rather than tracheal intubation or insertion of a supraglottic airway in the management of children with cardiac arrest in the out-of-hospital setting.[6–9] Our study finding of increased survival observed in the BVM ventilations group compared with advanced airways support the ILCOR recommendation.

Declaration of Competing Interest

MEH Ong reports grants from the Laerdal Foundation, Laerdal Medical, and Ramsey Social Justice Foundation for funding of the Pan-Asian Resuscitation Outcomes Study; an advisory relationship with Global Healthcare SG, a commercial entity that manufactures cooling devices. MEH Ong has a licensing agreement with ZOLL Medical Corporation and patent filed (Application no: 13/047,348) for a “Method of predicting acute cardiopulmonary events and survivability of a patient”. He is also the co-founder and scientific advisor of TIIM Healthcare, a commercial entity which develops real-time prediction and risk stratification solutions for triage. All other authors have no conflict of interest to declare.

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Table 1 – Baseline characteristics of the propensity score matched cohort of AAM with BVM.

Factors	BVM (n = 396)	AAM (n = 396)	|Standardized difference|, % [a]
Age group, n (%) 13–17 years	211 (53.3)	197 (49.8)	5.0
Gender, n (%) Female	121 (30.6)	125 (31.6)	4.2
Home residence, n (%)	104 (26.3)	121 (30.6)	7.9
Arrest witnessed, n (%)	173 (43.7)	178 (45)	0
Bystander CPR performed, n (%)	232 (58.6)	222 (56.1)	1.0
Initial rhythm VF/VT/Unknown shockable, n (%)	32 (8.1)	38 (9.6)	7.4
Prehospital drug administration, n (%)	45 (11.4)	72 (18.2)	24.4
Prehospital defibrillation, n (%)	54 (13.6)	57 (14.4)	4.2
Response time < 8 mins, n (%)	221 (55.8)	223 (56.3)	2.6
Cause of arrest, n (%)			
Presumed cardiac aetiology	111 (28)	125 (31.6)	9.7
Non-cardiac etiology	227 (57.3%)	215 (54.3%)	10.1
Pre-hospital ROSC (at scene and en-route), n (%)	20 (5.1%)	30 (7.6%)	9.1

[a] Absolute value of standardized difference is reported.

Table 2 – Outcomes of comparison of AAM with BVM in the overall unmatched cohort and in the propensity score matched cohort (including pre-hospital ROSC as a covariate).

	Number of patients with outcome/total patients (%)		aOR (95% CI) [a]	p-value
Overall unmatched cohort				
Primary analysis (AAM vs BVM)	**BVM**	**AAM**	**Effect of AAM vs BVM**	
1-month survival	347/2679 (13)	42/452 (9.3)	0.65 (0.41, 1.04)	0.071
Survival with favourable neurological outcome (CPC 1 or 2)	183/2679 (6.8)	8/452 (1.8)	0.19 (0.08, 0.5) *	0.001
Analysis of SGA vs BVM	**BVM**	**SGA**	**Effect of SGA vs BVM**	
1-month survival	347/2679 (13)	33/371 (8.9)	0.67 (0.41, 1.10)	0.114
Survival with favourable neurological outcome (CPC 1 or 2)	183/2679 (6.8)	5/371 (1.3)	0.13 (0.04, 0.41) *	0.001
Analysis of ETI vs BVM	**BVM**	**ETI**	**Effect of ETI vs BVM**	
1-month survival	347/2679 (13)	9/81 (11.1)	0.57 (0.19, 1.62)	0.289
Survival with favourable neurological outcome (CPC 1 or 2)	183/2679 (6.8)	3/81 (3.7)	0.51 (0.12, 2.20)	0.368
Propensity score- matched cohort				
Primary analysis (AAM vs BVM)	**BVM**	**AAM**	**Effect of AAM vs BVM**	
1-month survival	40/396 (10.1)	28/396 (7.1)	0.67 (0.41, 1.12)	0.126
Survival with favourable neurological outcome (CPC 1 or 2)	19/396 (4.8)	8/396 (2.0)	0.39 (0.17, 0.91) *	0.03
Analysis of SGA vs BVM	**BVM**	**SGA**	**Effect of SGA vs BVM**	
1-month survival	40/337 (11.9)	24/337 (7.1)	0.57 (0.34, 0.97) *	0.038
Survival with favourable neurological outcome (CPC 1 or 2)	18/337 (5.3)	5/337 (1.5)	0.27 (0.10, 0.73)*	0.001
Analysis of ETI vs BVM	**BVM**	**ETI**	**Effect of ETI vs BVM**	
1-month survival	7/59 (15.3)	4/59 (16.9)	0.54 (0.15, 1.95)	0.348
Survival with favourable neurological outcome (CPC 1 or 2)	6/59 (10.2)	3/59 (5.1)	0.51 (0.12, 2.20)	0.368

AAM, advanced airway management.
BVM, Bag-valve-mask ventilation.
SGA, supraglottic airway.
ETI, endotracheal intubation.
aOR, adjusted odds ratio.

[a] Adjusted for age, gender, EMS transport, location of arrest, witnessed status, bystander cardiopulmonary resuscitation, pre-hospital defibrillation, pre-hospital drug administration, EMS response time (time of call to time of ambulance arriving at scene), initial arrest rhythm, cause of arrest and pre-hospital ROSC (at scene and En-route).

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