CRITICAL CARE

Rapid response systems: a systematic review and meta-analysis

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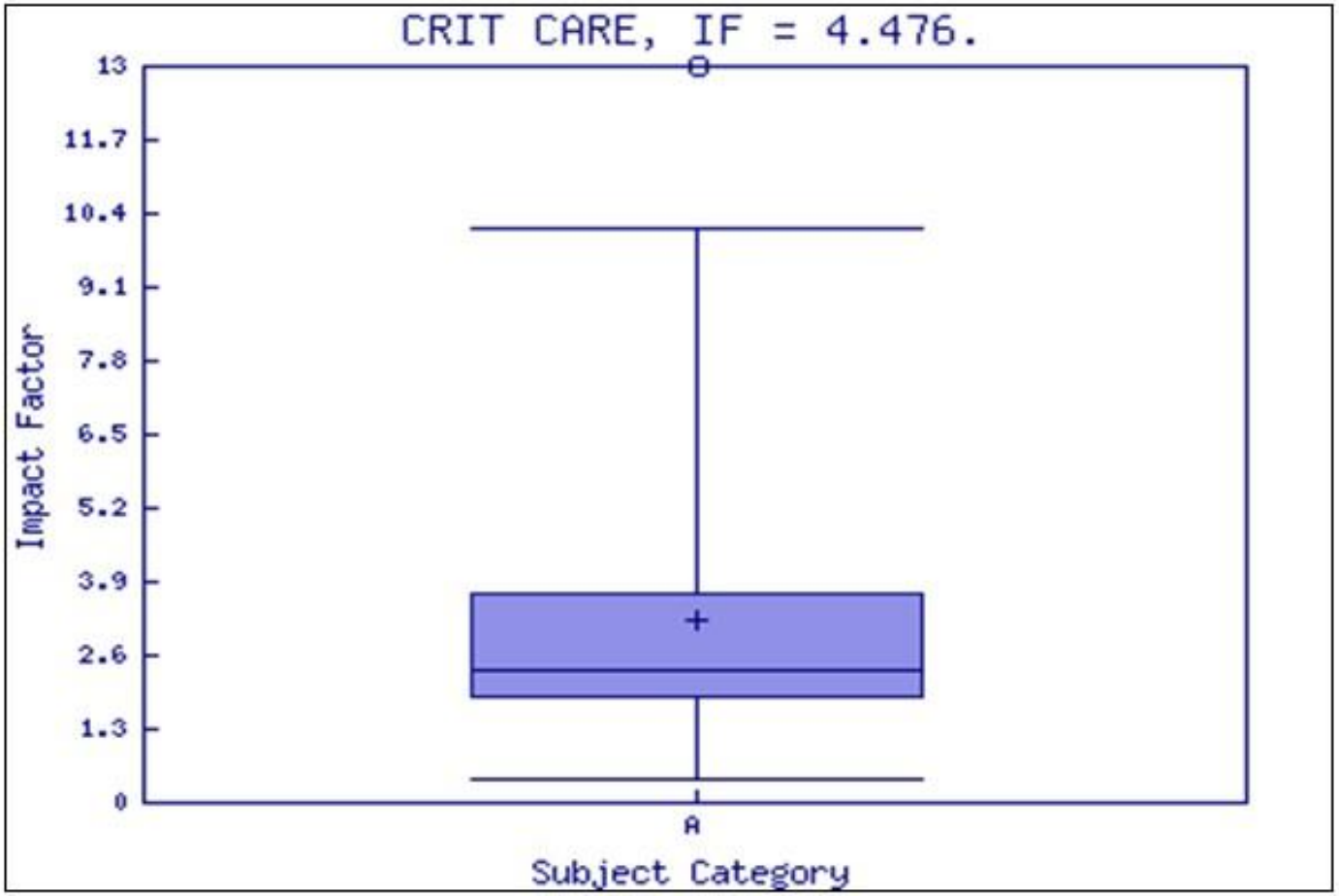
Critical Care. 2015;19(1)254
Dio:10.1186/S13054-015-0973-Y

第二加護病房 黃曉萍

2016.02.24.

Category Name	Total Journals in Category	Journal Rank in Category	Quartile in Category
CRITICAL CARE MEDICINE	27	5	Q1



步驟１：系統性文獻回顧探討的問題為何？

研究族群 / 問題 (Population/ Problem)：住院病人

介入措施 (Intervention)：醫療緊急小組(MET)

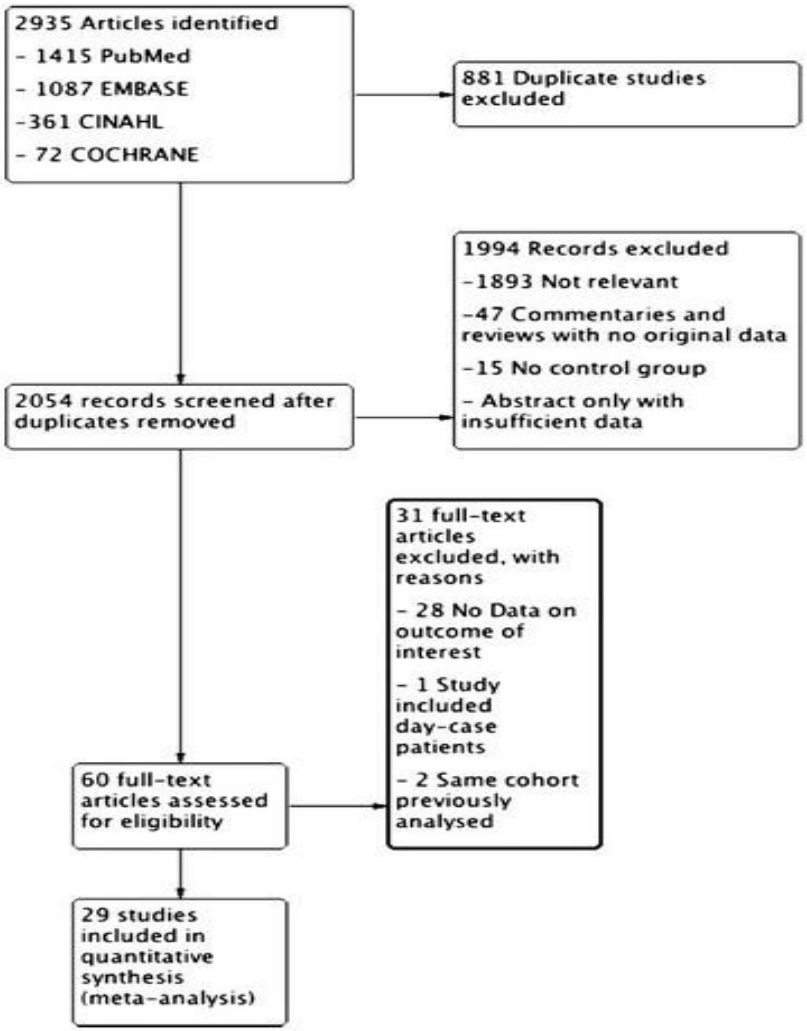
比較 (Comparison)：無醫療緊急小組(MET)

結果 (Outcomes)：有效降低死亡率及999

問題:醫療緊急小組(MET) 能有效降低死亡率及999嗎?

步驟 2：系統性文獻回顧的品質如何？

F - 研究是否找到 (Find) 所有的相關證據？



Literature search

Methods

- A systematic review of studies published between 1 January 1990 and 31 December 2013 was conducted in accordance with published guidelines [19, 20]. We used the PubMed, EMBASE, CINAHL (Cumulative Index to Nursing and Allied Health Literature) and Cochrane Register of Controlled trials databases.
- Additionally, a hand search of bibliographies of key publications was performed. Search terms included 'rapid response team', medical emergency team' and 'critical care outreach'.
- Details of the electronic search are described in Fig. Fig.11 with additional information provided in the supplementary appendix.

評讀結果：▓是 □否 □不清楚

A - 文獻是否經過嚴格評讀 (Appraisal)？

Risk of bias in individual studies

- Reviewers worked independently to assess study quality.
- The Newcastle Ottawa Scale (NOS) was used for assessing non-randomized studies [25].
- The NOS uses a star system to evaluate the selection of study groups, the comparability of groups and the ascertainment of either the exposure or outcome of interest.
- The interrupted time series(時間序列), controlled before–after(前後比較研究)and cluster randomized studies(集群隨機) were evaluated using the criteria recommended by the Cochrane Effective Practice and Organisation of Care Group [26].

評讀結果：▩是 □否 □不清楚

I - 是否只納入 (included) 具良好效度的文章？

P.9

Table 3

Risk of bias table for cluster randomized control trials and controlled before–after trials

Study	Allocation sequence generation	Allocation concealment	Baseline comparability	Complete outcome data	Outcome variables assessed blindly	Protection from contamination	Selective outcome reporting	Free from other biases
Bristow et al. [42]	High risk	High risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Priestley et al. [12]	High risk	High risk	High risk	High risk	Unclear	Unclear	High risk	Low risk
Hillman et al. [5]	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

評讀結果：▓是 □否 □不清楚

I - 是否只納入 (included) 具良好效度的文章？ P.3

選擇4　可行性1　結果3

Table 4

Risk of bias table using the Newcastle Ottawa Quality Assessment Scale for cohort studies

Study	Selection				Comparability	Outcome		
	Representativeness of exposed cohort	Selection of non-exposed cohort	Ascertainment of exposure	Outcome of interest was not present at the start of the study	Comparability of cohorts on the basis of design or analysis	Assessment of outcome	Was follow-up long enough for the events to occur?	Adequacy of follow-up cohorts
Al-Qahtani et al. [40]	*	*	*	*		*	*	*
Baxter et al. [41]	*	*	*	*		*	*	*
Beitler et al. [42]			*	*		*	*	*
Bellomo et al. [22]	*	*	*	*	*	*	*	*
Buist et al. [44]	*	*		*	*	*	*	
Campello et al. [45]	*		*	*		*	*	*
Dacey et al. [46]	*	*	*	*	*	*		
DeVita et al. [47]	*	*	*	*				*
Hayani et al. [48]			*	*		*	*	
Jones et al. [50]	*	*	*	*		*	*	
Kenward et al. [51]	*	*	*	*	*	*	*	
Konrad et al. [14]	*	*	*	*	*	*	*	*
Lim et al. [52]	*	*	*	*		*		*
Santamaria et al. [53]	*	*	*	*	*	*	*	*
Shah et al. [54]	*	*	*	*	*	*	*	*
Simmes et al. [55]			*	*		*		
Brilli et al. [56]	*	*	*	*	*	*	*	*
Anwar ul Haque et al. [58]		*		*		*	*	
Hunt et al. [59]	*	*	*	*		*	*	*
Kotsakis et al. [60]				*	*		*	*
Sharek et al. [61]	*	*	*	*	*	*	*	*
Tibballs and Kinney [23]	*	*		*		*	*	*
Zenker et al. [62]		*		*		*	*	*

- 評讀世代研究文章，用『紐卡索渥太華品質評估量表(NOS)』

評讀結果：■是 □否 □不清楚

I - 是否只納入 (included) 具良好效度的文章？

Table 5

Risk of bias table for interrupted time series studies

Study	Was the intervention independent of other changes?	Was the shape of the intervention effect pre-specified?	Was the intervention unlikely to affect data collection?	Was knowledge of the allocated interventions adequately prevented during the study?	Were incomplete outcome data adequately addressed?	Was the study free from selective outcome reporting?	Was the study free from other risks of bias?
Howell et al. [49]	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Hanson et al. [57]	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Low risk

評讀結果：■是 □否 □不清楚

T - 作者是否以表格和圖表「總結」(total up) 試驗結果？

1. The RRS studies had an effective sample size of 2,160,213 patients (1,107,492 in the intervention group and 1,108,380 in the control group) (Table 1).
2. Nineteen studies (65.5 %) reported physicians as part of the RRS team for 24 hours per day and 7 days per week, two studies only had physician presence for office hours Monday to Friday, seven studies had no physician presence and one study did not report on the composition of the team. All of the studies have been published since 2000 and 13 studies have been published after 2008 (the end date for systematic review by Chan et al.).
3. Twenty-five studies were single centre. Twenty-one studies were conducted in academic hospitals, seven in community hospitals and one study used multiple sites that included both academic and community hospitals.
4. The characteristics of the RRS intervention are described in Table 2. The number of RRS team activations per 1000 admissions was reported in 23 studies and varied substantially across studies.
5. **The mean and 95 % CI for the adult and paediatric activations per 1000 admissions were 16.3 (9.0–23.7) and 16.8 (6.0–27.6), respectively.**
6. **About 33 % (95 % CI 23–43 %) of referrals were admitted to the ICU immediately after a RRS team consultation and 9.7 % (95 % CI 4.5–14.9 %) acquired a new designation of do not attempt resuscitation.**

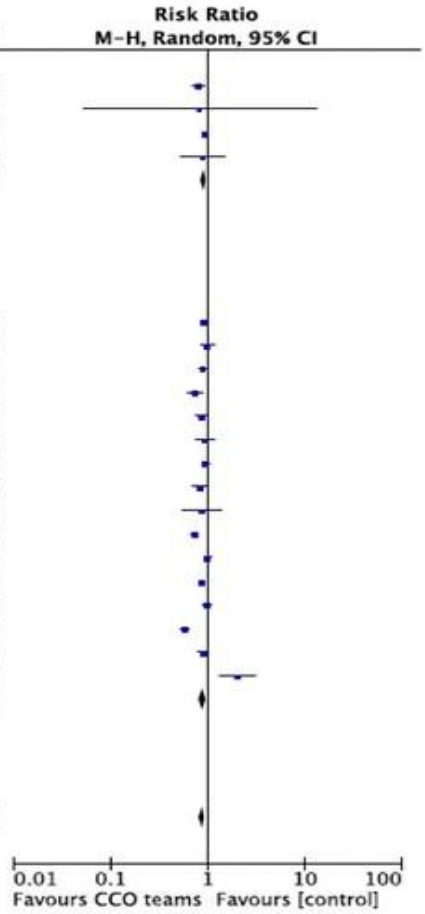
Table 1 Characteristics of included studies (P.5-6)
Table 2 Characteristics of rapid response system implementation and interventions (P7-8)

評讀結果：▩是 □否 □不清楚

T - 作者是否以表格和圖表「總結」 (total up) 試驗結果？

Fig. 2

Study or Subgroup	Rapid Response Systems Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
1.1.1 Cluster RCT, CBA and ITS Studies						
Bristow	243	18338	535	32604	5.4%	0.81 [0.69, 0.94]
Hillman	1	622	1	517	0.1%	0.83 [0.05, 13.26]
Howell	1755	90045	1383	66496	6.7%	0.94 [0.87, 1.00]
Priestley	27	530	28	487	1.5%	0.89 [0.53, 1.48]
Subtotal (95% CI)		**109535**		**100104**	**13.6%**	**0.91 [0.85, 0.97]**
Total events	2026		1947			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.11$, df = 3 (P = 0.38); $I^2 = 3\%$						
Test for overall effect: Z = 2.70 (P = 0.007)						
1.1.2 Observational and Before After Studies						
Al-Qahtani	3191	157804	2214	98931	6.9%	0.90 [0.86, 0.95]
Baxter	400	11271	279	7820	5.4%	0.99 [0.86, 1.16]
Beitler	1086	79013	1194	77021	6.5%	0.89 [0.82, 0.96]
Bellomo	222	20921	302	21090	5.0%	0.74 [0.62, 0.88]
Buist	393	22847	380	19317	5.6%	0.87 [0.76, 1.01]
Campello	357	70850	94	17557	4.1%	0.94 [0.75, 1.18]
Chan	773	24978	780	24193	6.3%	0.96 [0.87, 1.06]
Dacey	402	17090	160	5667	4.9%	0.83 [0.70, 1.00]
Hayani	26	294	53	520	1.8%	0.87 [0.55, 1.36]
Jones	4070	104001	873	16246	6.7%	0.73 [0.68, 0.78]
Kenward	1054	53500	1070	53500	6.5%	0.99 [0.91, 1.07]
Konrad	1211	73825	3854	203892	6.7%	0.87 [0.81, 0.93]
Lim	583	34699	569	33360	6.0%	0.99 [0.88, 1.10]
Santamaria	551	74616	1174	91137	6.2%	0.57 [0.52, 0.63]
Shah	970	45125	390	16244	6.0%	0.90 [0.80, 1.01]
Simmes	89	2410	25	1376	1.9%	2.03 [1.31, 3.15]
Subtotal (95% CI)		**793244**		**687871**	**86.4%**	**0.88 [0.81, 0.95]**
Total events	15378		13411			
Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 129.79$, df = 15 (P < 0.00001); $I^2 = 88\%$						
Test for overall effect: Z = 3.20 (P = 0.001)						
Total (95% CI)		**902779**		**787975**	**100.0%**	**0.88 [0.82, 0.94]**
Total events	17404		15358			
Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 135.66$, df = 19 (P < 0.00001); $I^2 = 86\%$						
Test for overall effect: Z = 3.69 (P = 0.0002)						
Test for subgroup differences: $Chi^2 = 0.41$, df = 1 (P = 0.52), $I^2 = 0\%$						

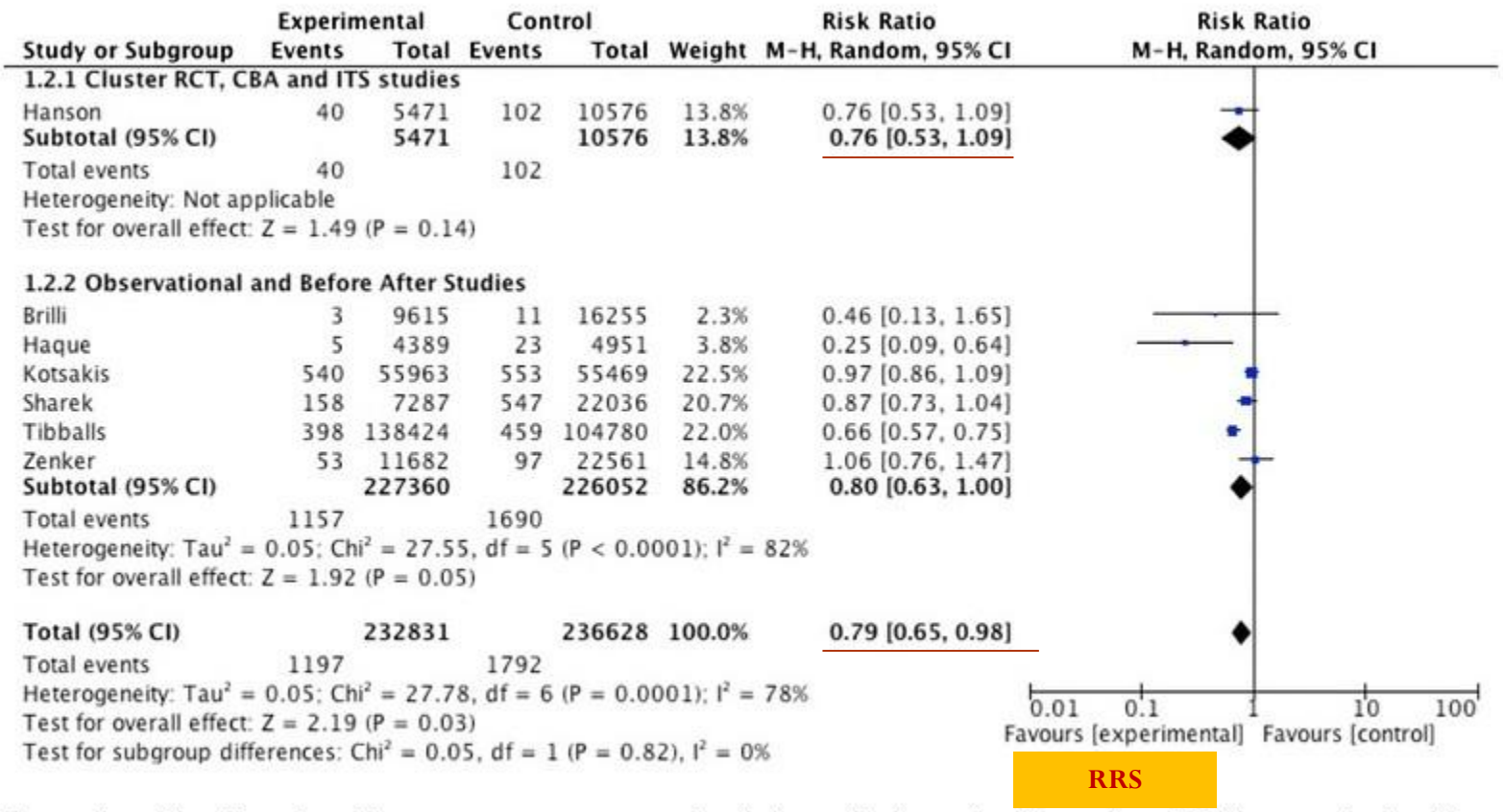


Forest plot of the effect of rapid response system teams on hospital mortality in adult in-patients. Weights are calculated from random-effects analysis. *CBA* controlled before–after, *CCO* critical care outreach, *CI* confidence interval, *ITS* interrupted time series, *RCT* randomized controlled trial

RRS在醫院成人使其死亡率下降（RR 0.87，95%CI 0.81-0.95，p <0.001）

T - 作者是否以表格和圖表「總結」 (total up) 試驗結果？

Fig. 3



RRS

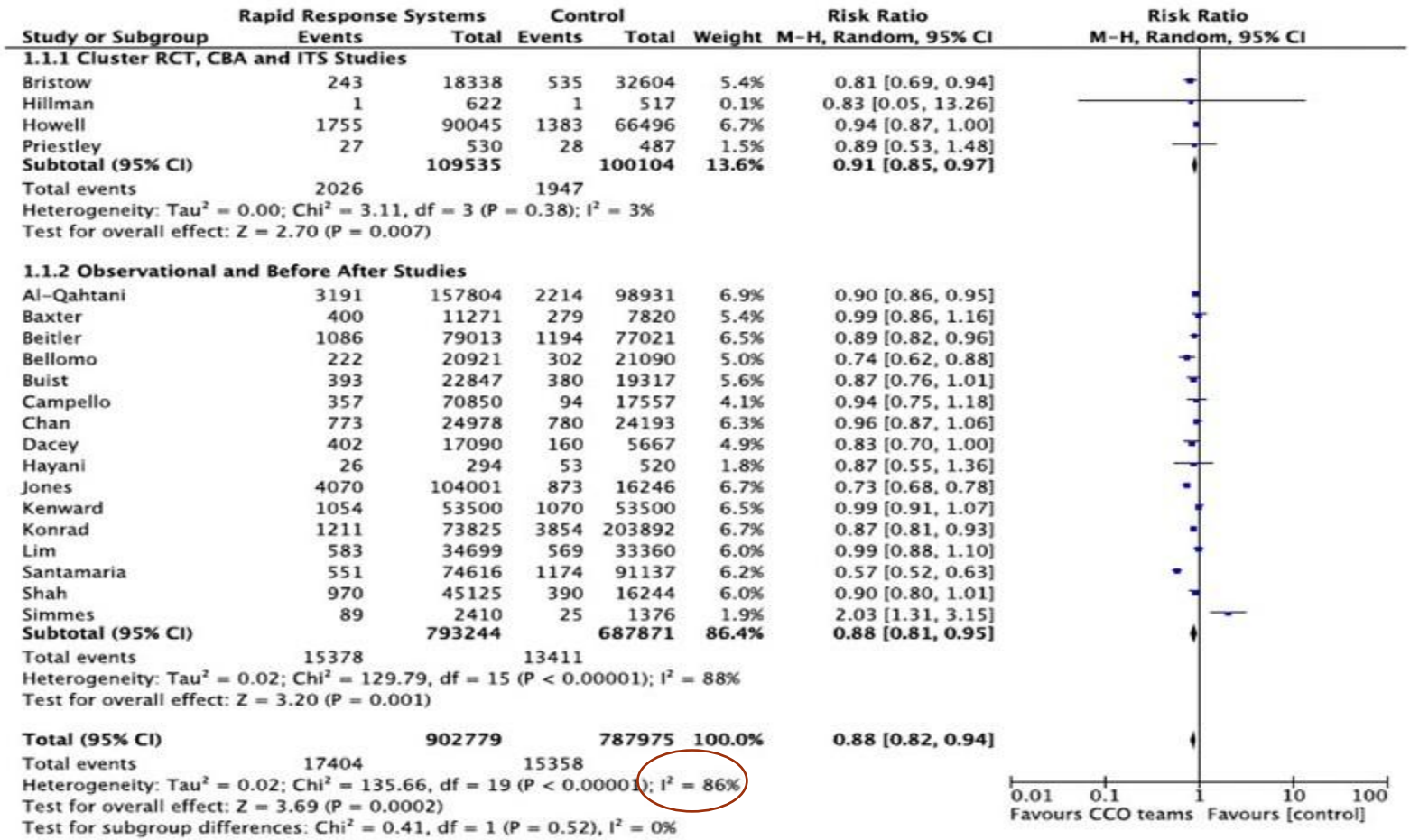
Forest plot of the effect of rapid response system teams on hospital mortality in paediatric in-patients. Weights are calculated from random-effects analysis. *CBA* controlled before–after, *CI* confidence interval, *ITS* interrupted time series, *RCT* randomized controlled trial

RRS存在使住院兒童的死亡率降低

評讀結果：▩是 □否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

Fig. 2



Forest plot of the effect of rapid response system teams on hospital mortality in adult in-patients. Weights are calculated from random-effects analysis. *CBA* controlled before–after, *CCO* critical care outreach, *CI* confidence interval, *ITS* interrupted time series, *RCT* randomized controlled trial

評讀結果：▩是 □否 □不清楚

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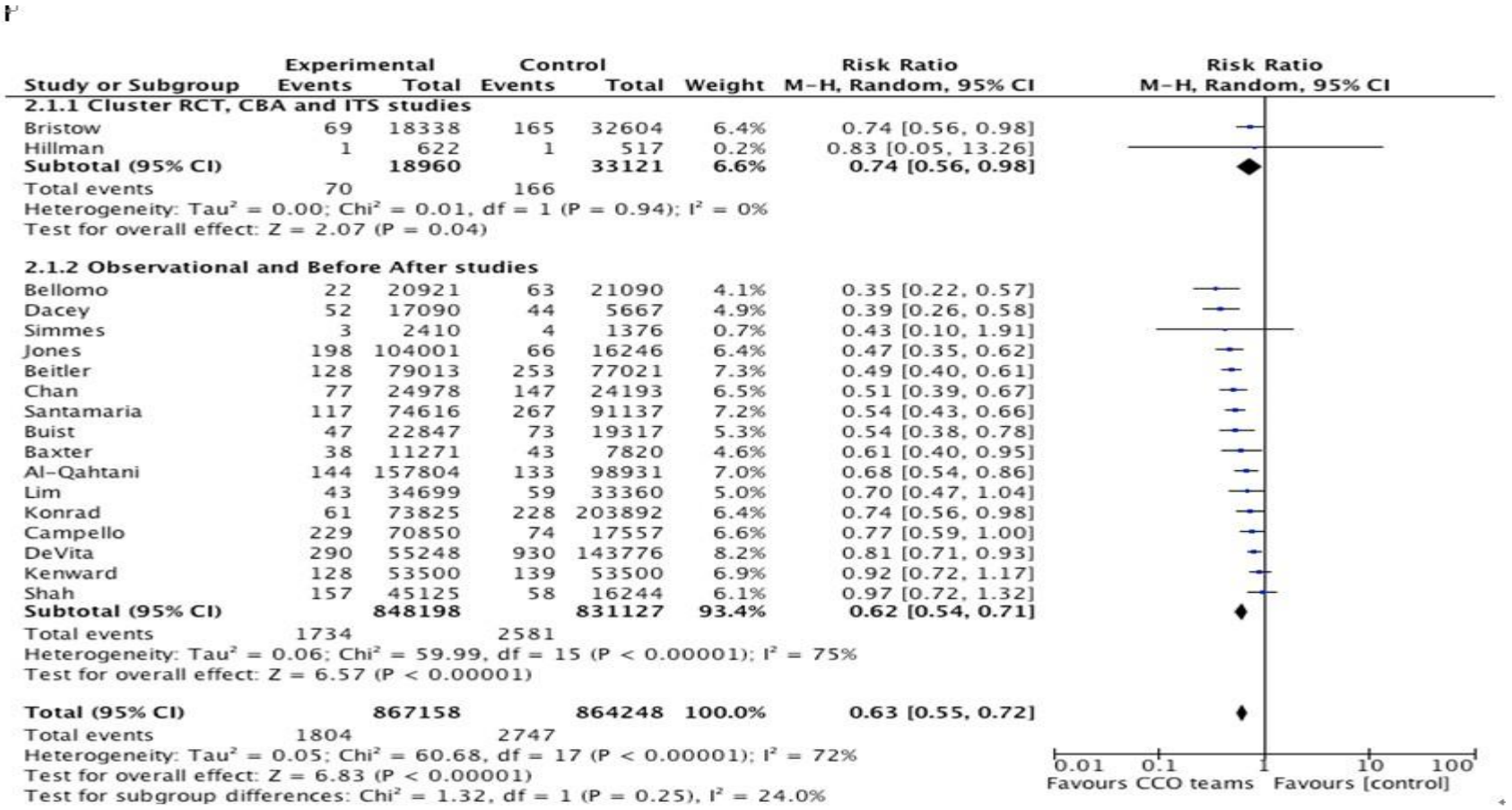


Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
2.1.1 Cluster RCT, CBA and ITS studies						
Bristow	69	18338	165	32604	6.4%	0.74 [0.56, 0.98]
Hillman	1	622	1	517	0.2%	0.83 [0.05, 13.26]
Subtotal (95% CI)		**18960**		**33121**	**6.6%**	**0.74 [0.56, 0.98]**
Total events	70		166			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.01$, df = 1 (P = 0.94); $I^2 = 0\%$						
Test for overall effect: Z = 2.07 (P = 0.04)						
2.1.2 Observational and Before After studies						
Bellomo	22	20921	63	21090	4.1%	0.35 [0.22, 0.57]
Dacey	52	17090	44	5667	4.9%	0.39 [0.26, 0.58]
Simmes	3	2410	4	1376	0.7%	0.43 [0.10, 1.91]
Jones	198	104001	66	16246	6.4%	0.47 [0.35, 0.62]
Beitler	128	79013	253	77021	7.3%	0.49 [0.40, 0.61]
Chan	77	24978	147	24193	6.5%	0.51 [0.39, 0.67]
Santamaria	117	74616	267	91137	7.2%	0.54 [0.43, 0.66]
Buist	47	22847	73	19317	5.3%	0.54 [0.38, 0.78]
Baxter	38	11271	43	7820	4.6%	0.61 [0.40, 0.95]
Al-Qahtani	144	157804	133	98931	7.0%	0.68 [0.54, 0.86]
Lim	43	34699	59	33360	5.0%	0.70 [0.47, 1.04]
Konrad	61	73825	228	203892	6.4%	0.74 [0.56, 0.98]
Campello	229	70850	74	17557	6.6%	0.77 [0.59, 1.00]
DeVita	290	55248	930	143776	8.2%	0.81 [0.71, 0.93]
Kenward	128	53500	139	53500	6.9%	0.92 [0.72, 1.17]
Shah	157	45125	58	16244	6.1%	0.97 [0.72, 1.32]
Subtotal (95% CI)		**848198**		**831127**	**93.4%**	**0.62 [0.54, 0.71]**
Total events	1734		2581			
Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 59.99$, df = 15 (P < 0.00001); $I^2 = 75\%$						
Test for overall effect: Z = 6.57 (P < 0.00001)						
Total (95% CI)		**867158**		**864248**	**100.0%**	**0.63 [0.55, 0.72]**
Total events	1804		2747			
Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 60.68$, df = 17 (P < 0.00001); $I^2 = 72\%$						
Test for overall effect: Z = 6.83 (P < 0.00001)						
Test for subgroup differences: $Chi^2 = 1.32$, df = 1 (P = 0.25), $I^2 = 24.0\%$						

Figure S1. Forest plot of the effect of Rapid Response System teams on adult cardiac arrest. Weights calculated from random effects model.

評讀結果：▓是 □否 □不清楚

T - 作者是否以表格和圖表「總結」 (total up) 試驗結果？

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
2.2.1 Cluster RCT, CBA and ITS studies						
Hanson	2	5471	11	10576	1.3%	0.35 [0.08, 1.59]
Subtotal (95% CI)		**5471**		**10576**	**1.3%**	**0.35 [0.08, 1.59]**
Total events	2		11			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.36 (P = 0.17)						
2.2.2 Observational and Before After Studies						
Brilli	6	9615	25	16255	3.5%	0.41 [0.17, 0.99]
Haque	12	4389	26	4951	5.9%	0.52 [0.26, 1.03]
Hunt	8	7503	16	7504	3.9%	0.50 [0.21, 1.17]
Kotsakis	150	55963	210	55469	46.4%	0.71 [0.57, 0.87]
Sharek	5	7287	53	22036	3.3%	0.29 [0.11, 0.71]
Tibballs	24	138424	20	104780	7.8%	0.91 [0.50, 1.64]
Zenker	60	11682	181	22561	27.9%	0.64 [0.48, 0.86]
Subtotal (95% CI)		**234863**		**233556**	**98.7%**	**0.64 [0.53, 0.77]**
Total events	265		531			
Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 6.86$, df = 6 (P = 0.33); $I^2 = 13\%$						
Test for overall effect: Z = 4.80 (P < 0.00001)						
Total (95% CI)		**240334**		**244132**	**100.0%**	**0.64 [0.54, 0.76]**
Total events	267		542			
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 7.52$, df = 7 (P = 0.38); $I^2 = 7\%$						
Test for overall effect: Z = 5.14 (P < 0.00001)						
Test for subgroup differences: $Chi^2 = 0.60$, df = 1 (P = 0.44), $I^2 = 0\%$						

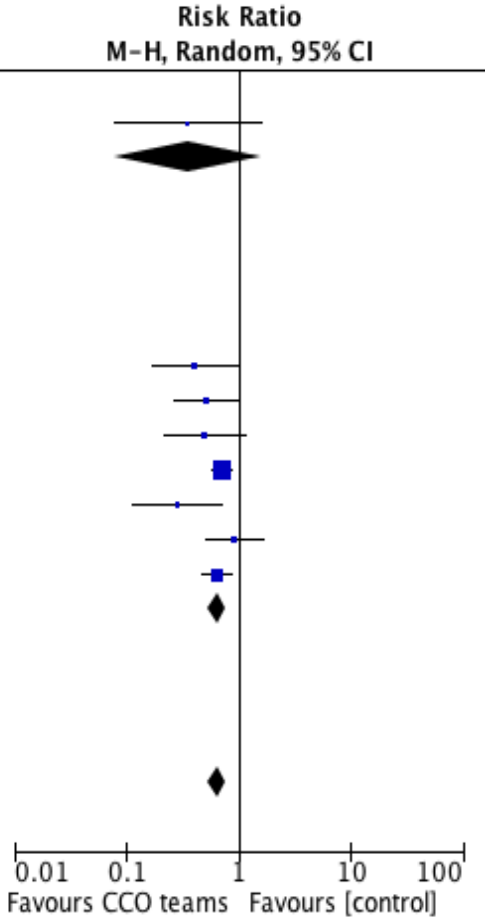
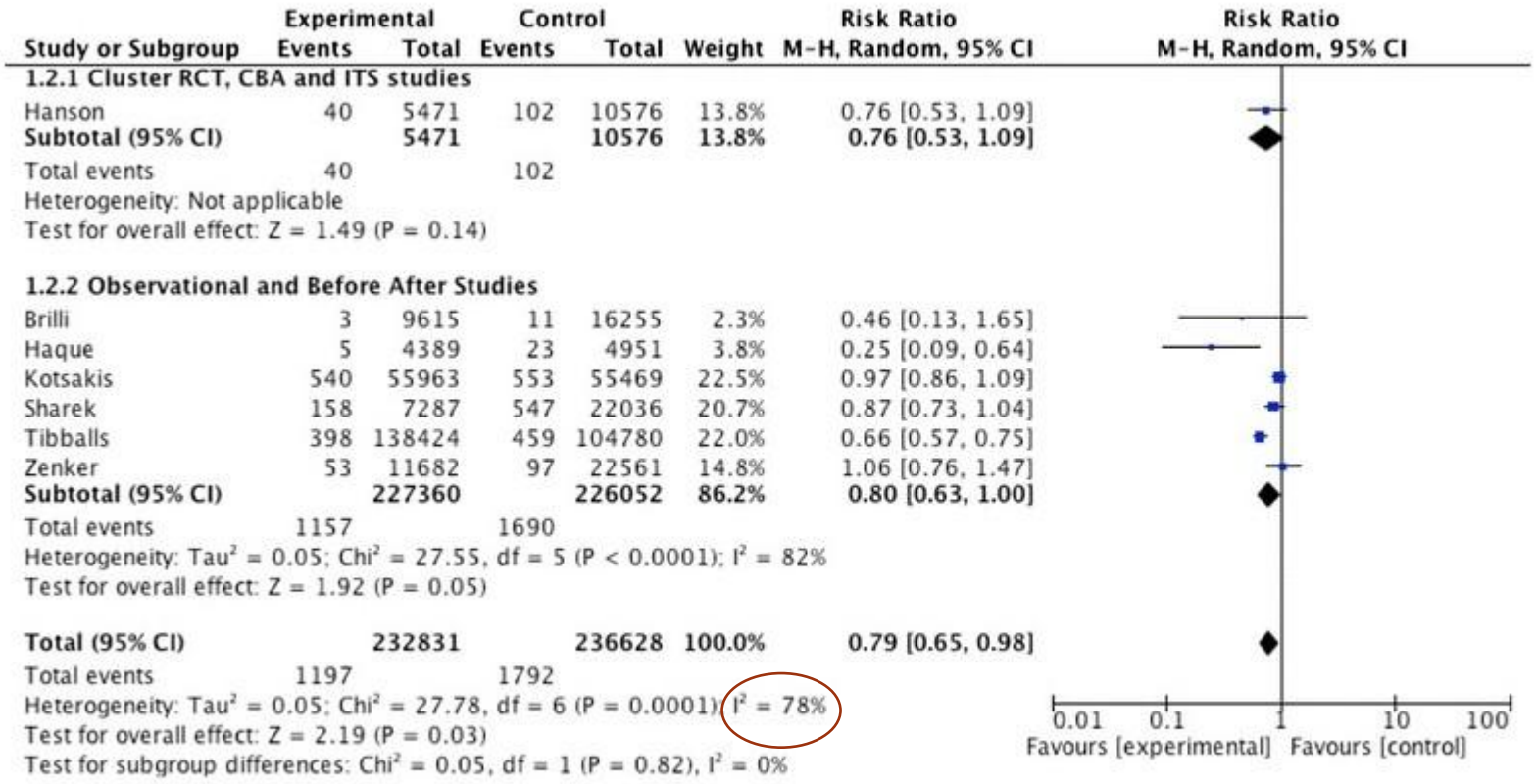


Figure S2. Forest plot of the effect of Rapid Response System teams on paediatric cardiac arrest. Weights calculated from random effects model.

評讀結果：▓是 □否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

Fig. 3



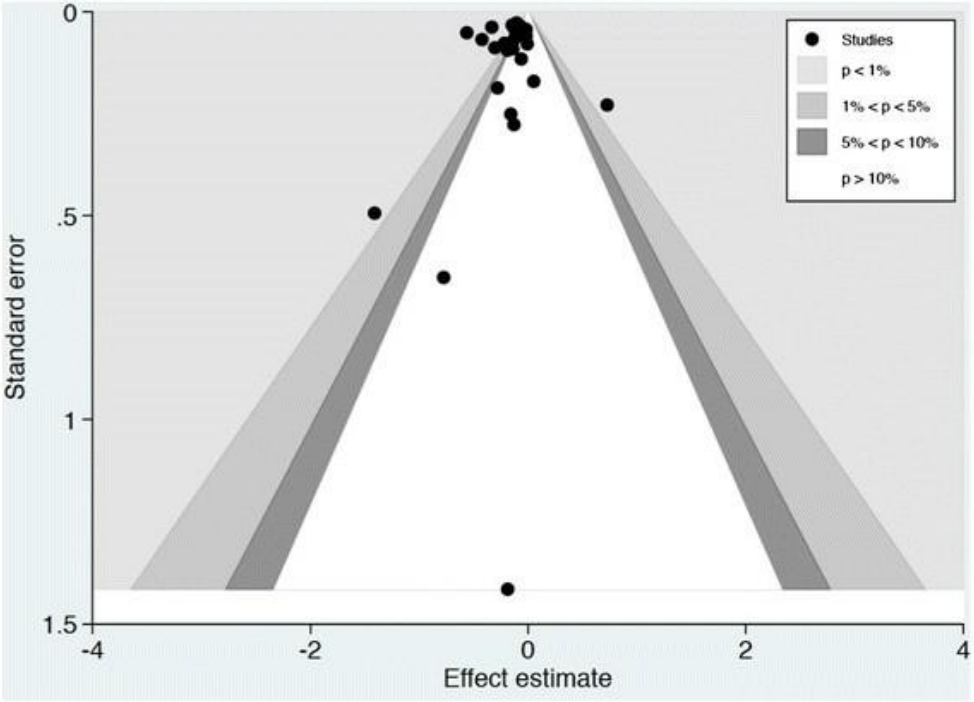
Forest plot of the effect of rapid response system teams on hospital mortality in paediatric in-patients. Weights are calculated from random-effects analysis. *CBA* controlled before–after, *CI* confidence interval, *ITS* interrupted time series, *RCT* randomized controlled trial

在兒童人群中，RRS還表現出與顯著異質性（死亡率降低（RR 0.82，95%CI 0.76-0.89）I^2 = 78%）

評讀結果：▩是 □否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

Fig. 4



Contour-enhanced funnel plot. If studies appear to be missing in areas of low statistical significance, then it is possible that the asymmetry is due to publication bias. Conversely, if the area in which studies are perceived to be missing are of high statistical significance, then publication bias is a less likely cause of the funnel asymmetry

可能存在發表偏誤

限制

- The vast majority of studies were observational studies without a contemporaneous control.
- Whilst there are several guidelines for the reporting of these studies, valuable information was often missing.
- The subgroup analysis did not find any significant difference in treatment effect in the different study methodologies.
- The outcomes of studies were reported variably.
  - Some studies reported all hospital mortality and others reported only non-DNAR designated hospital mortality
  - We used all hospital mortality reported because this offers the most conservative estimate of treatment.
- The major strength of our study is that the treatment effect has been consistent over time, is not influenced by any single study, and is robust to assumptions about clustering and to a further study being conducted.

結果

- This study found that RRS teams associate with a reduction in hospital mortality and cardiac arrest.

Key messages

- RRS teams are effective in reducing hospital mortality in both adult and paediatric in-patients.
- RRS teams also reduce hospital cardiac arrest.
- The vast majority of rapid response interventions do not require a physician and the presence of a physician was not associated with improved outcomes.

問題: 本院的MET是否應在修正啟動標準及落實執行面的狀況下，繼續推動?

綠:28人(同意)　黃:2人(尚無法確定)


Thank you...