

**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care****Worksheet author(s)**

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Date Submitted for review: 12 February 2010

**Clinical question.**

EIT-023B - For resuscitation systems (pre-hospital and in-hospital), does the use of a performance measurement system (eg Utstein) improve and/or allow for comparison of system outcomes (patient level and system level variables)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? **Intervention**

State if this is a proposed new topic or revision of existing worksheet: **New Topic**

**Conflict of interest specific to this question:**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? **NO**

Search strategy (including electronic databases searched).

MEDLINE (last search 10<sup>th</sup> Feb 2010)

1. exp *Heart Arrest/	17120
2. exp *Resuscitation/	36262
3. 1 or 2	48699
4. exp Emergency Medical Services/ or exp Emergency Service, Hospital/ or resuscitation systems.mp.	71561
5. exp *"Quality of Health Care"/	425709
6. performance measures.mp	2473
7. 5 or 6	427388
8. 3 and 4 and 7	356

Of the 356 possible titles, 39 were selected for further review.

(Note: The MESH heading **Health Care Quality, Access, and Evaluation** includes “Quality of Health Care”, “Quality Assurance, Health Care”, “Clinical Audit”, “Benchmarking”, Total Quality Management”)

EMBASE (last search 10<sup>th</sup> Feb 2010)

1. exp resuscitation/ or resuscitation.mp.	34185
2. exp emergency health service/	14628
3. exp quality control/ or exp *health care quality/ or exp performance/ or exp medical audit/ or exp performance measurement system/	214327
4. 1 and 2 and 3	114

Of the 114 titles, 17 additional abstracts were selected for further review.

COCHRANE (last search 10<sup>th</sup> Feb 2010)

#1 (cardiac arrest):ti,ab,kw	989
#2 performance measurement	3920
#3 quality assurance	1255
#4 emergency medical services	3682
#5 resuscitation	1690

#6	quality improvement	12737
#7	(( #1 OR #4 OR #5 ) AND ( #2 OR #3 OR #6 ))	638

Cochrane Reviews [286] | Other Reviews [52] | Clinical Trials [176] | Methods Studies [1] | Technology Assessments [6] | Economic Evaluations [113] | Cochrane Groups [4]

The 638 ‘hits’ were of the categories listed above and all titles were reviewed, with 5 additional references selected for further review (1 Cochrane Review; 1 ‘other review’; and 3 papers) – none of which directly addressed the worksheet question.

#### MASTER ENDNOTE LIBRARY SEARCH (last search 10<sup>th</sup> Feb 2010)

Key words in “Any Field” included “performance measurement” (4 hits, none selected); “quality assurance” (49 hits – 2 new papers selected for further review); “quality improvement” (36 hits – 1 new paper selected for further review); “quality assessment” (12 hits – none selected); “utstein” (118 hits – 18 selected for further review – mostly for Background section)

MEDLINE and EMBASE (last search 10<sup>th</sup> Feb 2010) A keyword search for ‘Utstein.mp’ [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier] yielded 270 hits in Medline and 259 hits in EMBASE. Following removal of 126 duplicates, 464 papers remained. A number of these are included in the Background/Commentary section of this worksheet. There were no additional papers identified that specifically related to the worksheet question.

Citation reports for the two key articles were also searched using the ISI Web of Knowledge.

#### • State inclusion and exclusion criteria

##### Inclusion:

Research papers (randomized controlled trials, controlled clinical trials, controlled before-and-after studies, or observational studies) that used ‘performance measurement’ as an intervention for improving processes of care or survival outcomes for (in-hospital or out-of-hospital) cardiac arrest patients.

##### Exclusion:

1. Non-research papers (ie commentary/editorial/letters/opinion).
2. Papers that only reported cardiac arrest outcomes, but didn’t test the effect of performance measurement / feedback on the system.

#### • Number of articles/sources meeting criteria for further review:

See above (under ‘Search Strategy’), with only two papers directly addressing the worksheet question.

## Summary of evidence

### Evidence Supporting Clinical Question

<b>Good</b>					
<b>Fair</b>					
<b>Poor</b>				Weydahl,1999,103 <sup>E2</sup>	
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Level of evidence</b>					

A = Return of spontaneous circulation      C = Survival to hospital discharge      E = Other endpoint  
 B = Survival of event      D = Intact neurological survival  
 E1 =CPR quality in real arrests    E2=team cohesiveness

### Evidence Neutral to Clinical question

<b>Good</b>					
<b>Fair</b>			Olasveengen,2007,427 <sup>C, E1</sup>		
<b>Poor</b>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Level of evidence</b>					

A = Return of spontaneous circulation      C = Survival to hospital discharge      E = Other endpoint  
 B = Survival of event      D = Intact neurological survival      *Italics = Animal studies*  
 E1 =CPR quality in real arrests      E2=team cohesiveness

### Evidence Opposing Clinical Question

<b>Good</b>					
<b>Fair</b>					
<b>Poor</b>					
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Level of evidence</b>					

A = Return of spontaneous circulation      C = Survival to hospital discharge      E = Other endpoint  
 B = Survival of event      D = Intact neurological survival      *Italics = Animal studies*

**REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:****Summary**

This worksheet question was interpreted as asking “does the use of performance measurement improve the EMS system/patient outcomes – in out-of-hospital or in-hospital cardiac arrest”? However, only two studies (Olasveengen,2007,427<sup>1</sup> and Weydahl,1999,103<sup>2</sup>) were identified that *directly* addressed the worksheet question. There is a plethora of papers that comment on the importance of cardiac arrest registries to improving outcome from cardiac arrest, however, there is a dearth of actual ‘evidence’ that performance measurement, within a quality improvement framework, actually improves processes of care and/or clinical outcomes in resuscitation. It would seem intuitively logical that “healthcare professionals would be prompted to modify their practice if given feedback that their clinical practice was inconsistent with that of their peers or accepted guidelines.”<sup>3</sup> However, a Cochrane Systematic Review<sup>3</sup> entitled “Audit and feedback: effects on professional practice and health care outcomes” (not focused specially on resuscitation) found this to not consistently be the case.

**Background**

In 1990 Eisenberg and colleagues<sup>4</sup> identified that the survival rates for out-of-hospital cardiac arrest could vary widely between locations, simply due to inconsistent case definitions impacting on the numerator and denominator used in the calculations. The authors concluded that “The absence of uniform definitions prevents meaningful intersystem comparisons, prohibits explorations of hypotheses about effective interventions, and interferes with the efforts of quality assurance.”<sup>4,p1249</sup> It was in recognition of this problem that an international task force, with representation from major resuscitation bodies from around the world, developed guidelines for the uniform reporting of outcome data on out-of-hospital cardiac arrest.<sup>5</sup> The guidelines are referred to as the ‘Utstein Guidelines’ in recognition of the name of an ancient abbey in Stavanger, Norway – the Utstein Abbey – where the first meeting of the group was held in 1990.<sup>5</sup> These were followed by further ‘Utstein’ type guidelines, including: guidelines for reporting paediatric advanced life support in 1995<sup>6</sup>; guidelines for in-hospital resuscitation in 1997<sup>7</sup>; guidelines for uniform reporting of data from drowning in 2003<sup>8</sup> and more recently guidelines for reporting post-resuscitation care.<sup>9</sup> In April 2002 a task force of the International Liaison Committee on Resuscitation (ILCOR) met in Australia, to review the worldwide experience with the Utstein definitions and templates, and led to the revision of the core reporting template – which could be used for in-hospital and out-of-hospital cardiac arrest reporting and for both adults and paediatric arrests.<sup>10</sup> More recently, with the growing recognition of the importance of the quality (depth and rate) of CPR performed on survival<sup>11</sup>, there have been calls for data on CPR quality to be included as a matter of standard practice on with all studies of cardiac arrest, in addition to being useful within quality improvement processes both in-hospital and out-of-hospital.<sup>12</sup>

Since 1991, there have been a number of papers published with reference to ‘Utstein’. A recent (10 Feb 2010) keyword search of MEDLINE and EMBASE for ‘Utstein.mp’ [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier] yielded 270 hits in Medline and 259 hits in EMBASE. Following removal of 126 duplicates, 464 papers remained. A 2003 paper by Fredriksson et al<sup>13</sup> sought to systematically review studies of out-of-hospital cardiac arrest published according to the Utstein guidelines. They identified 47 research papers but only 14 provided sufficient data to be included in their review, despite others claiming to be reporting according to the Utstein guidelines.<sup>13</sup> In an earlier paper, Cone et al had similarly expressed concern about the underuse of the Utstein template, thus: “Six years after the release of the Utstein style for OOHCA research, fewer than 60% of OOHCA research articles actually use the style.”<sup>14</sup>

Similarly, Nurmi et al found that data collection of resuscitation attempts using definitions provided in the Utstein guidelines was performed only in 22% of Finnish hospitals.<sup>15</sup>

Nonetheless, the development of standardised definitions and recommendations for data items to be reported gave hope for comparison of results between different emergency medical systems<sup>16 17</sup> as well as monitoring trends in performance within a single organisation.<sup>18</sup> The concept of the utility of outcome data for quality improvement and resource justification was recognised and led to the establishment of large regional / state-wide cardiac arrest registries in many locations around the world, including (but not limited to) Amsterdam<sup>19</sup>; Arizona<sup>20</sup>; Belgium<sup>21</sup>; Germany<sup>22</sup>; Gothenburg<sup>23</sup>; King County, Wa<sup>24</sup>; Los Angeles<sup>25</sup>; various regions of Norway<sup>26</sup>; Osaka<sup>27</sup>; Perth(Aus)<sup>28</sup>; Singapore<sup>29</sup> and Taiwan<sup>30</sup>. The Resuscitation Outcomes Consortium (ROC), which is a population-based registry involving out-of-hospital cardiac arrest in eight US and three Canadian regions; and the National Registry of Cardiopulmonary Resuscitation (NRCPR), which is a prospective, multisite, observational study of in-hospital resuscitation<sup>31</sup> are two large registries established in North America.

Despite these developments, there is still much to be understood as to why there is such 'tremendous variability in outcome'<sup>13</sup> between different EMS, to identify the impact of regional differences in patient and system characteristics<sup>32</sup> and identify (and test) strategies to maximise survival outcomes.

Nichol et al(2008) have asserted that "the success of efforts to prevent and manage out-of-hospital cardiac arrest depend on the availability of surveillance data at the national, state, and local levels"<sup>33,p2305</sup> and make the following recommendations:

1. *Out-of-hospital cardiac arrests and their outcomes through hospital discharge should be classified as reportable events as part of a heart disease and stroke surveillance system.*
2. *Data collected on patients' encounters with emergency medical services systems should include descriptions of the performance of cardiopulmonary resuscitation by bystanders and defibrillation by lay responders.*
3. *National annual reports on key indicators of progress in managing acute cardiovascular events in the out-of-hospital setting should be developed and made publicly available.*"<sup>33,p2299</sup>

## Results

There is international recognition of the utility of population-based registries of in-hospital and out-of-hospital cardiac arrest in emergency system evaluation and outcome improvement. However, there were only two papers found that directly investigated the effect of EMS system performance evaluation as an intervention, namely:

1. *Olasveengen TM, Tomlinson AE, Wik L, Sunde K, Steen PA, Myklebust H, et al. A failed attempt to improve quality of out-of-hospital CPR through performance evaluation. *Prehospital Emergency Care* 2007;11(4):427-33.*
2. *Weydahl PG, Stoen AM, Jorgensen B, Arnulf V, Steen PA. Utstein registration used as a tool in organisational development. *Resuscitation* 1999;40(2):103-6.*

The Olasveengen, 2007, 427 (LOE 3, quality fair) before-and-after intervention study sought to test the hypothesis that providing information about CPR performance to the training teams of three different ambulance services would facilitate local education and improve CPR quality. Overall, there was no statistically significant differences between the periods before and after the CPR performance based evaluation (CPR\_PE) intervention in any of the CPR quality components analysed. However, whilst not reaching statistical significance there was potentially clinically

important improvement in the % correct depth of compression (35% versus 51%,  $p=0.12$ ) and a reduction in the percentage of compressions that were too shallow (51% versus 40%). The authors concluded that the “quality of CPR was not improved probably because of an inadequate implementation strategy” and advise that “bringing about changes in established practice likely requires a well thought-through implementation plan, addressing current barriers and giving sufficient time for repeated performance evaluations documenting progress.” Moreover, they call for more research into evidence based implementation strategies.<sup>1</sup>

The Weydahl, 1999, 103 (LOE 4, Poor) paper is a case series study reporting ( $n=163$ ) out-of-hospital cardiac arrest outcomes (arrests of presumed cardiac origin where resuscitation was attempted) in Ostfold county in Norway following the reorganisation of the EMS services. All out-of-hospital cardiac arrests in Ostfold county in which the EMS system responded in 1997 were registered according to the Utstein template. The results were reported back to the EMS personnel and presented to the media. The authors reported a positive psychological effect on the ambulance staff thus: "The Utstein registration also appears to have produced a feeling of unity among the personnel from the seven former EMS providers, and has played an important role in integrating the ambulance service into the emergency departments of the hospitals." Similarly, they report positive effects from the media presentation - which "profiled the ambulance service in Ostfold as being of a good standard, and have helped to create popular confidence in a period with centralisation of emergency hospital functions." There was no examination of the effect of the feedback to the EMS personnel on resuscitation performance (eg CPR quality) or patient outcomes (ie survival).

### **Conclusion**

Despite the intuitive appeal of the notion that performance measurement, within a quality improvement framework, actually improves processes of care and/or clinical outcomes in resuscitation – there is insufficient evidence to draw conclusions regarding the effectiveness of performance measurement interventions in resuscitation systems.

### **Knowledge Gaps**

1. Research into how to optimally monitor and improve the quality of care delivered within a resuscitation system.
2. Research to test the hypothesis that providing feedback to emergency medical personnel about their performance (individually and/or at a system level) is associated with better patient outcomes.

### **Acknowledgements:**

## *Citation List*

**Olasveengen, TM, Tomlinson, AE, Wik, L, et al. (2007).** "A failed attempt to improve quality of out-of-hospital CPR through performance evaluation." Prehospital Emergency Care **11**(4): 427-33.

### Notes

**Olasveengen, 2007, 427**

EVIDENCE= Neutral

LOE= 3

QUALITY= Fair

COMMENTS

*Hypothesis: That providing information about CPR performance to the training teams of the different ambulance services would facilitate local education and improve CPR quality.*

*Study design: Before-and-after intervention study. Intervention= the CPR performance based evaluation (CPR\_PE) (as assessed using a specially designed monitor/defibrillator equipped with a sternal pad fitted with an accelerometer and a pressure sensor, compression force and depth was measured during CPR) from Oct 2004-June 2005 was fedback to local CPR instructors at each site - with implementation strategies for local CPR improvement left to the discretion of the local instructors but included addition of the information into retraining and recertification of the crews. CPR performance by ambulance personnel at each of the study sites during Oct 2004-June 2005 (n=85) were compared to the pre-CPR-PE period (n=39) .*

*Outcomes: Time without compressions (No flow time NFT); no-flow ratio (NFR) defined as NFT divided by total time segment without ROSC; chest compression depth*

*Subjects; Adult (>=18 years) out-of-hospital cardiac arrests*

*Location: 3 ambulance services: London(UK); Stockholm(Sweden) and Akershus(Norway).*

*Results: Overall, there was no statistically significant differences between the periods before and after CPR\_PE in any of the CPR quality components analysed. However, whilst not reaching statistical significance there was a potentially clinically important improvement in the % correct depth of compression (35% versus 51%, p=0.12) and reduction in the percentage of compressions that were too shallow (51% versus 40%). No stat sig differences in survival (5% versus 2% - but only 2 cases in each).*

*Conclusion: (from paper) Simply presenting the performance evaluation to CPR-instructors with emphasis on areas in need of improvement at the respective sites was clearly insufficient to improve their CPR quality. Leaving the sole responsibility of developing an implementation strategy to the respective CPR instructors gave little control over how the information was used.*

*Limitations: (from paper) Quality of CPR was not improved probably because of an inadequate implementation strategy. Bringing about changes in established practice likely requires a well thought-through implementation plan, addressing current barriers and giving sufficient time for repeated performance evaluations documenting progress. The presence of committed and respected leaders focusing on areas in need of improvement is also believed to be important. As evidence-based medicine is increasingly demanded, more research is needed to give evidence based implementation strategies.*

**Weydahl, PG, Stoen, AM, Jorgensen, B, et al. (1999).** "Utstein registration used as a tool in organisational development." Resuscitation **40**(2): 103-6.

### Notes

**Weydahl, 1999, 103**

EVIDENCE= SUPPORT

LOE= 4

*QUALITY=Poor*

*COMMENT*

*Following the reorganisation of EMS services in In Ostfold county in Norway, all out-of-hospital cardiac arrests in Ostfold county in which the EMS system responded in 1997 were registered according to the Utstein template. The results were reported back to the EMS personnel and presented to the media.*

*The authors report that "The Utstein registration also appears to have produced a feeling of unity among the personnel from the seven former EMS providers, and has played an important role in integrating the ambulance service into the emergency departments of the hospitals." Similarly, they report positive effects from the media presentation - which "profiled the ambulance service in Ostfold as being of a good standard, and have helped to create popular confidence in a period with centralisation of emergency hospital functions."*

*Limitations: No examination of the effect of the feedback tot he EMS personnel on resuscitation performance (eg CPR quality) or patient outcomes (ie survival).*



## *Reference List*

1. Olasveengen TM, Tomlinson AE, Wik L, Sunde K, Steen PA, Myklebust H, et al. A failed attempt to improve quality of out-of-hospital CPR through performance evaluation. *Prehospital Emergency Care* 2007;11(4):427-33.
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