**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care**

**Worksheet author(s)**

| Steven C. Brooks | Date Submitted for review: September 16, 2008 |

**Clinical question.**

In patients with suspected ACS/MI in prehospital setting (P), does the use of prehospital ECG and advance ED notification (I), compared with no prehospital ECG (C), improve outcome (e.g. arrhythmias, infarct size, ekg resolution, survival to discharge, 30/60d mortality) (O)?

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

Intervention/therapy

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

**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).**

Databases will be searched from 2004 until present. This will update the previous search done for C2005 using a very similar search strategy.

A) The AHA Endnote library will be searched using the following terms:

- Chest pain or myocardial infarction or emergency medical service or emergency medical technician or paramedic or prehospital or electrocardiography

B) OVID Medline will be searched with the following strategy:

(Note: “term.mp” denotes a search for the term in the title, abstract and subject heading fields of the citation)

1. exp Emergency Medical Services/
2. exp Emergency Medical Technicians/
3. ambulance.mp. or exp AMBULANCES/
4. prehospital.mp.
5. pre-hospital.mp.
6. paramedic.mp.
7. 1 or 2 or 3 or 4 or 5 or 6
8. exp ELECTROCARDIOGRAPHY/ or electrocardiography.mp.
9. ecg.mp.
10. ekg.mp.
11. 8 or 9 or 10
12. myocardial infarction.mp. or exp myocardial infarction/
13. chest pain.mp. or exp Chest Pain/
14. angina.mp. or exp angina pectoris/
15. acute coronary syndrome$.mp. or exp Acute Coronary Syndrome/
16. 12 or 13 or 14 or 15
17. 7 and (11 or 16)
18. limit 17 to (humans and yr="2004 - 2008")

C) The Cochrane CENTRAL database will be searched with the following strategy using the OVID platform:

1. Myocardial infarction.mp.
2. chest pain.mp.
3. angina.mp.
4. ischemia.mp.
5. ami.mp.
| 6. acute coronary syndrome.mp. |
| 7. emergency medical services.mp. |
| 8. emergency medical technician.mp. |
| 9. ambulance.mp. |
| 10. paramedic.mp. |
| 11. prehospital.mp. |
| 12. pre-hospital.mp. |
| 13. electrocardiogram.mp. |
| 14. electrocardiography.mp. |
| 15. ekg.mp. |
| 16. ecg.mp. |
| 17. 1 or 2 or 3 or 4 or 5 or 6 |
| 18. 7 or 8 or 9 or 10 or 11 or 12 |
| 19. 13 or 14 or 15 or 16 |
| **20. 18 and (17 or 19)** |
| 21. limit 20 to yr="2004 - 2008" |
| 22. limit 21 to humans |

D) OVID EMBASE will be searched using the following strategy:

1. myocardial infarction.mp or exp Heart Infarction/
2. chest pain.mp or exp Thorax Pain/
3. angina.mp or exp Angina Pectoris
4. exp HEART MUSCLE ISCHEMIA/
5. 1 or 2 or 3 or 4
6. exp Emergency Health Service/
7. exp Rescue Personnel/
8. exp AMBULANCE/
9. exp patient transport/ or prehospital.mp
10. 6 or 7 or 8 or 9
11. exp ELECTROCARDIOGRAPHY/ or electrocardiography.mp
12. ecg.mp
13. ekg.mp
14. 11 or 12 or 13
15. 5 and 10 and 14
16. limit 15 to human

E) Bibliography hand search of included articles and review articles (see excluded citations list for hand-searched reviews)

- State inclusion and exclusion criteria

**Inclusion criteria:**
Studied prehospital ECG among patients with suspected acute myocardial infarction
ECGs recorded by prehospital medical personnel
With advance notification of receiving hospital
Measured outcomes including clinical outcomes (arrhythmias, infarct size, ekg resolution, survival to discharge, 30/60d mortality) or treatment time interval (e.g. time to reperfusion)

**Exclusion criteria:**
Letters, editorials, reviews other than systematic review/metaanalysis, abstract only publications. Articles where the effect of co-interventions such as bypassing local emergency departments for PCI centres could not be differentiated from the effect of a prehospital 12-lead ECG
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**Number of articles/sources meeting criteria for further review:**

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Oct 19/08 OVID EMBASE 1049 hits
## Summary of evidence

### Evidence Supporting Clinical Question

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Red text from 2005 worksheet

<table>
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<tr>
<th>A = Return of spontaneous circulation</th>
<th>B = Survival of event (mortality)</th>
<th>C = Survival to hospital discharge</th>
<th>D = Intact neurological survival</th>
<th>E = Other endpoint</th>
<th>E1 = Door-to-fibrinolysis time interval</th>
<th>E2 = Door-to-PTCA time interval</th>
<th>E3 = Ambulance call to first balloon inflation</th>
<th>E4 = Symptom onset to balloon inflation</th>
<th>E5 = Troponin elevation</th>
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Evidence Neutral to Clinical question

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Level of evidence

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

*Italicics = Animal studies*

Evidence Opposing Clinical Question

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Level of evidence

A = Return of spontaneous circulation  
B = Survival of event  
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*Italicics = Animal studies*
Since the advent of portable 12-lead ECG monitors in the 1980s, it has been possible to identify candidates for coronary reperfusion in the prehospital setting. The ultimate goal of 12-lead PHECG is to aid in earlier diagnosis of ST-segment elevation acute myocardial infarction (STEMI) so that time to reperfusion may be reduced. This may be accomplished through expediting prehospital care, giving prehospital fibrinolytics (PHFL), triaging patients to receiving facilities capable of administering reperfusion therapies or by providing advance notification to the receiving hospital so that in-hospital delay to reperfusion may be reduced.

In many respects, the use of 12-lead electrocardiography in the prehospital setting is a heterogeneous concept. The use of PHECG as a diagnostic test may differ in clinical setting (e.g. in the patient’s home vs. in the General Practitioner’s (GP) office), the provider (patient vs. paramedic vs. nurse vs. physician), the geographical environment (urban vs. rural), the mode of transmission (interpretation and verbal communication vs. cellular transmission), and the response to a positive test (PHFL vs transport to a facility after advance notification). This variability creates some difficulty in interpreting the data produced by 12-lead PHECG studies. Care must be taken when making generalizations and recommendations regarding the use of prehospital 12-lead technology. Those involving PHECG have various strategies for managing STEMI patients as co-interventions. These strategies include diversion of the patient directly to a PCI centre and prehospital fibrinolysis.

This overview sought to determine the efficacy of 12-lead PHECG with advanced hospital notification in patients with suspected AMI as strategy independent from these co-interventions. Thus, many studies which necessarily included the use of prehospital 12-lead electrocardiography to identify eligible STEMI patients for other interventions such as prehospital fibrinolysis or diversion, were excluded from this review if the independent effect of prehospital 12-lead ECG and advanced hospital notification was not the focus of the article and the effect of which could not be distinguished from other concomitant interventions. The specific interventions aiming to manage patients with STEMI identified by prehospital 12-lead have been assessed in other worksheets completed by this task force. The aim of this worksheet was to assess the efficacy of prehospital 12-lead ECG with advanced hospital notification, performed by EMS personnel, as a stand-alone intervention for patients with suspected STEMI.

The literature provides ample evidence that 12-lead PHECG with advance notification is feasible in the sense that diagnostic quality PHECGs can be acquired and transmitted efficiently in a high percentage of patients assessed with this tool. The data on feasibility were reviewed as part of the 2005 worksheet on this topic and were not included in this iteration. The diagnostic accuracy of the prehospital 12-lead ECG in the hands of various providers has also been reviewed in other worksheets within this taskforce.

The literature supports the assertion that PHECG with advance notification reduces in-hospital delay to reperfusion therapy. Several studies included in this review have measured this directly (Adams, 2006; Melville, 2003; Takase, 2006; Takase, 2007; Tarkula, 2006; Wall, 2000). This variability creates some difficulty in interpreting the data produced by 12-lead PHECG studies. Care must be taken when making generalizations and recommendations regarding the use of prehospital 12-lead technology. Those involving PHECG have various strategies for managing STEMI patients as co-interventions. These strategies include diversion of the patient directly to a PCI centre and prehospital fibrinolysis.

Examining the absolute benefit of PHECG with advance notification reported in these studies, it seems reasonable to hypothesize that it may inversely proportional to the baseline door-to-treatment intervals. In systems with very short transport times where the door-to-reperfusion interval is minimized may see less additional benefit with the prehospital 12-lead ECG. Future research is needed to clarify whether the addition of PHECG to an already optimized door-to-needle interval is efficacious and cost-effective. Two studies included in this review highlight the importance of advanced hospital notification in the event of a STEMI diagnosis on PHECG. In these two studies, the benefit of PHECG with respect to reducing reperfusion delays disappeared when advanced hospital notification was not used (Adams, 2006; Melville, 2003; Tarkula, 2006).

The presumed benefit of reducing in-hospital delay to treatment is a reduction in mortality. The GISSI and ISIS mega-trials have proven that earlier reperfusion in patients with AMI decreases mortality. Direct evidence suggesting an association between the use of PHECG and a reduction in mortality is thin. Two studies included in this review report reductions in mortality, both of which are statistically non-significant. In the paper by Millar-Craig (Miall-Craig, 1997; 456), inhospital all-cause mortality was 15.6% in a group of STEMI patients brought by EMS to the emergency department without PHECG and 8.4% in those who had a PHECG and brought directly to the CCU for fibrinolysis. This difference was not statistically significant. The study was not powered to detect a mortality difference. In the Tarkula paper (Tarkula, 2005; 770), reported an 11% inhospital mortality in STEMI patients brought by EMS without a PHECG versus 5% in those with a PHECG (p<0.19). All patients with STEMI were ultimately transferred for urgent PCI. The question of mortality benefits from PHECG with advance notification may never be directly answered with certainty because of the enormous numbers of patients that would be required to complete a well-powered study. It is logical to assert that if PHECG can reduce delay to reperfusion then a clinical benefit can be presumed based on what we already know about the relationship between delay to reperfusion and mortality.

Although the literature has been consistent in demonstrating the utility of PHECG and advance notification in reducing reperfusion delays, there are several methodological issues that require consideration. For example, in the three older British studies (Vanijere, 1998; Melville, 1998; Millar-Craig, 1997), 12-lead involved PHECG with advance notification and direct admission to the Cardiac Care Unit (CCU) for patients who had clinical and ECG criteria for thrombolytic therapy. In all three studies, patients in the control group were initially admitted through the Accident and Emergency (A&E) ward. In these emergency health systems, fibrinolysis was not available in the A&E wards. Patients who were eligible for fibrinolysis required assessment by A&E physicians, referral to CCU personnel and then transfer to the CCU where they received fibrinolysis. Thus, the experimental group who received PHECG with advance notification and direct CCU admission were actually subjected to two interventions. It is impossible to determine the treatment effect contribution from each of these interventions. It is completely plausible that all of the treatment effect was attributable to the reduction in transfer and consultation delays and not to PHECG with advance notification.

Many of the studies reporting door-to-treatment time intervals had historical controls (Adams, 2006; Melville, 2003; Tarkula, 2005; 316; Wall, 2000; 104). This presents a potential bias in the form of the Hawthorne Effect. It is possible that paramedics and hospital personnel may have changed their behavior in ways to reduce hospital treatment delays because they were aware of the goal of reducing delay. Historical control groups may not control for this change in behavior in addition to the planned intervention of PHECG. It is difficult to determine what proportion of the treatment effect is due to the intervention and what proportion is due to the Hawthorne Effect.

The safety issues with PHECG relate to delay of hospital transport. Acquisition, interpretation and transmission of PHECGs cause an on-scene delay. The initial concern for patients who were candidates for reperfusion was that the time savings in the hospital phase of treatment would be offset by the longer on-scene intervals required for the PHECG. This concern is also important for those patients with other etiologies of chest pain who require immediate care in a hospital setting (e.g. aortic dissection). There are no on outcomes of patients without acute coronary syndromes who receive a PHECG with respect to morbidity or mortality; however, the literature (most of which is outside the scope of this review) provides clear evidence that on-scene time intervals are not drastically increased by PHECG and are certainly less than 5 minutes in the great majority of cases.

In summary, PHECG with advanced hospital notification reduces reperfusion delay for patients who are treated with fibrinolysis or PCI. The literature on this topic is heterogeneous with respect to the type of PHECG strategy that is employed and the methodological quality of most studies can only be considered fair. A mortality reduction is at this point only presumed, and it is unlikely that future studies will provide direct evidence of this. Nonetheless, PHECG and advance notification appears to be feasible, safe and confer no additional risk to the patient with STEMI. PHECG and advance notification, allowing earlier diagnosis of STEMI patients in the field, can facilitate triage decisions and activate coordinated regional treatment strategies. The relative efficacy of these strategies is beyond the scope of this
review, but is addressed in other worksheets commissioned by this task force. The time savings associated with PHECG and advance notification are well-established, so now future research efforts in this area need to establish the optimal strategies for STEMI patients identified in this manner.

Acknowledgements:

**Citation List**


LOE 3
Relevance - TIME-NE study. Comparison of interest - pre-intervention phase consecutive patients with STEMI identified on PHECG WITHOUT prehospital notification. Paramedics brought 12-lead ECG into ED with patient. Intervention phase involved PHECG transmitted to cardiologist hand-held device. This comparison isolates the specific effect of prehospital notification
Outcomes - Median Door-to-balloon time 50 minutes in the intervention group vs 110 minutes in the pre-intervention group with PHECG but not prehospital notification.


LOE 2
Relevance - retrospective cohort study comparing a number of different cohorts based on mode of arrival and whether or not a "Cath Alert" was performed. Comparison of interest was between a cohort of STEMI patients presenting via EMS with (n=100) and without (n=5) PHECG and advance notification.
Methodological quality - Poor. Cohorts very difficult to discern because of confusing methodological description. Numbers in group without PHECG very small. Reasons for patients getting an ECG unclear -- were these cases unusual clinical presentations? High probability of selection bias.
Outcome - Door-to-balloon interval mean(SD) in minutes: 53(21) for PHECG with advance notification vs 68 (20) for those without PHECG p=0.007
Direction - Supportive


LOE 2
Relevance - Small prospective non-randomized study with many potential biases. 10 out of 30 ambulance units volunteered to be experimental group (given portable 12-lead ECGs, training in reading ECGs and protocol for advance notification and direct CCU admission) The remaining 20 paramedic teams who did not volunteer were the control group (no PHECG, A&E admission)
Potential bias in that keen paramedics in the experimental group may have been faster, more efficient even before the intervention. It is difficult to determine the relative treatment effect of triage
to CCU vs. PHECG and advance notification. Needed a control group that was admitted directly to the CCU with no advance notification. It has been shown in other work that door-to-needle time can be reduced simply by having the thrombolytic administered in the ED or place of admission rather than waiting for CCU transfer. This study and others studying the impact of direct admission to the CCU are probably showing this effect in addition to any independent effect of the PHECG and advance notification. Because of this, for the purposes of this analysis, the evidence will be supportive by extrapolation.

Methodologic Quality - Fair
Outcomes - Call-to-needle time in 13 STEAMI patients with advance notification and direct CCU admission 82 +/- 32 minutes vs. 112 +/- 35 minutes (p<0.02) in 36 patients who did not receive a PHECG and who were admitted through the A/E.
Direction - Supportive


LOE 2
Relevance - systematic review of 4 studies comparing PHECG with no PHECG in "United States relevant" studies.
Methodologic Quality - Fair. Good search technique. Only 1 reviewer for relevance, quality and data abstraction. No description of included study design or details including reperfusion strategy and the definition of the measured interval.
Outcomes - "time to reperfusion" (without hard end-points described) reduced by 24.7 minutes 95% CI (16.7-32.7)
Direction - Supportive


LOE 4
Relevance - 5 cases of wireless PHECG transmission with direct cath lab admission
Methodological quality - good
Outcomes - door-to-balloon interval 33, 27, 33, 27, 35 minutes for each of the cases
Direction - Supportive


LOE 3
Relevance - small study performed at a centre with poor baseline door to reperfusion intervals. Single centre.
Methodologic quality - Fair. Unclear how comparison group was assembled. ? consecutive patients with STEMI identified in ER?
Outcomes - Door-to-intervention mean (SD) 145 (76.9) historical with no PHECG versus 80.1 (35.4) with PHECG and advance notification p=0.001
Direction - Supportive

LOE - 2
Relevance - Prospective study of nurse/paramedic administered and interpreted 12-lead ECG with advance hospital notification by radio. 155 consecutive patients with suspected AMI. Prehospital nurses and paramedics trained to recognize the clinical and electrocardiographic features of STEAMI. Notified ED and prepared patient for thrombolysis when eligible patient identified. Scene times and in-hospital time intervals compared with historical controls. Key feature of this study is the fact that there was no transmission of ECGs but instead a radio communication of the diagnosis. Methodologic quality - Fair. Problems with study - historical controls. Cannot rule out the Hawthorne effect contribution to door-to-needle times. Small study with no tests of statistical significance. Large standard deviations in door-to-needle times. No demographic description. Outcomes - Nurses/paramedics were able to identified all 21 patients with the ultimate diagnosis of AMI as “AMI” or “high suspicion of AMI. 17 of 21 identified as AMI. On-scene time in the PHECG group was longer than in the control group (14 +/- 5.1 vs. 11.5 +/- 4.9 minutes). No statistical test of significance. Among those who underwent reperfusion therapy, the average door-to-needle time in 14 PHECG patients was 22 +/- 13.8 minutes. A historic control group of 12 patients who received thrombolysis in the year prior to the study had an average door-to-needle time of 51 +/- 50 minutes. Direction: Supportive


LOE - 1
Relevance - Small prospective, randomized study comparing prehospital ECG with cellular transmission to the ED and standard EHS care without PHECG or advance notification. Looked at on-scene times and door-to-treatment times. Methodologic quality - Fair. Issues with study - Randomized but no demographics reported. Unknown whether the treatment and control groups are similar. Small study. Inherent problems with historical and concurrent controls - Hawthorne effect. Unfortunately, no thrombolytic candidates in no PHECG group (by assumption - this was not reported). Outcomes - 34 patients in PHECG group and 37 patients in no PHECG group. Transport times 18.2 and 17.6 minutes respectively. No demographic information provided re patients. Only inclusion criteria was paramedic’s suspicion of possible AMI. No exclusion criteria. No statistical difference between groups with respect to on-scene time. Door-to-thrombolysis interval 48 +/- 12 minutes for 5 patients in PHECG group with AMI vs 103 +/- 44 minutes in 51 historical control patients (demographics and clinical characteristics not clearly described). This was statistically significant. Also compared with concurrent patients who did not receive PHECG – 68 +/- 29 minutes (no p-value reported). Direction - Supportive

LOE 1

Relevance - Prospective, randomized trial (for PHECG vs no PHECG) comparing the door-to-thrombolysis times for patients suffering STEMI who arrive at the ED by different modes of transport. Four arms of trial – walk-ins, local (non EHS) ambulance, specially trained EHS without PHECG and EHS with PHECG and cellular transmission of ECG to ED. Patients picked up by EHS randomized to PHECG or no PHECG once the ECG leads had been attached en route to hospital.

Methodologic quality - Fair. Patient population not clearly defined other than “patients with acute myocardial infarction”. Inclusion and exclusion criteria not mentioned. Data for patients who had PHECG but did not have AMI was not reported – relevant for safety and feasibility.

Outcomes - No demographics of patients described. No on-scene times reported. No transport times reported. Median hospital delays to treatment in minutes: Walk in (n=57) 64, ambulance(n=55) 55, EHS with no PHECG (n=11) 50, EHS with PHECG and cellular transmission (n=11) 30. Decrease in EHS with and without PHECG statistically significant p=0.00. Cannot tell from this study whether application of ECG leads, transmission of ECG and extra assessment done by EHS crews lengthened prehospital time significantly. Difficult to interpret benefit of hospital-based time savings when this information is not available. For this reason, the study will be rated as “Fair” in quality.

Direction - Supportive


LOE - 2

Relevance - Prospective, non-randomized study from U.K. looking at PHECG and cellular transmission of the ECG to CCU nursing staff. Nurses directed paramedics to bypass A/E with patients who had STEAMI. Hospital-based times to thrombolysis in PHECG/fast-track CCU patients compared to historical controls admitted to the A/E who had thrombolysis but no PHECG

Methodologic quality - Fair. Problems: Impossible to determine the effect of PHECG and advance notification on the time to treatment vs. the effect of direct admission to the CCU (similar to Banerjee 98, Miller-Craig 97 - please see citations for further discussion of direct to CCU admission papers for the purposes of this analysis) Essentially, the treatment group has received two interventions - PHECG with advance notification and triage to the geographically distinct CCU directly. To interpret the effect of PHECG on the reduced time, we need a control group who received PHECG with advance notification who then went to the A/E. It may have been the case that if all chest pain patients were admitted to the CCU directly (no PHECG) the times to treatment may have been similarly reduced. Impossible to relate these results to systems where thrombolysis or preparation for PTCA is done through the ED. Although this paper appears to support the use of PHECG with advance notification, this can only be said in the context of direct admission to the CCU. For this reason, this evidence is considered “supportive by extrapolation”. It’s generalizability is limited.

Outcomes - 100 ECGs transmitted, 22 identified as having AMI, 11 thrombolysed in hospital. Door-to-needle time reduced by 60 minutes in PHECG/direct CCU admission group compared with previous three year audit. No testing of statistical significance or measure of precision of this estimate. No statistical tests of significance. Control group not clearly described – no numbers, demographics etc.

Direction: Supportive

LOE - 2
Relevance - Prospective study with two phases looking at paramedic-interpreted PHECG with advance notification and direct admission to the CCU (i.e. bypassing the A/E department). Patients in Phase I had PHECG done but this was not used in clinical decision making and patients went to the ED for assessment. In Phase II patient received a PHECG and paramedics identified patients with STEAMI and notified CCU of direct admission. Patients in phase I and II were compared.
Methodologic quality - Fair. Quality of evidence rated as “fair” because of the design (making it difficult to decide on whether this was effect of PHECG or direct CCU transfer) and lack of concurrent control.
Outcomes - Call to needle reduced in Phase II from 154 minutes to 93 minutes (p<.001) Door to needle time reduced in Phase II from 97 to 37 minutes (p<0.001). In a group of patients with no unusual delay (i.e. doctor called to another arrest, one patient with streptokinase so delay for TPA) door to needle time in Phase II was only 19 minutes. Paramedic average interpretation accuracy 92% in phase II of study 92.6% were of diagnostic quality in phase II. In patients with confirmed myocardial infarctions, mortality within 42 days was 15.6% in Phase I vs. 8.4% in Phase II. Not statistically significant.
Direction: Supportive (by extrapolation)


LOE 2
Relevance - systematic review of studies comparing PHECG and advance notification with no PHECG
Quality - Good. Rigorous review methods
Outcomes - 5 studies included. 1990-1997. On scene time 1.19 (.84-3.21) longer with PHECG. DTN time 36.1 min less with PHECG but significant heterogeneity statistically. 30 day Mortality 15.6% without PHECG vs 8.4% with in one study only (Millar-Craig)
Direction - supportive


LOE 3
Relevance - Single site study of patients assessed by paramedics with cp. 12-lead ECG done and transmitted to local ER. ER doctor activated cath lab team for STEMI patients. Comparison with historical DTB times (data not presented in the paper but discussed in the discussion)
Quality – poor – unable to determine nature of comparison group. Nature of EMS system, training for ECGs, nature of EMS personnel not adequately described.
Outcomes – Mean door-to-needle time
Magnitude --44+/- 17.4 min vs 88 +/- 35 minutes in historical controls without prehospital ECG.

**LOE 2**

*Relevance* - Single site study of STEMI patients taken to PCI. **Comparison groups:** STEMI patients transported by EMS with ECG/PH activation vs. ECG/NO PH activation vs no ECG

*Quality* - good. problem with ? selection bias -- cohorts may have been determined by patient factors/EMS factors which confound the time differences

*Outcomes* - ECG and PH activation vs no ECG - Mean Door to reperfusion interval 70.4 minutes versus 101.6 minutes p=0.007. Comparing those with ECG only (no prehospital activation) and no ECG - no significant difference between these two subgroups.

*Direction* - Supportive


**LOE 2**

*Relevance* - retrospective cohort. **Relevant arms in study:** A = closest hospital with no PHECG. **B= closest hospital with PHECG and advance notification.** Patients with STEMI were transferred out to PCI centre as needed.

*Methodologic quality* - Fair. Groups were not adequately described to assess for potential confounders

*Outcomes* - Ambulance call to first balloon inflation median (25th-75th percentiles) 168 vs 127 minutes p<0.001, symptom onset to balloon inflation 250 (179-347) vs 175 (149-260), in-hospital mortality 11% vs 5% p=.19

*Direction* - Supportive


**LOE - 2**

*Relevance* - Prospective study measuring door-to-PTCA times in 50 consecutive patients with AMI who had PHECG with cellular transmission to the ED and also paramedic interpretation and voice advance notification to EP via cell phone. **EP activated cath lab when PTCA-eligible patient identified in the prehospital phase.** **Historical control group (PTCA patients prior to PHECG started).**

*Methodologic quality* - Fair. issues with study: **Small study.** **Historical control group before project begun (?Hawthorne effect).** Only demographics for intervention group described - no clear description of controls. **No data on patients who got PHECG but did not have AMI.** ?Safety. **No description of effect on call to hospital arrival time.**

*Outcomes* - Median door-to-PTCA interval 109 minutes in control group vs. 80 minutes in the PHECG group (p=0.002 – Statistical test not described).

*Direction: Supportive*