Critical Review Form
Clinical Prediction or Decision Rule

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Citation: Mahler SA, et al. **The HEART Pathway randomized trial: identifying emergency department patients with acute chest pain for early discharge.** Circ Cardiovasc Qual Outcomes. 2015

Guide		Comments
	What is being studied?	
1.	**Study Objective**	Determine whether application of the "HEART pathway" (HEART score plus 0 & 3 hr troponin) can meaningfully reduce objective cardiac testing, increase early discharges and reduce index hospital LOS compared with usual care while maintaining high sensitivity and NPV (>99%) for MACE.
2.	**Study Design**	Randomized controlled single tertiary care-center trial Randomization - Stratified by presence of known coronary disease (including previous revascularization) - Randomized within strata to 1 of 2 arms as determined by a randomization sequence generated by nQuery Advisor 6.0 - Investigators and staff were blinded to the randomization sequence (unless the attending and the study supervisor disagreed, which led to the study supervisor informing the attending and the unblinding of that patient)
3.	**Inclusion Criteria**	>21 Symptoms suggestive of ACS EKG and troponin ordered for initial evaluation
4.	**Exclusion Criteria**	- New ST segment elevation > 1mm - Hypotension - Life expectancy < 1 yr - Non-cardiac medical/surgical/psychiatric illness determined by provider to require admission - Previous enrollment - Non-English speaking - Incapacity or unwillingness to consent
5.	**Outcome Measures**	- Rate of objective cardiac testing within 30 days of presentation defined as: -Proportion of patients receiving any stress testing modality, coronary CTA, or invasive coronary angiography at the index visit or within 30 days.

		- Secondary outcome measures: - Early discharge (discharge from ED w/o objective cardiac testing) - index LOS - Cardiac related recurrent ED visits
I.	***Is this a newly derived instrument* (Level IV)?**	
A.	Was validation restricted to the retrospective use of statistical techniques on the original database? (If so, this is a Level IV rule & is not ready for clinical application).	No, it was a randomized controlled single- center trial that placed patient into one of two groups and applied a pathway to determine clinical treatment. This was a new study population
II.	**Has the instrument been validated? (Level II or III). If so, consider the following:**	
1a	Were all important predictors included in the derivation process?	Patient was placed in low-risk or high risk based on the outcome of their "Heart score", which was 5 components: - History - High risk features (middle/L-sided pain, heavy CP, diaphoresis, radiation, n/v, exertional, relief of symptoms by sublingual nitrates. - EKG - Age - Risk factors - 3 or more of: Obesity, current/recent smoker, DM, Fam. hx of CAD <55, HTN, hypercholesterolemia - OR any 1 of : Known CAD, Prior stroke, PAD - Troponin Heart pathway then did serial troponins to discover outcome of patients. Normally Heart pathway takes into account the factors we currently consider clinically. HEART appears to include commonly used clinical criteria for risk assessment.
1b	Were all important predictors present in significant proportion of the study population?	Yes, table 1 shows that all risk factors were presented by patients at some point during the study. Good range of representation of patients at different levels of risk.
1c	Does the rule make clinical sense?	Yes, it provides an algorithm for the risk stratification of acute chest pain patients that aims to decrease the use of additional unwarranted testing. By using serial troponins, it is more typical of current practice. Prior

		validation studies as well as HEART derivation use single troponin value.
2	Did validation include prospective studies on several different populations from that used to derive it (II) or was it restricted to a single population (III)?	Isolated population since it was performed at a single hospital, no widespread evidence. Suggests a multicenter trial of structured HEART pathway implementation. However, the population studied here is from the US and more typical of our own patient population.
3	*How well did the validation study meet the following criteria?*	
3a	Did the patients represent a wide spectrum of severity of disease?	Yes, patients ranged from no associated coronary disease to MIs.
3b	Was there a blinded assessment of the gold standard?	Heart pathway was compared to physician clinical judgment. There was no "gold standard" (i.e. catherization) performed on every patient.
3c	Was there an explicit and accurate interpretation of the predictor variables & the actual rule without knowledge of the outcome?	Yes, predictor variables were assigned point values on their degree of likelihood in contributing to MACE, these were done without knowledge of if the patient had an actual MACE. Table 2 breaks down the prevalence of risk factors presented in population.
3d	Did the results of the assessment of the variables or of the rule influence the decision to perform the gold standard?	No. Clinicians were permitted to not adhere to the HEART pathway. Permitting non-adherence (29%) may have increased risk of selection bias Limited study demonstrated efficacy of Heart Pathway compared with general clinician judgment in terms of reducing unnecessary cardiac testing, but further testing is needed to verify.
4	How powerful is the rule (in terms of sensitivity & specificity; likelihood ratios; proportions with alternative outcomes; or relative risks or absolute outcome rates)?	Heart Pathway had 100% sensitivity, 49.6 Specificity, 10.7% PPV and >99% NPV for detecting MACE. Compared with serial troponins alone which had a sensitivity of 87.5%, specificity of 97.0 % PPV of 63.6% and NPV of 99.2%.
III.	**Has an impact analysis demonstrated change in clinical behavior or patient outcomes as a result of using the instrument? (Level I). If so, consider the following:**	
1	How well did the study guard against bias in terms of differences at the start (concealed randomization, adjustment in analysis) or as	- Risk stratification decided by attending, reviewed by research supervisor. If disagreement, research supervisor approached attending about it resulting in contamination bias between the two study arms - Incomplete f/u of 10 patients (4%)

	the study proceeded (blinding, co-intervention, loss to follow-up)?	- Kappa score of 0.63 suggests substantial agreement but not perfect agreement for high vs. low risk patients. - All f/u patients had cardiac event at initial visit - No patients appeared on the social security death master file - Physician non-adherence may predispose to selection bias. One in four HEART pathway patients were non-adherent -
2	What was the impact on clinician behavior and patient-important outcomes?	Use of the Heart Pathway resulted in: 1) Less cardiac testing (56.7 vs 68.8) 2) Early discharge (39.7 vs. 18.4) 3) Decreased LOS (by 12 hours) 4) Decreased return visits for cardiac symptoms (2.8 vs 4.3) 5) Increased cardiac related non-index hospitalizations (3.6 vs. 2.8)

Limitations:

1. May be underpowered to determine the actual incidence of MACE. None of the HEART studies look at large patient populations so accuracy of results (in a low prevalence disease process) may not be sufficient to provide accurate data.
2. Adherence to HEART pathway was only 71% though none of the 19 patients had MACE
3. Primary outcome measure differed from other trials, which used MACE.
4. Inter-observer agreement was not excellent and it would be interesting to assess what component had greatest inter-observer difference

Comments:

I think as clinicians a lot of times we have a low suspicion for cardiac disease, but will put a patient in CP obs/ promote stress testing just d/t the minute chance they may have ACS. This pathway provides us a way to algorithmically sort people based on their hx, risk factors, etc. and if further validated could spare patients from unwarranted testing while protecting the physician.

Since prior history of CAD (2 points) was not an exclusion criterion are we ready to apply HEART pathway to "low risk" patients with hx of CAD?