Impact of use of the HEART score in chest pain patients

Judith Poldervaart, MD, PhD
Julius Center
The HEART-score

- Diagnostic risk score for chest pain patients at ED
- 5 clinical elements
- Supports direct clinical decision

<table>
<thead>
<tr>
<th>Risk category</th>
<th>HEART score</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0-3</td>
<td>Discharge</td>
</tr>
<tr>
<td>Intermed</td>
<td>4-6</td>
<td>Observation</td>
</tr>
<tr>
<td>High</td>
<td>7-10</td>
<td>Invasive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History (Anamnesis)</th>
<th>HEART score</th>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly suspicious</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Moderately suspicious</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Slightly suspicious</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ECG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant ST-deviation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Non-specific repolarisation disturbance / LBBB / PM</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 55 years</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>45 – 65 years</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>&lt; 45 years</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 3 risk factors or history of atherosclerotic disease</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1 or 2 risk factors</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No risk factors known</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Troponin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 3x normal limit</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1-3x normal limit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>≤ normal limit</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Total

Risk factors for atherosclerotic disease:
- Hypercholesterolemia
- Cigarette smoking
- Hypertension
- Positive family history
- Diabetes Mellitus
- Obesity (BMI>30)
Chest Pain in the Emergency Room

A Multicenter Validation of the HEART Score

Barbara E. Backus, MD, A. Jacob Six, MD, PhD,†; Johannes C. Kelder, MD,‡; Thomas P. Mann,§
Frederique van den Akker,§ E. Giuso Mast, MD,§; Stefan H. J. Moonen, MD, PhD,¶; Rob M. van Tooren, MD,**
and Pieter A. J. M. Dommeselaer, MD, MD

Original Article

Can the HEART Score Safely Reduce Stress Testing and Cardiac Imaging in Patients at Low Risk for Major Adverse Cardiac Events?

Simon A. Mahler, MD, §; Brian C. Hiestand, MD, MPH, §; David C. Goff, Jr., MD, PhD, *
James W. Hockstra, MD, †; and Chadwick D. Miller, MD, MS

Original Article

The HEART Pathway Randomized Trial
Identifying Emergency Department Patients With Acute Chest Pain for Early Discharge

Simon A. Mahler, MD, MS; Robert F. Riley, MD; Brian C. Hiestand, MD, MPH;
Gregory B. Russell, MS; James W. Hockstra, MD; Cedric W. Lefebvre, MD;
Bret A. Nicks, MD; David M. Cline, MD; Kim L. Askew, MD; Stephanie B. Elliott, BS;
David M. Herrington MD, MHS; Gregory L. Burke, MD; Chadwick D. Miller, MD, MS

Original Article

HEART Score to Further Risk Stratify Patients With Low TIMI Scores

Shannon Marcou, BA, Anna Marie Chang, MD, Betsy Lee, MD, Rama Sathii, MHS, Judd E. Hollander, MD

Original Article

Chest pain in the emergency department: risk stratification with Manchester triage system and HEART score

Luis Leite, Rui Baptista, Jorge Leitão, Joana Coelho, Filipe Breda, Luís Elvas, Isabel Fonseca, Armando Carvalho and José Nascimento Costa

Original Article

HEART Score: A Simple and Useful Tool That May Lower the Proportion of Chest Pain Patients Who Are Admitted

Dina Melki, MD, Tomas Jernberg, MD, PhD
HEART-Impact trial: hypothesis

Fast & accurate risk stratification with HEART score

Improves management & care in chest pain patients

• Fewer admissions and diagnostic procedures in low-risk
• More aggressive in high-risk
• **However, without increasing incidence of cardiac events!**
  – non-inferiority design

Theory ≠ practice??
**Methods**

**Location of inclusion**
- 9 Dutch hospitals
- July 2013 – August 2014

**Inclusion**
- Chest pain
- Able to give informed consent

**Exclusion**
- STEMIs

**Primary outcome**
- MACE within 6 weeks
  - unstable angina
  - NSTEMI
  - STEMI
  - CAG – conservatively
  - PCI
  - CABG
  - Death
  - Adjudication committee

**Secondary outcomes**
- Use of health care resources
  - Recurrent ED visit
  - (Re)admission
  - Out-patient clinic visit
  - GP visit
  - Diagnostic procedures
- Quality of life
- Direct costs
- Indirect costs
- Cost-effectiveness
Methods: study protocol

Acute chest pain patients

Cluster randomization (stepped wedge design)

‘Usual care period’

Assessment and management according to current guidelines

‘HEART period’

Calculation of HEART score

0-3
Low risk
Early discharge

4-6
Intermediate risk
Non-invasive stress testing or imaging

7-10
High risk
Early invasive diagnostics and treatment

Deviation from proposed policy possible
HEART-Impact trial: stepped wedge

Clinic 9
Clinic 8
Clinic 7
Clinic 6
Clinic 5
Clinic 4
Clinic 3
Clinic 2
Clinic 1

1 2 3 4 5 6 7 8 9 10

→ 10 time periods ("steps")

= HEART

= USUAL CARE
Results: patient flow

Assessed for eligibility at ED (n=4,267)

- Excluded (n=601)
  - Declined to participate (n=341)
  - Language barrier (n=84)
  - Informed consent missing (n=73)
  - Recurrent presentation (n=51)
  - Unable to participate (n=37)
  - Not meeting inclusion criteria (n=15)

Enrollment

Randomized (n=3,666)

Allocation

usual care (n=1,833)

- Allocated to usual care (n=1,833)
  - Received usual care (n=1,833; 100%)
  - Did not receive usual care (n=0; 0%)

- Lost to follow-up:
  - Vital status not retrieved (n=5; 0.3%)
  - Drop-out (n=1)

- Analysed (n=1,827)
  - Excluded from analysis (n=0)

HEART care (n=1,833)

- Allocated to HEART (n=1,833)
  - Received HEART score (n=1,778; 97.0%)
  - Did not receive HEART score (n=55; 3.0%)

Follow-Up

- Lost to follow-up:
  - Vital status not retrieved (n=10; 0.6%)
  - Drop-out (n=2)

Analysis

- Analysed (n=1,821)
  - Excluded from analysis (n=0)
## Results: baseline characteristics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>All patients (N=3,648)</th>
<th>Usual care (N=1,827)</th>
<th>HEART care (N=1,821)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># male</strong></td>
<td>1980 (54%)</td>
<td>1005 (55%)</td>
<td>975 (54%)</td>
</tr>
<tr>
<td><strong>Mean age (SD)</strong></td>
<td>62 (14)</td>
<td>62 (14)</td>
<td>62 (14)</td>
</tr>
<tr>
<td><strong>History of cardiovascular disease</strong></td>
<td>1266 (35%)</td>
<td>670 (37%)</td>
<td>596 (33%)</td>
</tr>
<tr>
<td><strong>HEART score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEART score 0-3 (low risk)</td>
<td></td>
<td>-</td>
<td>715 (40%)</td>
</tr>
<tr>
<td>HEART score 4-6 (intermediate risk)</td>
<td></td>
<td>-</td>
<td>861 (49%)</td>
</tr>
<tr>
<td>HEART score 7-10 (high risk)</td>
<td></td>
<td>-</td>
<td>190 (11%)</td>
</tr>
</tbody>
</table>
# Results: incidence of MACE

<table>
<thead>
<tr>
<th></th>
<th>Usual care (n=1,827)</th>
<th>HEART care (n=1,821)</th>
<th>HEART 0-3 (n=715)</th>
<th>HEART 4-6 (n=861)</th>
<th>HEART 7-10 (n=190)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of patients with MACE</strong></td>
<td>405 (22.2%)</td>
<td>345 (18.9%)</td>
<td>14 (2.0%)</td>
<td>175 (20.2%)</td>
<td>140 (73.7%)</td>
</tr>
<tr>
<td><strong>MACE - components</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Death – total</strong></td>
<td>9 (0.5%)</td>
<td>5 (0.3%)</td>
<td>1 (0.1%)</td>
<td>2 (0.2%)</td>
<td>2 (1.1%)</td>
</tr>
<tr>
<td>Cardiovascular death</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Non-cardiovascular death</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Death by unknown cause</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Cardiac ischemia – total</strong></td>
<td>400 (21.9%)</td>
<td>329 (18.1%)</td>
<td>10 (1.4%)</td>
<td>162 (18.8%)</td>
<td>143 (75.3%)</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>157</td>
<td>105</td>
<td>6</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>NSTEMI</td>
<td>214</td>
<td>211</td>
<td>4</td>
<td>91</td>
<td>107</td>
</tr>
<tr>
<td>STEMI</td>
<td>29</td>
<td>13</td>
<td>0</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td><strong>Significant stenosis – total</strong></td>
<td>290 (15.9%)</td>
<td>247 (13.6%)</td>
<td>10 (1.4%)</td>
<td>117 (13.6%)</td>
<td>102 (11.8%)</td>
</tr>
<tr>
<td>Stenosis managed conservatively</td>
<td>39</td>
<td>41</td>
<td>1</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td>PCI</td>
<td>208</td>
<td>158</td>
<td>7</td>
<td>70</td>
<td>66</td>
</tr>
<tr>
<td>CABG</td>
<td>43</td>
<td>48</td>
<td>2</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total number of MACE</strong></td>
<td>699</td>
<td>581</td>
<td>21</td>
<td>281</td>
<td>247</td>
</tr>
</tbody>
</table>

* total of MACE components exceeds MACE total: 1 patient can have > 1 component
Results: non-inferiority

- Non-inferiority margin:
  - absolute risk difference in MACE usual care & HEART care
  - 95% one-sided CI of should not exceed margin of 3%
Results: non-inferiority of HEART care
### Results: initial presentation at ED

<table>
<thead>
<tr>
<th>INFORMATION AVAILABLE IN ALL NINE HOSPITALS</th>
<th>Usual care</th>
<th>HEART care</th>
<th>HEART score 0-3</th>
<th>HEART score 4-6</th>
<th>HEART score 7-10</th>
<th>HEART unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=1,827)</td>
<td>(n=1,821)</td>
<td>(n=715)</td>
<td>(n=861)</td>
<td>(n=190)</td>
<td>(n=55)</td>
<td></td>
</tr>
</tbody>
</table>

#### Initial presentation at ED

(a) **not admitted** – no. (%)

- Usual care: 1,199 (66%)
- HEART care: 1,263 (69%)
- HEART score 0-3: 648 (91%)
- HEART score 4-6: 556 (65%)
- HEART score 7-10: 29 (15%)
- HEART unknown: 30 (55%)

- Of which prompt discharge < 4h*: 564 (47%)
- Of which prolonged observation at ED/CPU: 635 (53%)

(b) **hospital admission** – no. (%)

- Usual care: 628 (34%)
- HEART care: 558 (31%)
- HEART score 0-3: 67 (9%)
- HEART score 4-6: 305 (35%)
- HEART score 7-10: 161 (85%)
- HEART unknown: 25 (45%)

- Of which admission to CCU/ICU after ED: 296 (47%)

#### Median length of stay at ED in hours: min (P25-P75)

- Usual care: 3:57 (2:30-5:57)
- HEART care: 3:55 (2:35-5:44)
- HEART score 0-3: 3:16 (2:21-4:43)
- HEART score 4-6: 4:40 (2:56-6:20)
- HEART score 7-10: 3:32 (2:16-5:51)
- HEART unknown: 2:57 (2:17-5:11)

#### Total number of days

- Usual care: 3365
- HEART care: 3085
- HEART score 0-3: 193
- HEART score 4-6: 1521
- HEART score 7-10: 1228
- HEART unknown: 143

- Of which days on CCU / ICU

- Usual care: 1032
- HEART care: 880
- HEART score 0-3: 44
- HEART score 4-6: 360
- HEART score 7-10: 435
- HEART unknown: 41

#### ≥ 1 recurrent visit at ED – no. (%)

- Usual care: 266 (15%)
- HEART care: 277 (15%)
- HEART score 0-3: 72 (10%)
- HEART score 4-6: 151 (18%)
- HEART score 7-10: 46 (24%)
- HEART unknown: 8 (15%)

- Final diagnosis cardiac ischemia

- Usual care: 80
- HEART care: 79
- HEART score 0-3: 11
- HEART score 4-6: 49
- HEART score 7-10: 18
- HEART unknown: 11

#### ≥ 1 readmission, non-elective – no. (%)

- Usual care: 221 (12%)
- HEART care: 193 (11%)
- HEART score 0-3: 49 (10%)
- HEART score 4-6: 104 (12%)
- HEART score 7-10: 37 (19%)
- HEART unknown: 3 (5%)

- Total number of readmissions

- Usual care: 296
- HEART care: 261
- HEART score 0-3: 59
- HEART score 4-6: 145
- HEART score 7-10: 51
- HEART unknown: 6

- Median number of days (P25-P75)

- Usual care: 2 (0-6)
- HEART care: 2 (0-6)
- HEART score 0-3: 2 (0-4)
- HEART score 4-6: 2 (0-7)
- HEART score 7-10: 2 (0-7)
- HEART unknown: 2 (0-4)

#### ≥ 1 out-patient clinic visit – no. (%)

- Usual care: 1,093 (60%)
- HEART care: 1,267 (70%)
- HEART score 0-3: 381 (53%)
- HEART score 4-6: 686 (80%)
- HEART score 7-10: 165 (87%)
- HEART unknown: 35 (64%)

- Total number of visits

- Usual care: 2730
- HEART care: 3203
- HEART score 0-3: 848
- HEART score 4-6: 1823
- HEART score 7-10: 443
- HEART unknown: 89

- Specialism cardiology

- Usual care: 1505
- HEART care: 1779
- HEART score 0-3: 417
- HEART score 4-6: 1034
- HEART score 7-10: 267
- HEART unknown: 61

- Specialism other than cardiology

- Usual care: 1225
- HEART care: 1424
- HEART score 0-3: 431
- HEART score 4-6: 789
- HEART score 7-10: 176
- HEART unknown: 28

#### ≥ 1 new visit at GP for cardiac reason – no. (%) †

- Usual care: 195 (11%)
- HEART care: 213 (12%)
- HEART score 0-3: 86 (12%)
- HEART score 4-6: 102 (12%)
- HEART score 7-10: 18 (9%)
- HEART unknown: 7 (13%)
Results: recurrent ED visits, readmissions, out-patient clinic visits, GP visits

- No difference after adjustment for clustering and time
## Results: diagnostic procedures

<table>
<thead>
<tr>
<th>Tests mentioned in this table</th>
<th>Usual care N=1,176</th>
<th>HEART care N=804</th>
<th>HEART 0-3 N=346</th>
<th>HEART 4-6 N=361</th>
<th>HEART 7-10 N=65</th>
<th>HEART unknown N=32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients with one or more of the tests</td>
<td>765 (65%)</td>
<td>461 (57%)</td>
<td>137 (40%)</td>
<td>250 (69%)</td>
<td>56 (86%)</td>
<td>18 (56%)</td>
</tr>
<tr>
<td>Diagnostic testing – total numbers</td>
<td>1,565</td>
<td>940</td>
<td>228</td>
<td>541</td>
<td>136</td>
<td>35</td>
</tr>
<tr>
<td>Number of tests within first two days</td>
<td>582 (37%)</td>
<td>347 (37%)</td>
<td>49 (21%)</td>
<td>216 (40%)</td>
<td>65 (48%)</td>
<td>17 (49%)</td>
</tr>
<tr>
<td>Stress bicycle ECG testing†</td>
<td>465 (40%)</td>
<td>300 (37%)</td>
<td>96 (28%)</td>
<td>175 (48%)</td>
<td>18 (28%)</td>
<td>11 (34%)</td>
</tr>
<tr>
<td>Echocardiography (transthoracic)</td>
<td>410 (35%)</td>
<td>243 (30%)</td>
<td>50 (15%)</td>
<td>142 (39%)</td>
<td>43 (66%)</td>
<td>8 (25%)</td>
</tr>
<tr>
<td>Nuclear imaging</td>
<td>198 (17%)</td>
<td>89 (11%)</td>
<td>24 (7%)</td>
<td>56 (16%)</td>
<td>8 (12%)</td>
<td>1 (0%)</td>
</tr>
<tr>
<td>CT-scan or CT-angiography (excluding PE)</td>
<td>87 (7%)</td>
<td>47 (6%)</td>
<td>16 (5%)</td>
<td>27 (7%)</td>
<td>3 (5%)</td>
<td>1 (0%)</td>
</tr>
<tr>
<td>Coronary CT-Angiography (CCTA)</td>
<td>40 (3%)</td>
<td>26 (3%)</td>
<td>14 (4%)</td>
<td>10 (3%)</td>
<td>0 (0%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Cardiac MRI</td>
<td>19 (2%)</td>
<td>16 (2%)</td>
<td>6 (2%)</td>
<td>10 (3%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Coronary angiography (CAG)</td>
<td>346 (29%)</td>
<td>219 (27%)</td>
<td>22 (6%)</td>
<td>121 (34%)</td>
<td>64 (98%)</td>
<td>12 (38%)</td>
</tr>
<tr>
<td>CAG: normal coronary arteries</td>
<td>41</td>
<td>19</td>
<td>4</td>
<td>13</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CAG: non-significant stenosis</td>
<td>101</td>
<td>69</td>
<td>13</td>
<td>39</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>CAG: significant stenosis conservatively treated</td>
<td>28</td>
<td>15</td>
<td>0</td>
<td>12</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CAG: significant stenosis invasively treated</td>
<td>176</td>
<td>116</td>
<td>5</td>
<td>57</td>
<td>45</td>
<td>9</td>
</tr>
</tbody>
</table>
## Results: non-adherence to recommended HEART policy

- No discharge in low-risk patients
- No additional testing in high-risk patients

<table>
<thead>
<tr>
<th></th>
<th>Usual care N=1,827</th>
<th>HEART care N=1,766†</th>
<th>HEART low-risk N=715 ‡</th>
<th>HEART high-risk N=190</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adherence to HEART policy</strong></td>
<td>n/a</td>
<td>Yes N=1,453 (82.3%)</td>
<td>Yes N=424 (59.3%)</td>
<td>Yes N=168 (88%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No N=313 (17.7%)</td>
<td>No N=291 (40.7%)</td>
<td>No N=22 (12%)</td>
</tr>
<tr>
<td><strong>MACE within 6 weeks</strong></td>
<td>405 (22.2%)</td>
<td>315 (21.7%)</td>
<td>3 (0.7%)</td>
<td>137 (82%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 (4.5%)</td>
<td>11 (3.8%)</td>
<td>3 (14%)</td>
</tr>
<tr>
<td><strong>MACE only AMI, emergency revascularisation and death</strong></td>
<td>243 (13.3%)</td>
<td>203 (14.0%)</td>
<td>0 (0%)</td>
<td>113 (67%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 (1.6%)</td>
<td>5 (1.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Discharge ≤4 hours after presentation</strong></td>
<td>564 (47%)</td>
<td>549 (37.8%)</td>
<td>66 (21.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>359 (84.7%)</td>
<td>57 (19.6%)</td>
<td>9 (40%)</td>
</tr>
<tr>
<td><strong>Prolonged observation at ED</strong></td>
<td>635 (53%)</td>
<td>438 (30.1%)</td>
<td>180 (57.5%)</td>
<td>7 (4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65 (15.3%)</td>
<td>167 (57.4%)</td>
<td>13 (59%)</td>
</tr>
<tr>
<td><strong>Initial admission to hospital</strong></td>
<td>628 (34%)</td>
<td>466 (32.1%)</td>
<td>67 (21.4%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 (0%)</td>
<td>67 (23.7%)</td>
<td>161 (100%)</td>
</tr>
<tr>
<td><strong>Recurrent ED visits within 3 months</strong></td>
<td>266 (15%)</td>
<td>233 (16.0%)</td>
<td>36 (11.5%)</td>
<td>41 (24%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41 (9.7%)</td>
<td>31 (10.7%)</td>
<td>41 (23%)</td>
</tr>
<tr>
<td><strong>Non-elective readmissions within 3 months</strong></td>
<td>221 (12%)</td>
<td>164 (11.3%)</td>
<td>26 (8.3%)</td>
<td>35 (21%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26 (6.1%)</td>
<td>24 (8.2%)</td>
<td>2 (9%)</td>
</tr>
<tr>
<td><strong>Outpatient clinic visits within 3 months</strong></td>
<td>1,093 (60%)</td>
<td>1,025 (70.5%)</td>
<td>207 (66.1%)</td>
<td>144 (86%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>187 (44.1%)</td>
<td>189 (64.9%)</td>
<td>18 (82%)</td>
</tr>
</tbody>
</table>
What do our results mean?

• **HEART score is safe**
  – No increase of MACE during HEART care
  – Low risk MACE incidence: 2.0% (including UA and elective PCI)

• **Only limited impact on management**
  – After adjustment for clustering and time steps, no difference in early discharge <4 hours, readmissions, recurrent ED visits, outpatient clinic visits, GP visits or diagnostic procedures occurred
  – 232 low-risk patients: prolonged observation at ED/CPU

• **Non-adherence**
Clinical implications

• Use of HEART score safe in work-up chest pain patients

• Identification of barriers for acceptance and use

• Chest pain remains diagnostic dilemma:
  – What is an acceptable risk?
Acknowledgements

Patients

Residents

Participating hospitals

Pieter Doevedans, UMC Utrecht
Clara van Ofwegen, Diakonessenhuis, Utrecht
Jacob Six, Hofpoort, Woerden
Thomas Oosterhof, Gelderse vallei Ede
Jan-Melle van Dantzig, Catharina, Eindhoven
Herman Mannaerts, Amstelland, Amstelveen
Yolande Appelman, Vumc, Amsterdam
Benno Rensing, St. Antonius, Nieuwegein
Nicolette Ernst, Atrium, Heerlen

Investigator team

Arno Hoes
Pieter Doevedans
Hans Reitsma
Jacob Six
Barbra Backus
Erik Koffijberg
Judith Poldervaart