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Methods and formulas used to calculate the GRACE Risk Scores for patients presenting to hospital with an acute coronary syndrome:

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IN-HOSPITAL MODELS

1. 8 Granger reduced model estimates for hospital death  
Arch Int Med, Oct 2003  
(Can be used to estimate the probability of hospital death.)

2. Translation of 8 estimates into Granger risk score (nomogram)

3. How Granger risk score relates to probability of hospital death  
(Note- probability computed directly from model estimates in #1 should be slightly more accurate, as a single score cannot completely replace 8 distinct factors.)

4. Risk score for in-hospital death or MI (nomogram)

POST DISCHARGE MODELS

5. 9 Eagle reduced model estimates for death in 6 months after discharge  
JAMA, June 2004  
(Can be used to estimate the probability of 6-month death.)

6. Translation of 9 estimates into Eagle risk score (nomogram)

7. Risk score for death or MI in 6 months after discharge (nomogram)

ADMISSION TO 6 MONTHS MODELS

8. Risk score for Fox prediction of death from admission to 6 months later (nomogram)  
BMJ, Oct 2006

9. Risk score for Fox prediction of death or MI from admission to 6 months later (nomogram)
**Granger Model for In-hospital Death**

1. Model estimates from multiple logistic regression model
   Intercept -7.7035
   AGE (per 1 yr) 0.0531
   PULSE (per 1 BPM) 0.0087
   SYSTOLIC BLOOD PRESSURE (per 1 mmHG) -0.0168
   INITIAL SERUM CREATININE, mg,dl 0.1823
   KILLIP CLASS (1,2,3, or 4) 0.6931
   CARDIAC ARREST at presentation* 1.4586
   INITIAL CARDIAC ENZYME Positive* 0.4700
   ST SEGMENT DEVIATION* 0.8755

* enter a value of 1 if factor is present, 0 otherwise.

To obtain estimated risk of death from above estimates
Compute $X_B$, where $X=\text{individual patient's value for each factor (eg, age=57, pulse=70...)}$, and $B=\text{estimates above, including the intercept}$. $X_B$ is then the summed product of the patient characteristics times the estimates, with the intercept added for every patient.

For example, if a patient is age 57, pulse 70, SBP 110, creatinine 1.2, Killip class III, had cardiac arrest and ST deviation but not initial positive enzymes, $X_B$ is:

\[
X_B = -7.7035 + 57 \times 0.0531 + 70 \times 0.0087 - 110 \times 0.0168 + 1.2 \times 0.1823 + 3 \times 0.6931 + 1 \times 1.4586 + 0 \times 0.47 + 1 \times 0.8755 (= -1.28364).
\]

The probability of in-hospital death is then

\[
P = \frac{\exp**(X_B)}{(1 + \exp**(X_B))} (= .21693),
\]

where $\exp$ is 2.71828..., and ** means raised to that power ($X_B$ power).

The SAS macro below illustrates this computation for a given patient

```sas
%macro xb(val1,val2,val3,val4,val5,val6,val7,val8);
data x;
age=&val1;
pulse=&val2;
sbp=&val3;
creat=&val4;
kilip=&val5;
carrst=&val6;
posinit=&val7;
stchange=&val8;
xb= -7.7035 + (0.0531*age) + (0.0087*pulse) - (0.0168*sbp) + (0.1823*creat) + (0.6931*kilip) + (1.4586*carrst) + (0.4700*posinit) + (0.8755*stchange);
p=(exp(xb))/(1 + exp(xb));run;
%mend xb;
%xb(val1=57,val2=70,val3=110,val4=1.2,val5=3,val6=1,val7=0,val8=1);
```

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2. Nomogram translating **Eight Granger Model estimates** for in-hospital death into integer GRACE Risk Scores (see pg. 2351 of Granger article)

**SAS code for obtaining risk score as in article**

* **Create data for HS Grace score**

* assign points as in nomogram for Granger **.

* 1. Killip class I,II,III,IV;

   if killip=1 then killips = 0;
   else if killip=2 then killips = 20;
   else if killip=3 then killips = 39;
   else if killip=4 then killips = 59;

* 2. **BPSYS** is systolic blood pressure (mm Hg);

   if 0 <= bpsys < 80 then sysbp2 = 58;
   else if 80 <= bpsys < 100 then sysbp2 = 58 -(bpsys-80)(10/20);
   else if 100 <= bpsys < 110 then sysbp2 = 48 -(bpsys-100)(5/10);
   else if 110 <= bpsys < 120 then sysbp2 = 39 -(bpsys-110)(4/10);
   else if 120 <= bpsys < 130 then sysbp2 = 30 -(bpsys-120)(5/10);
   else if 130 <= bpsys < 140 then sysbp2 = 24 -(bpsys-130)(5/10);
   else if 140 <= bpsys < 150 then sysbp2 = 19 -(bpsys-140)(5/10);
   else if 150 <= bpsys < 160 then sysbp2 = 15 -(bpsys-150)(5/10);
   else if 160 <= bpsys < 180 then sysbp2 = 10 -(bpsys-160)(9/20);
   else if 180 <= bpsys < 200 then sysbp2 = 10 -(bpsys-180)(10/20);
   else if bpsys >= 200 then sysbp2 = 0;

* 3. **PULSE** in beats/minute;

   if 0 <= pulse < 50 then pulse2 = 0;
   else if 50 <= pulse < 60 then pulse2 = 0 + (pulse-50)(3/10);
   else if 60 <= pulse < 70 then pulse2 = 3 + (pulse-60)(3/10);
   else if 70 <= pulse < 80 then pulse2 = 6 + (pulse-70)(3/10);
   else if 80 <= pulse < 90 then pulse2 = 9 + (pulse-80)(3/10);
   else if 90 <= pulse < 100 then pulse2 = 12 + (pulse-90)(3/10);
   else if 100 <= pulse < 110 then pulse2 = 15 + (pulse-100)(3/10);
   else if 110 <= pulse < 120 then pulse2 = 18 + (pulse-110)(12/40);
   else if 150 <= pulse < 200 then pulse2 = 30 + (pulse-150)(16/50);
   else if pulse >= 200 then pulse2 = 46;

* 4. **AGE** in years;

   if 0 <= age < 30 then age2 = 0;
   else if 30 <= age < 40 then age2 = 0 + (age-30)(17/10);
   else if 40 <= age < 50 then age2 = 17 + (age-40)(16/10);
   else if 50 <= age < 60 then age2 = 33 + (age-50)(17/10);
   else if 60 <= age < 70 then age2 = 50 + (age-60)(17/10);
   else if 70 <= age < 80 then age2 = 67 + (age-70)(16/10);
   else if 80 <= age < 90 then age2 = 83 + (age-80)(17/10);
   else if age >= 90 then age2 = 100;

* 5. Creatinine in mg/dl;

   if 0.0 <= creat_mg < 0.2 then crt2 = 0 + (creat_mg-0)(1.2);
   else if 0.2 <= creat_mg < 0.4 then crt2 = 1 + (creat_mg-0.2)(2/2); 
   else if 0.4 <= creat_mg < 0.6 then crt2 = 3 + (creat_mg-0.4)(1/2);
else if 0.6 <= creat_mg < 0.8 then crt2 = 4 + (creat_mg - 0.6)*(2/2);
else if 0.8 <= creat_mg < 1.0 then crt2 = 6 + (creat_mg - 0.8)*(1/2);
else if 1.0 <= creat_mg < 1.2 then crt2 = 7 + (creat_mg - 1.0)*(1/2);
else if 1.2 <= creat_mg < 1.4 then crt2 = 8 + (creat_mg - 1.2)*(2/2);
else if 1.4 <= creat_mg < 1.6 then crt2 = 10 + (creat_mg - 1.4)*(1/2);
else if 1.6 <= creat_mg < 1.8 then crt2 = 11 + (creat_mg - 1.6)*(2/2);
else if 1.8 <= creat_mg < 2.0 then crt2 = 13 + (creat_mg - 1.8)*(1/2);
else if 2.0 <= creat_mg < 3.0 then crt2 = 14 + (creat_mg - 2.0)*(7/1);
else if 3.0 <= creat_mg < 4.0 then crt2 = 21 + (creat_mg - 3.0)*(7/1);
else if creat_mg >= 4.0 then crt2 = 28;

* 6. STCHANGE is ST deviation, assigned a value of 1 if present, 0 if absent;
* 7. POSINIT is positive initial cardiac enzymes (1 if present, 0 if absent);
* 8. CARRST is cardiac arrest on presentation (1 if present, 0 if absent);

* Risk score=sum of points for 8 factors;

Death_pt = killips + sysbp2 + pulse2 + age2 + crt2 + 28*stchange + 14*posinit + 39*carrst;
3. How GRACE Risk Scores Relate to Probability of In-hospital Death

Estimated Event Rates by Nomogram Score

Table of selected individual scores by probability of in-hospital death
(Note- probability computed directly from model estimates in #1 should be slightly more accurate, as a single score cannot completely replace 8 distinct factors.)

<table>
<thead>
<tr>
<th>Score</th>
<th>Probability</th>
<th>Score</th>
<th>Probability</th>
<th>Score</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>0.002</td>
<td>184</td>
<td>0.11</td>
<td>214</td>
<td>0.25</td>
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<tr>
<td>79</td>
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<td>187</td>
<td>0.12</td>
<td>216</td>
<td>0.26</td>
</tr>
<tr>
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<td>0.006</td>
<td>190</td>
<td>0.13</td>
<td>217</td>
<td>0.27</td>
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<tr>
<td>100</td>
<td>0.008</td>
<td>192</td>
<td>0.14</td>
<td>219</td>
<td>0.28</td>
</tr>
<tr>
<td>107</td>
<td>0.01</td>
<td>195</td>
<td>0.15</td>
<td>220</td>
<td>0.29</td>
</tr>
<tr>
<td>129</td>
<td>0.02</td>
<td>197</td>
<td>0.16</td>
<td>222</td>
<td>0.3</td>
</tr>
<tr>
<td>141</td>
<td>0.03</td>
<td>199</td>
<td>0.17</td>
<td>235</td>
<td>0.4</td>
</tr>
<tr>
<td>151</td>
<td>0.04</td>
<td>201</td>
<td>0.18</td>
<td>248</td>
<td>0.5</td>
</tr>
<tr>
<td>158</td>
<td>0.05</td>
<td>203</td>
<td>0.19</td>
<td>260</td>
<td>0.6</td>
</tr>
<tr>
<td>164</td>
<td>0.06</td>
<td>205</td>
<td>0.2</td>
<td>274</td>
<td>0.7</td>
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<tr>
<td>169</td>
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<td>0.21</td>
<td>290</td>
<td>0.8</td>
</tr>
<tr>
<td>173</td>
<td>0.08</td>
<td>209</td>
<td>0.22</td>
<td>315</td>
<td>0.9</td>
</tr>
<tr>
<td>177</td>
<td>0.09</td>
<td>211</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>181</td>
<td>0.1</td>
<td>213</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Nomogram for translating eight Granger risk factors into an in-hospital death/MI risk score (as used in Palm Pilot software available on GRACE website)

*****SAS code .................................................................................................................................; In hospital death/MI score (based on palm pilot);
* 1. AGE in years;
  if 0 <= age < 30 then age3 = 0;
  else if 30 <= age < 40 then age3 = 0 + (age-30)*(1.3);
  else if 40 <= age < 50 then age3 = 13 + (age-40)*(1.4);
  else if 50 <= age < 60 then age3 = 27 + (age-50)*(1.3);
  else if 60 <= age < 70 then age3 = 40 + (age-60)*(1.4);
  else if 70 <= age < 80 then age3 = 54 + (age-70)*(1.3);
  else if 80 <= age < 90 then age3 = 67 + (age-80)*(1.3);
  else if age >= 90 then age3 = 80;

* 2. PULSE in beats/minute;
  if 0 <= pulse < 50 then pulse3 = 0;
  else if 50 <= pulse < 60 then pulse3 = 0 + (pulse-50)*(0.3);
  else if 60 <= pulse < 70 then pulse3 = 3 + (pulse-60)*(0.2);
  else if 70 <= pulse < 80 then pulse3 = 5 + (pulse-70)*(0.3);
  else if 80 <= pulse < 90 then pulse3 = 8 + (pulse-80)*(0.3);
  else if 90 <= pulse < 100 then pulse3 = 11 + (pulse-90)*(0.3);
  else if 100 <= pulse < 110 then pulse3 = 14 + (pulse-100)*(0.2);
  else if 110 <= pulse < 150 then pulse3 = 16 + (pulse-110)*(0.3);
  else if 150 <= pulse < 200 then pulse3 = 28 + (pulse-150)*(0.26);
  else if pulse >= 200 then pulse3 = 41;

* 3. BPSYS is systolic blood pressure (mm Hg);
  if 0 <= sbp < 80 then sysbp3 = 53;
  else if 80 <= sbp < 100 then sysbp3 = 53 - (sbp-80)*(0.4);
  else if 100 <= sbp < 110 then sysbp3 = 45 - (sbp-100)*(0.5);
  else if 110 <= sbp < 120 then sysbp3 = 40 - (sbp-110)*(0.5);
  else if 120 <= sbp < 130 then sysbp3 = 35 - (sbp-120)*(0.4);
  else if 130 <= sbp < 140 then sysbp3 = 31 - (sbp-130)*(0.5);
  else if 140 <= sbp < 150 then sysbp3 = 26 - (sbp-140)*(0.4);
  else if 150 <= sbp < 160 then sysbp3 = 22 - (sbp-150)*(0.5);
  else if 160 <= sbp < 180 then sysbp3 = 17 - (sbp-160)*(0.4);
  else if 180 <= sbp < 200 then sysbp3 = 9 - (sbp-180)*(0.45);
  else if sbp >= 200 then sysbp3 = 0;

* 4. Creatinine in mg/dl (same points as for death score);
  if 0.0 <= creat_mg < 0.2 then crt2 = 0 + (creat_mg-0.0)*(1/2);
  else if 0.2 <= creat_mg < 0.4 then crt2 = 1 + (creat_mg-0.2)*(2/2);
  else if 0.4 <= creat_mg < 0.6 then crt2 = 3 + (creat_mg-0.4)*(1/2);
  else if 0.6 <= creat_mg < 0.8 then crt2 = 4 + (creat_mg-0.6)*(2/2);
  else if 0.8 <= creat_mg < 1.0 then crt2 = 6 + (creat_mg-0.8)*(1/2);
  else if 1.0 <= creat_mg < 1.2 then crt2 = 7 + (creat_mg-1.0)*(1/2);
  else if 1.2 <= creat_mg < 1.4 then crt2 = 8 + (creat_mg-1.2)*(2/2);
  else if 1.4 <= creat_mg < 1.6 then crt2 = 10 + (creat_mg-1.4)*(1/2);
  else if 1.6 <= creat_mg < 1.8 then crt2 = 11 + (creat_mg-1.6)*(2/2);
  else if 1.8 <= creat_mg < 2.0 then crt2 = 13 + (creat_mg-1.8)*(1/2);
  else if 2.0 <= creat_mg < 3.0 then crt2 = 14 + (creat_mg-2.0)*(7/1);
  else if 3.0 <= creat_mg < 4.0 then crt2 = 21 + (creat_mg-3.0)*(7/1);
  else if creat_mg >= 4.0 then crt2 = 28;
* 5. Killip class I, II, III, IV;
  if killip=1 then killips3 = 0;
  else if killip=2 then killips3 = 33;
  else if killip=3 then killips3 = 67;
  else if killip=4 then killips3 = 100;

* 6. CARRST is cardiac arrest on presentation (1 if present, 0 if absent);
* 7. POSINIT is positive initial cardiac enzymes (1 if present, 0 if absent);
* 8. STCHANGE is ST deviation, assigned a value of 1 if present, 0 if absent;

* Death/MI risk score=sum of points for 8 factors;
  deathmi_pt = killips3 + sysbp3 + pulse3 + age3 + crt2 + 67*stchange + 54*posinit + 98*carrst;

How score relates to probability of in-hospital death or MI

<table>
<thead>
<tr>
<th>Score</th>
<th>Prob</th>
<th>Score</th>
<th>Prob</th>
<th>Score</th>
<th>Prob</th>
</tr>
</thead>
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<td>&lt;30</td>
<td>2</td>
<td>173-180</td>
<td>13</td>
<td>241-245</td>
<td>24</td>
</tr>
<tr>
<td>30-56</td>
<td>3</td>
<td>181-187</td>
<td>14</td>
<td>246-250</td>
<td>25</td>
</tr>
<tr>
<td>57-78</td>
<td>4</td>
<td>188-194</td>
<td>15</td>
<td>251-254</td>
<td>26</td>
</tr>
<tr>
<td>79-95</td>
<td>5</td>
<td>195-201</td>
<td>16</td>
<td>255-259</td>
<td>27</td>
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<tr>
<td>96-110</td>
<td>6</td>
<td>202-207</td>
<td>17</td>
<td>260-263</td>
<td>28</td>
</tr>
<tr>
<td>111-123</td>
<td>7</td>
<td>208-213</td>
<td>18</td>
<td>264-268</td>
<td>29</td>
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<td>60</td>
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<td>236-240</td>
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<td>&gt;470</td>
<td>80</td>
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</tbody>
</table>
Eagle Model Predicting Death within 6 Months after Hospital Discharge

5. Model estimates from multiple Cox regression model
Pg. 2730 of JAMA article

Base survival 0.99950
AGE (per 1 yr) 0.05713
PULSE (per 1 BPM) 0.00891
SYSTOLIC BLOOD PRESSURE (per 1 mmHG) -0.00630
INITIAL SERUM CREATININE, mg,dl 0.15807
Positive initial enzymes (presentation)* 0.47321
ST SEGMENT DEPRESSION (presentation)* 0.36053
Past MI (determined at presentation)* 0.39271
Past CHF (determined at presentation)* 0.76678
In-hospital PCI* -0.44618

* enter a value of 1 if factor is present, 0 otherwise.

To obtain estimated risk of 6 month post discharge death from above estimates
Compute XB, where X=individual patient's value for each factor (eg, age=57, pulse=70...), and
B=estimates above, including the intercept.
XB is then the summed product of the patient characteristics times the estimates, with the intercept added
for every patient.

For example, if a patient is age 57, pulse 70, SBP 110, creatinine 1.2, no positive initial enzymes, had ST
depression, no past MI, past CHF, had in-hospital PCI, XB is:

\[
XB = 57 \times 0.05713 + 70 \times 0.00891 - 110 \times 0.0063 + 1.2 \times 0.15807 + 0 \times 0.47321 + 1 \times 0.36053 + 0 \times 0.39271 + 1 \times 0.76678 - 1 \times 0.44618 = 4.05792 .
\]

The probability of 6 month post discharge death is then
\[
P = 1 - \text{baseline survival}^* \left( \exp^{XB} \right) (= .0285),
\]
where base survival is .9995, exp is 2.71828..., and ** means raised to that power (so .9995 raised to the
(2.71828 raised to the XB power)).

The SAS macro below illustrates this computation for a given patient
%
macro prob(val1, val2, val3, val4, val5, val6, val7, val8, val9, val10);
data x;
age=&val1; pulse=&val2; bpsys=&val3; creat=&val4; posinit=&val5;
stdepr=&val6; mhmi=&val7; mhchf=&val8; nopci=&val9; basesurv=&val10;
Xbeta = (age*0.05713) + (pulse*0.00891) - (bpsys*0.0063) +
(creat*0.15807) + (posinit*0.47321) + (stdepr*0.36053) +
(mhmi*0.39271) + (mhchf*0.76678) - (pci*0.44618);
exbeta=exp(xbeta);
cumsurv=basesurv**exbeta;
p=1-cumsurv;
run;
proc print data=x; run;
%mend
%
prob(val1=57, val2=70, val3=110, val4=1.2, val5=0, val6=1, val7=0, val8=1, val9=1, val10=.9995);
6. Nomogram translating *Eagle Model* estimates for death within the 6 months after discharge into GRACE Risk Score integers (see pg. 2731 of 2004 JAMA article)

SAS code for obtaining risk score as in article

* 1. Age in years;
  if 0 <= age < 35 then age_sc = 0;
  else if 35 <= age < 45 then age_sc = 0 + (age-35)*(18-0)/10;
  else if 45 <= age < 55 then age_sc = 18 + (age-45)*(36-18)/10;
  else if 55 <= age < 65 then age_sc = 36 + (age-55)*(55-36)/10;
  else if 65 <= age < 75 then age_sc = 55 + (age-65)*(73-55)/10;
  else if 75 <= age < 85 then age_sc = 73 + (age-75)*(91-73)/10;
  else if 85 <= age < 90 then age_sc = 91 + (age-85)*(100-91)/5;
  else if age >= 90 then age_sc = 100;

* 2. Pulse at presentation, in beats/minute;
  if 0 <= pulse < 50 then pulse_sc = 0;
  else if 50 <= pulse < 60 then pulse_sc = 0 + (pulse-50)*(3-0)/10;
  else if 60 <= pulse < 80 then pulse_sc = 3 + (pulse-60)*(9-3)/20;
  else if 80 <= pulse < 100 then pulse_sc = 9 + (pulse-80)*((14-9)/20;
  else if 100 <= pulse < 130 then pulse_sc = 14 + (pulse-100)*((23-14)/30;
  else if 130 <= pulse < 175 then pulse_sc = 23 + (pulse-130)*((35-23)/45;
  else if 175 <= pulse < 200 then pulse_sc = 35 + (pulse-175)*((43-35)/25;
  else if pulse >= 200 then pulse_sc = 43;

* 3. Systolic blood pressure at presentation, in mm Hg;
  if 0 <= bpsys< 80 then sbp_sc = 24;
  else if 80 <= bpsys< 90 then sbp_sc = 24 - (bpsys-80)*((24-22)/10;
  else if 90 <= bpsys< 110 then sbp_sc = 22 - (bpsys-90)*((22-18)/20;
  else if 110 <= bpsys< 130 then sbp_sc = 18 - (bpsys-110)*((18-14)/20;
  else if 130 <= bpsys< 150 then sbp_sc = 14 - (bpsys-130)*((14-10)/20;
  else if 150 <= bpsys< 180 then sbp_sc = 10 - (bpsys-150)*((10-4)/30;
  else if 180 <= bpsys< 200 then sbp_sc = 4 - (bpsys-180)*((4-0)/20;
  else if bpsys>200 then sbp_sc = 0;

* 4. Initial creatinine in mg/dL;
  if 0 <= creat < 0.2 then creat_sc = 0 + (creat-0.0)*((1-0)/0.2;
  else if 0.2 <= creat < 0.4 then creat_sc = 1 + (creat-0.2)*((2-1)/0.2;
  else if 0.4 <= creat < 0.6 then creat_sc = 2 + (creat-0.4)*((3-2)/0.2;
  else if 0.6 <= creat < 0.8 then creat_sc = 3 + (creat-0.6)*((4-3)/0.2;
  else if 0.8 <= creat < 1.0 then creat_sc = 4 + (creat-0.8)*((5-4)/0.2;
  else if 1.0 <= creat < 1.2 then creat_sc = 5 + (creat-1.0)*((6-5)/0.2;
  else if 1.2 <= creat < 1.4 then creat_sc = 6 + (creat-1.2)*((7-6)/0.2;
  else if 1.4 <= creat < 1.6 then creat_sc = 7 + (creat-1.4)*((8-7)/0.2;
  else if 1.6 <= creat < 1.8 then creat_sc = 8 + (creat-1.6)*((9-8)/0.2;
  else if 1.8 <= creat < 2.0 then creat_sc = 9 + (creat-1.8)*((10-9)/0.2;
  else if 2.0 <= creat < 3.0 then creat_sc = 10+ (creat-2.0)*((15-10)/1.0;
  else if 3.0 <= creat < 4.0 then creat_sc = 15+ (creat-3.0)*((20-15)/1.0;
  else if creat >= 4.0 then creat_sc = 20;

* for 5-8, code 0 if absent, 1 if present;
* 5. POSINIT is initial elevated serum cardiac biomarkers;
* 6. STDEPR is ST-segment depression on initial ECG;
* 7. MHMI is history of MI (as of hospital admission);

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* 8. MHCHF is history of CHF (as of hospital admission);
* 9. NOPCI is PCI performed in hospital (code 1 = no PCI, 0 = PCI);
* Risk score = sum of points for 9 factors;

*** equation;
escore = age_sc + pulse_sc + sbp_sc + creat_sc + 15*posinit
     + 11*stdepr + 12*mhmi + 24*mhchf + 14*nopci;

Table of selected individual scores by probability of 6 month death
(Note- probability computed directly from model estimates in section #5 should be slightly more accurate, as a single score cannot completely replace 8 distinct factors.)

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<th>Score</th>
<th>Probability</th>
<th>Score</th>
<th>Probability</th>
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<td></td>
<td>225</td>
<td>70.00%</td>
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</table>
7. Nomogram translating five risk factors for post discharge death/MI into GRACE Risk Scores (as used in Palm Pilot program)

Risk score for 6 mo post discharge death or MI- 5 factors. This score ignores 5 death model factors: pulse, sys BP, creatinine, PCI, and ST depression, and introduces in-hospital CABG.

* 1. Age in years;
  if 0 <=age < 35 then age_sc = 0;
  else if 35 <=age < 45 then age_sc = 0 + (age-35)*(18-0)/10;
  else if 45 <=age < 55 then age_sc = 18 + (age-45)*(36-18)/10;
  else if 55 <=age < 65 then age_sc = 36 + (age-55)*(55-36)/10;
  else if 65 <=age < 75 then age_sc = 55 + (age-65)*(73-55)/10;
  else if 75 <=age < 85 then age_sc = 73 + (age-75)*(91-73)/10;
  else if 85 <=age < 90 then age_sc = 91 + (age-85)*(100-91)/5;
  else if age >=90 then age_sc = 100;

* 2-4 are coded 1=present, 0=absent;
  * 2. POSINIT is initial elevated serum cardiac biomarkers;
  * 3. MHMI is history of MI (as of hospital admission);
  * 4. CHF is past CHF or CHF developed in the hospital;
  * 5. NOCABG is CABG performed in the hospital (1=no CABG 0=CABG);
  if chfpe=1 or mhchf=1 then chf=1;
  if chfpe=0 and mhchf=0 then chf=0;
  if cabg=1 then nocabg=0;
  if cabg=0 then nocabg=1;

  dthmi_pt= age_sc + 22*posinit + 29*mhmi + 72*chf + 36*nocabg;

How risk score for 6-month death/MI relates to probability of 6-month death/MI (from Palm Pilot software)

Please NOTE: Because the death/MI score ignores 5 factors in the death model, it's possible the death probability > death/MI prob based on solely on score. In such cases, the death/MI prob is made > death prob, since it's illogical to have the combined death/MI prob. be < death prob.

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</table>

* Must be > prob of death alone (see note above)
**Fox Model for Death between Hospital Admission and 6 months later**

8. Nomogram for risk score for death from admission to 6 months later
(as used in Palm Pilot software)

Although the published paper (BMJ 2006) mentions 9 reduced model factors, the palm pilot uses the 8 Granger factors

* 1. **AGE in years:**
  - if $0 \leq \text{age} < 35$ then age2 = 0;
  - else if $35 \leq \text{age} < 45$ then age2 = 0 + (age-35)*(1.8);
  - else if $45 \leq \text{age} < 55$ then age2 = 18 + (age-45)*(1.8);
  - else if $55 \leq \text{age} < 65$ then age2 = 36 + (age-55)*(1.8);
  - else if $65 \leq \text{age} < 75$ then age2 = 54 + (age-65)*(1.9);
  - else if $75 \leq \text{age} < 85$ then age2 = 73 + (age-75)*(1.8);
  - else if $85 \leq \text{age} < 90$ then age2 = 91 + (age-85)*(1.8);
  - else if age $\geq 90$ then age2 = 100;

* 2. **PULSE in beats/minute:**
  - if $0 \leq \text{pulse} < 70$ then pulse2 = 0;
  - else if $70 \leq \text{pulse} < 80$ then pulse2 = 0 + (pulse-70)*( .3);
  - else if $80 \leq \text{pulse} < 90$ then pulse2 = 3 + (pulse-80)*( .2);
  - else if $90 \leq \text{pulse} < 100$ then pulse2 = 5 + (pulse-90)*( .3);
  - else if $100 \leq \text{pulse} < 110$ then pulse2 = 8 + (pulse-100)*( .2);
  - else if $110 \leq \text{pulse} < 150$ then pulse2 = 10 + (pulse-110)*( .3);
  - else if $150 \leq \text{pulse} < 200$ then pulse2 = 22 + (pulse-150)*( .3);
  - else if pulse $\geq 200$ then pulse2 = 34;

* 3. **BPSYS is systolic blood pressure (mm Hg):**
  - if $0 \leq \text{sbp} < 80$ then sysbp2 = 40;
  - else if $80 \leq \text{sbp} < 100$ then sysbp2 = 40 -(sbp-80)*( .3);
  - else if $100 \leq \text{sbp} < 110$ then sysbp2 = 34 -(sbp-100)*( .3);
  - else if $110 \leq \text{sbp} < 120$ then sysbp2 = 31 -(sbp-110)*( .4);
  - else if $120 \leq \text{sbp} < 130$ then sysbp2 = 27 -(sbp-120)*( .3);
  - else if $130 \leq \text{sbp} < 140$ then sysbp2 = 24 -(sbp-130)*( .3);
  - else if $140 \leq \text{sbp} < 150$ then sysbp2 = 20 -(sbp-140)*( .4);
  - else if $150 \leq \text{sbp} < 160$ then sysbp2 = 17 -(sbp-150)*( .3);
  - else if $160 \leq \text{sbp} < 180$ then sysbp2 = 14 -(sbp-160)*( .3);
  - else if $180 \leq \text{sbp} < 200$ then sysbp2 = 8 -(sbp-180)*( .4);
  - else if sbp $\geq 200$ then sysbp2 = 0;

* 4. **Creatinine in mg/dl:**
  - if $0.0 \leq \text{creat} < 0.2$ then crt2 = 0 + (creat-0)*(1/2);
  - else if $0.2 \leq \text{creat} < 0.4$ then crt2 = 1 + (creat-0.2)*(2/2);
  - else if $0.4 \leq \text{creat} < 0.6$ then crt2 = 3 + (creat-0.4)*(1/2);
  - else if $0.6 \leq \text{creat} < 0.8$ then crt2 = 4 + (creat-0.6)*(2/2);
  - else if $0.8 \leq \text{creat} < 1.0$ then crt2 = 6 + (creat-0.8)*(1/2);
  - else if $1.0 \leq \text{creat} < 1.2$ then crt2 = 7 + (creat-1.0)*(1/2);
  - else if $1.2 \leq \text{creat} < 1.4$ then crt2 = 8 + (creat-1.2)*(2/2);
  - else if $1.4 \leq \text{creat} < 1.6$ then crt2 = 10 + (creat-1.4)*(1/2);
  - else if $1.6 \leq \text{creat} < 1.8$ then crt2 = 11 + (creat-1.6)*(2/2);
  - else if $1.8 \leq \text{creat} < 2.0$ then crt2 = 13 + (creat-1.8)*(1/2);
  - else if $2.0 \leq \text{creat} < 3.0$ then crt2 = 14 + (creat-2.0)*(7/1);
  - else if $3.0 \leq \text{creat} < 4.0$ then crt2 = 21 + (creat-3.0)*(7/1);
  - else if creat $\geq 4.0$ then crt2 = 28;

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* 5. Killip class I,II,III,IV;
   if killip=1 then killips = 0;
   else if killip=2 then killips = 15;
   else if killip=3 then killips = 29;
   else if killip=4 then killips = 44;

* 6. CARRST is cardiac arrest on presentation (1 if present, 0 if absent);
* 7. POSINIT is positive initial cardiac enzymes (1 if present, 0 if absent);
* 8. STCHANGE is ST deviation, assigned a value of 1 if present, 0 if absent;

* Death risk score=sum of points for 8 factors;
  deatha6_pt = killips + sysbp2 + pulse2 + age2 + crt2 + 17*stchange + 13*posinit + 30*carrst;

<table>
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<th>Score</th>
<th>Prob</th>
<th>Score</th>
<th>Prob</th>
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<td>163</td>
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</tr>
</tbody>
</table>
9. Nomogram for Risk Score for Death or MI from Admission to 6 Months later (as used in Palm Pilot software) (pulse is not used)

* 1. AGE in years;
  if \( 0 \leq \text{age} < 35 \) then \( \text{age}^2 = 0 \);
  else if \( 35 \leq \text{age} < 45 \) then \( \text{age}^2 = 18 + (\text{age}-35)^*1.8 \);
  else if \( 45 \leq \text{age} < 55 \) then \( \text{age}^2 = 36 + (\text{age}-45)^*1.8 \);
  else if \( 55 \leq \text{age} < 65 \) then \( \text{age}^2 = 54 + (\text{age}-55)^*1.9 \);
  else if \( 65 \leq \text{age} < 75 \) then \( \text{age}^2 = 73 + (\text{age}-65)^*1.8 \);
  else if \( 75 \leq \text{age} < 85 \) then \( \text{age}^2 = 91 + (\text{age}-85)^*1.8 \);
  else if \( \text{age} \geq 90 \) then \( \text{age}^2 = 100 \);

* 3. BPSYS is systolic blood pressure (mm Hg);
  if \( 0 \leq \text{sbp} < 80 \) then \( \text{sysbp}^3 = 54 \);
  else if \( 80 \leq \text{sbp} < 200 \) then \( \text{sysbp}^3 = 54 - (\text{sbp}-80)^*0.45 \);
  else if \( \text{sbp} \geq 200 \) then \( \text{sysbp}^3 = 0 \);

* 4. Creatinine in mg/dl;
  if \( 0.0 \leq \text{creat} < 3.0 \) then \( \text{crt}^3 = 0 + (\text{creat}-0)^*10 \);
  else if \( 3.0 \leq \text{creat} < 4.0 \) then \( \text{crt}^3 = 30 + (\text{creat}-3.0)^*11 \);
  else if \( \text{creat} \geq 4.0 \) then \( \text{crt}^3 = 41 \);

* 5. Killip class I,II,III,IV;
  if \( \text{killip}=1 \) then \( \text{killips}^3 = 0 \);
  else if \( \text{killip}=2 \) then \( \text{killips}^3 = 27 \);
  else if \( \text{killip}=3 \) then \( \text{killips}^3 = 55 \);
  else if \( \text{killip}=4 \) then \( \text{killips}^3 = 82 \);

* Death/MI risk score=sum of points for 7 factors (pulse not used);
  \( \text{deathmia6}_pt = \text{killips}^3 + \text{sysbp}^3 + \text{age}^2 + \text{crt}^3 + 39^{*}\text{stchange} + 41^{*}\text{posinit} + 66^{*}\text{carrst} \)

How score relates to probability of death/MI between admission and 6 months later

Note- if probability of death/MI based on score is less than prob of death alone, score is ignored and prob of death/MI is made > prob of death

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<th>Score</th>
<th>Prob*</th>
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* Must be > probability of death alone (see note above)