DECLARATION OF CONFLICT OF INTEREST

• None
Predicitng Survival in Chronic Heart Failure:

A Risk Score based on 39372 Patients from 30 Studies

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on behalf of the MAGGIC Collaborative Group
MAGGIC

Meta-Analysis Global Group In Chronic Heart Failure

Individual patient data from 30 studies
(7 randomised trials, 23 registries)

39372 patients (both reduced and preserved ejection fraction)

median 2.5 years follow-up, 15851 (40.2%) died

Six Largest Studies are: DIAMOND, DIG, CHARM, ECHOS, HOLA, IN-CHF
Disclosures

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National Heart Foundation of New Zealand
The University of Auckland
The University of Glasgow
Developing a Model for Mortality Risk

23 candidates variables for prediction

imputing missing data

Poisson regression models, adjusting for study and time

forward stepwise variable selection

P<.001 for inclusion

checks for linearity, eg ejection fraction, BMI

identifying interactions, eg preserved vs reduced EF

checks for goodness of fit, generalisability

strength of discrimination

make risk score user-friendly
Final Model for Predicting Mortality

13 Independent Predictors in total
30 studies with 39372 patients of whom 40.2% died

Top Five Predictors

<table>
<thead>
<tr>
<th>Predictor</th>
<th>risk ratio</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (per 10 years)</td>
<td>1.47</td>
<td>39.5</td>
</tr>
<tr>
<td>Ejection Fraction (per 5% up to 40%)</td>
<td>0.90</td>
<td>-20.7</td>
</tr>
<tr>
<td>NYHA Class I</td>
<td>0.78</td>
<td>-6.5</td>
</tr>
<tr>
<td>NYHA Class II</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>NYHA Class III</td>
<td>1.42</td>
<td>17.3</td>
</tr>
<tr>
<td>NYHA Class IV</td>
<td>1.70</td>
<td>16.3</td>
</tr>
<tr>
<td>Serum Creatinine (per 10 $\mu$mol/l)</td>
<td>1.04</td>
<td>19.8</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.42</td>
<td>16.7</td>
</tr>
</tbody>
</table>

$z>3.3$ means $P<.001$

$z>6.1$ means $P<.000000001$
Next Eight Independent Predictors

<table>
<thead>
<tr>
<th>Predictor</th>
<th>risk ratio</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>on beta blocker</td>
<td>0.76</td>
<td>-11.9</td>
</tr>
<tr>
<td>BMI (per 5 kg/m$^2$ up to 30 kg/m$^2$)</td>
<td>0.84</td>
<td>-10.0</td>
</tr>
<tr>
<td>systolic BP (per 10mmHg)</td>
<td>0.96</td>
<td>-8.5</td>
</tr>
<tr>
<td>HF duration &gt; 18 months</td>
<td>1.19</td>
<td>7.8</td>
</tr>
<tr>
<td>current smoker</td>
<td>1.15</td>
<td>6.4</td>
</tr>
<tr>
<td>COPD</td>
<td>1.23</td>
<td>6.4</td>
</tr>
<tr>
<td>male</td>
<td>1.11</td>
<td>5.3</td>
</tr>
<tr>
<td>on ACEI and/or ARB</td>
<td>0.90</td>
<td>-3.7</td>
</tr>
</tbody>
</table>
Separate Models for Reduced and Preserved EF?

Actually, all predictors relevant in both

Impact of Age is more marked in preserved EF

Impact of lower SBP is less marked in preserved EF

Differences across Studies?

In general, consistent predictors across studies

But, unexplained between-study variation in mortality remains
Model Discrimination

3 year mortality: 8% bottom decile → 71% top decile
Observed v Predicted 3 Year Mortality Risk by Decile

- Decile 1: Predicted 6%, Observed 5%
- Decile 2: Predicted 10%, Observed 9%
- Decile 3: Predicted 14%, Observed 13%
- Decile 4: Predicted 18%, Observed 17%
- Decile 5: Predicted 22%, Observed 21%
- Decile 6: Predicted 26%, Observed 25%
- Decile 7: Predicted 30%, Observed 29%
- Decile 8: Predicted 34%, Observed 33%
- Decile 9: Predicted 38%, Observed 37%
- Decile 10: Predicted 42%, Observed 41%
Mortality Risk by Ejection Fraction

Rate ratio (95% CI)

Ejection fraction (%)
Mortality Risk by Body Mass Index

Rate ratio (95% CI)

BMI (kg/m²)
Mortality Risk by Serum Creatinine

Rate ratio (95% CI)

Creatinine (μmol/l)
Mortality Risk by Ejection Fraction and Age

Mortality rate ratio

Age (years)

EF < 30
EF 30-39
EF 40-

<55 55-59 60-64 65-69 70-74 75-79 80-
Mortality Risk by Ejection Fraction & Systolic Blood Pressure

- EF < 30
- EF 30-39
- EF 40-

Systolic Blood Pressure (mmHg):
- <110
- 110-
- 120-
- 130-
- 140-
- 150-
Next Steps

create a user-friendly integer risk score

website in preparation
Conclusions

Survival in heart failure hugely variable

Risk score developed from 39372 patients in 30 studies

More robust, generalisable than previous scores

Covers both reduced and preserved LV function

Includes 13 well known risk factors

A Powerful Discriminator

User-Friendly Options in Preparation