<table>
<thead>
<tr>
<th>Title</th>
<th>Regional Variations in Medical Expenditure and Hospitalization Days for Heart Attack Patients in Japan: Evidence from the Tokai Acute Myocardial Infarction Study (TAMIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
<td>Noguchi, Haruko; Shimizutani, Satoshi; Masuda, Yuichiro</td>
</tr>
<tr>
<td>Citation</td>
<td></td>
</tr>
<tr>
<td>Issue Date</td>
<td>2007-11</td>
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<tr>
<td>Type</td>
<td>Technical Report</td>
</tr>
<tr>
<td>Text Version</td>
<td>publisher</td>
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<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/10086/14653">http://hdl.handle.net/10086/14653</a></td>
</tr>
</tbody>
</table>
# Table 1: Basic statistics

## Definition of variables

<table>
<thead>
<tr>
<th></th>
<th>Total (N=757)</th>
<th>High-tech treatments (N=608)</th>
<th>Low-tech treatments (No CATH) (N=149)</th>
<th>Significance of differences in means across hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CATH</td>
<td>0.803</td>
<td>1.000</td>
<td>1.000</td>
<td>a</td>
</tr>
<tr>
<td>PTCA</td>
<td>0.634</td>
<td>0.789</td>
<td>1.000</td>
<td>a</td>
</tr>
<tr>
<td>Low-tech treatments only</td>
<td>0.197</td>
<td>0.000</td>
<td>0.000</td>
<td>a</td>
</tr>
<tr>
<td><strong>2. Hospital expenditure and days</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First hospitalization-total hospital expenditure (yen)</td>
<td>2,291,870 (1,556,774)</td>
<td>2,512,184 (1,565,133)</td>
<td>2,631,310 (1,487,167)</td>
<td>1,392,868 (1,148,839)</td>
</tr>
<tr>
<td><strong>3. Density of medical facilities and mean income at the sphere level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of high-tech hospitals (PTCA available) per 100,000 population</td>
<td>2.568 (3.402)</td>
<td>2.655 (3.577)</td>
<td>2.717 (3.763)</td>
<td>2.115 (2.548)</td>
</tr>
<tr>
<td>Number of low-tech hospitals (no PTCA available) per 100,000 population</td>
<td>15.571 (13.259)</td>
<td>14.932 (13.034)</td>
<td>13.642 (12.622)</td>
<td>18.177 (13.885)</td>
</tr>
<tr>
<td>Number of high-volume hospitals with more than 100 beds per 100,000 population</td>
<td>2.532 (0.728)</td>
<td>2.545 (0.755)</td>
<td>2.572 (0.777)</td>
<td>2.483 (0.605)</td>
</tr>
<tr>
<td>Number of physicians per 100,000 population</td>
<td>154.941 (50.692)</td>
<td>153.838 (49.689)</td>
<td>153.249 (48.235)</td>
<td>159.441 (54.540)</td>
</tr>
<tr>
<td>Number of hospital beds per 100,000 population</td>
<td>856.310 (228.176)</td>
<td>847.807 (232.934)</td>
<td>844.222 (241.585)</td>
<td>891.007 (204.715)</td>
</tr>
<tr>
<td>Population density (per square kilometer)</td>
<td>3,275 (2,395)</td>
<td>3,222 (2,345)</td>
<td>3,178 (2,331)</td>
<td>3,492 (2,586)</td>
</tr>
<tr>
<td>Mean taxable income (yen)</td>
<td>3,801,902 (222,583)</td>
<td>3,791,244 (218,469)</td>
<td>3,767,501 (206,341)</td>
<td>3,845,394 (234,409)</td>
</tr>
<tr>
<td><strong>4. Patient characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (Female=1)</td>
<td>0.252 (0.435)</td>
<td>0.227 (0.419)</td>
<td>0.219 (0.414)</td>
<td>0.356 (0.480)</td>
</tr>
<tr>
<td>Age</td>
<td>64.507 (12.039)</td>
<td>62.617 (11.430)</td>
<td>62.638 (11.611)</td>
<td>72.221 (11.400)</td>
</tr>
<tr>
<td>Number of family members living with a patient</td>
<td>2.184 (1.472)</td>
<td>2.189 (1.449)</td>
<td>2.191 (1.445)</td>
<td>2.161 (1.564)</td>
</tr>
<tr>
<td>Presence of spouse (=1 if yes)</td>
<td>0.753 (0.432)</td>
<td>0.785 (0.411)</td>
<td>0.806 (0.396)</td>
<td>0.624 (0.486)</td>
</tr>
<tr>
<td>Health insurance for the elderly (enrollment=1)</td>
<td>0.357 (0.479)</td>
<td>0.289 (0.454)</td>
<td>0.304 (0.461)</td>
<td>0.631 (0.484)</td>
</tr>
<tr>
<td><strong>5. Comorbidity variables (13/27)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continence: totally continent</td>
<td>0.950 (0.218)</td>
<td>0.961 (0.195)</td>
<td>0.952 (0.214)</td>
<td>0.906 (0.293)</td>
</tr>
<tr>
<td>Continence: occasionally incontinent</td>
<td>0.003 (0.051)</td>
<td>0.000 (0.000)</td>
<td>0.000 (0.000)</td>
<td>0.013 (0.115)</td>
</tr>
<tr>
<td>Continence: unknown urinary continence</td>
<td>0.045 (0.207)</td>
<td>0.038 (0.191)</td>
<td>0.046 (0.209)</td>
<td>0.074 (0.262)</td>
</tr>
<tr>
<td>Mobility: walks independently</td>
<td>0.956 (0.148)</td>
<td>0.969 (0.133)</td>
<td>0.967 (0.136)</td>
<td>0.906 (0.137)</td>
</tr>
<tr>
<td>Mobility: walks with assistance</td>
<td>0.015 (0.221)</td>
<td>0.012 (0.233)</td>
<td>0.013 (0.231)</td>
<td>0.027 (0.162)</td>
</tr>
<tr>
<td>Mobility: unable to walk</td>
<td>0.007 (0.221)</td>
<td>0.002 (0.233)</td>
<td>0.002 (0.231)</td>
<td>0.027 (0.162)</td>
</tr>
<tr>
<td>Mobility: unknown mobility</td>
<td>0.022 (0.488)</td>
<td>0.018 (0.487)</td>
<td>0.019 (0.487)</td>
<td>0.040 (0.492)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.390 (0.488)</td>
<td>0.387 (0.487)</td>
<td>0.385 (0.487)</td>
<td>0.403 (0.492)</td>
</tr>
<tr>
<td>Hyperlipemia</td>
<td>0.157 (0.364)</td>
<td>0.164 (0.371)</td>
<td>0.158 (0.365)</td>
<td>0.128 (0.335)</td>
</tr>
<tr>
<td>Diabetes treated by insulin</td>
<td>0.052 (0.297)</td>
<td>0.058 (0.292)</td>
<td>0.056 (0.292)</td>
<td>0.027 (0.319)</td>
</tr>
<tr>
<td>Angina</td>
<td>0.156 (0.363)</td>
<td>0.140 (0.347)</td>
<td>0.150 (0.357)</td>
<td>0.221 (0.417)</td>
</tr>
<tr>
<td>Cardiac heart failure or pulmonary edema</td>
<td>0.070 (0.255)</td>
<td>0.039 (0.195)</td>
<td>0.031 (0.174)</td>
<td>0.195 (0.397)</td>
</tr>
<tr>
<td>Old myocardial infarction</td>
<td>0.098 (0.297)</td>
<td>0.094 (0.292)</td>
<td>0.094 (0.292)</td>
<td>0.114 (0.319)</td>
</tr>
<tr>
<td>Current cigarette smoker</td>
<td>0.522 (0.500)</td>
<td>0.563 (0.496)</td>
<td>0.567 (0.496)</td>
<td>0.356 (0.480)</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>0.128 (0.128)</td>
<td>0.115 (0.115)</td>
<td>0.092 (0.115)</td>
<td>0.181 (0.115)</td>
</tr>
<tr>
<td>Condition</td>
<td>Value_1</td>
<td>Value_2</td>
<td>Value_3</td>
<td>Value_4</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Family medical history of ischemic heart disease</td>
<td>0.334</td>
<td>0.319</td>
<td>0.289</td>
<td>0.360</td>
</tr>
<tr>
<td>Renal failure</td>
<td>0.164</td>
<td>0.164</td>
<td>0.158</td>
<td>0.161</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>0.004</td>
<td>0.003</td>
<td>0.004</td>
<td>0.007</td>
</tr>
<tr>
<td>Cerebrovascular accident: cerebral infarction</td>
<td>0.079</td>
<td>0.071</td>
<td>0.069</td>
<td>0.114</td>
</tr>
<tr>
<td>Cerebrovascular accident: brain hemorrhage</td>
<td>0.008</td>
<td>0.010</td>
<td>0.010</td>
<td>0.000</td>
</tr>
<tr>
<td>COPD</td>
<td>0.004</td>
<td>0.003</td>
<td>0.004</td>
<td>0.007</td>
</tr>
<tr>
<td>Anecurym of aorta</td>
<td>0.011</td>
<td>0.012</td>
<td>0.008</td>
<td>0.007</td>
</tr>
<tr>
<td>Ulcus pepticum</td>
<td>0.090</td>
<td>0.097</td>
<td>0.088</td>
<td>0.060</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.036</td>
<td>0.035</td>
<td>0.035</td>
<td>0.040</td>
</tr>
<tr>
<td>Autoimmune disease</td>
<td>0.012</td>
<td>0.003</td>
<td>0.004</td>
<td>0.047</td>
</tr>
<tr>
<td>Drug allergy/medical reaction</td>
<td>0.055</td>
<td>0.056</td>
<td>0.048</td>
<td>0.054</td>
</tr>
<tr>
<td>Dementia/Alzheimer's disease</td>
<td>0.016</td>
<td>0.016</td>
<td>0.017</td>
<td>0.013</td>
</tr>
<tr>
<td>Terminal illness</td>
<td>0.001</td>
<td>0.000</td>
<td>0.000</td>
<td>0.007</td>
</tr>
<tr>
<td>CAG history</td>
<td>0.091</td>
<td>0.090</td>
<td>0.088</td>
<td>0.094</td>
</tr>
<tr>
<td>PTCA history</td>
<td>0.045</td>
<td>0.049</td>
<td>0.050</td>
<td>0.027</td>
</tr>
<tr>
<td>CABG history</td>
<td>0.005</td>
<td>0.007</td>
<td>0.006</td>
<td>0.000</td>
</tr>
<tr>
<td>6. Variables on severity of health condition on admission (18/26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate</td>
<td>80.215</td>
<td>78.592</td>
<td>78.605</td>
<td>86.871</td>
</tr>
<tr>
<td>Temperature</td>
<td>36.234</td>
<td>36.211</td>
<td>36.154</td>
<td>36.337</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>131.356</td>
<td>133.148</td>
<td>133.901</td>
<td>123.695</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>74.355</td>
<td>75.193</td>
<td>75.309</td>
<td>70.684</td>
</tr>
<tr>
<td>Mean arterial pressure (MAP: excluding &lt;0 and &gt;300)</td>
<td>93.599</td>
<td>94.730</td>
<td>95.059</td>
<td>88.640</td>
</tr>
<tr>
<td>Height</td>
<td>159.827</td>
<td>160.192</td>
<td>160.356</td>
<td>157.816</td>
</tr>
<tr>
<td>Weight</td>
<td>59.405</td>
<td>59.911</td>
<td>60.089</td>
<td>56.612</td>
</tr>
<tr>
<td>Boby Mass Index (BMI: Weight (kg)/(Height (m))^2)</td>
<td>19.143</td>
<td>20.348</td>
<td>20.156</td>
<td>14.229</td>
</tr>
<tr>
<td>Glucose</td>
<td>181.759</td>
<td>177.517</td>
<td>175.552</td>
<td>198.757</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.854</td>
<td>3.875</td>
<td>3.868</td>
<td>3.755</td>
</tr>
<tr>
<td>Highest creatinine</td>
<td>1.388</td>
<td>1.394</td>
<td>1.409</td>
<td>1.366</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>45.162</td>
<td>46.213</td>
<td>47.350</td>
<td>40.831</td>
</tr>
<tr>
<td>White blood cells (unit:000)</td>
<td>10.396</td>
<td>10.412</td>
<td>10.330</td>
<td>10.333</td>
</tr>
<tr>
<td>Platelets (unit:0000)</td>
<td>22.179</td>
<td>22.273</td>
<td>21.981</td>
<td>21.790</td>
</tr>
<tr>
<td>Blood urea nitrogen (BUN/SUN)</td>
<td>18.138</td>
<td>17.453</td>
<td>17.361</td>
<td>21.034</td>
</tr>
<tr>
<td>EKG trace: MI/injury</td>
<td>0.841</td>
<td>0.836</td>
<td>0.844</td>
<td>0.866</td>
</tr>
<tr>
<td>EKG trace: transmural (new qwave) MI</td>
<td>0.106</td>
<td>0.104</td>
<td>0.121</td>
<td>0.114</td>
</tr>
<tr>
<td>EKG trace: old/remote MI</td>
<td>0.095</td>
<td>0.086</td>
<td>0.083</td>
<td>0.134</td>
</tr>
<tr>
<td>EKG trace: ventricular tachycardia/flutter</td>
<td>0.129</td>
<td>0.118</td>
<td>0.127</td>
<td>0.174</td>
</tr>
<tr>
<td>EKG trace: atrial fibrillation/flutter</td>
<td>0.089</td>
<td>0.084</td>
<td>0.073</td>
<td>0.107</td>
</tr>
<tr>
<td>EKG trace: LBBB</td>
<td>0.022</td>
<td>0.016</td>
<td>0.017</td>
<td>0.047</td>
</tr>
<tr>
<td>EKG trace: RBBB</td>
<td>0.079</td>
<td>0.081</td>
<td>0.081</td>
<td>0.074</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Hospital 1</td>
<td>Hospital 2</td>
<td>Hospital 3</td>
<td>Hospital 4</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>EKG trace: left fascicular blocks</td>
<td>0.004</td>
<td>0.005</td>
<td>0.006</td>
<td>0.000 b</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.070)</td>
<td>(0.079)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>EKG trace: heart block, 2nd/3rd degree</td>
<td>0.069</td>
<td>0.072</td>
<td>0.077</td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td>(0.253)</td>
<td>(0.259)</td>
<td>(0.267)</td>
<td>(0.226)</td>
</tr>
<tr>
<td>Congestive heart failure(CHF)/pulmonary edema on chest X rays</td>
<td>0.293</td>
<td>0.263</td>
<td>0.265</td>
<td>0.416 b</td>
</tr>
<tr>
<td></td>
<td>(0.456)</td>
<td>(0.441)</td>
<td>(0.442)</td>
<td>(0.495)</td>
</tr>
<tr>
<td>Stress test suggests ischemia</td>
<td>0.022</td>
<td>0.023</td>
<td>0.017</td>
<td>0.020 a</td>
</tr>
<tr>
<td></td>
<td>(0.148)</td>
<td>(0.150)</td>
<td>(0.128)</td>
<td>(0.141)</td>
</tr>
<tr>
<td>Killip 1 or Killip 2</td>
<td>0.597</td>
<td>0.638</td>
<td>0.633</td>
<td>0.430 a</td>
</tr>
<tr>
<td></td>
<td>(0.491)</td>
<td>(0.481)</td>
<td>(0.482)</td>
<td>(0.497)</td>
</tr>
<tr>
<td>Killip class 3</td>
<td>0.203</td>
<td>0.181</td>
<td>0.177</td>
<td>0.295 b</td>
</tr>
<tr>
<td></td>
<td>(0.403)</td>
<td>(0.385)</td>
<td>(0.382)</td>
<td>(0.458)</td>
</tr>
<tr>
<td>Killip class 4</td>
<td>0.199</td>
<td>0.181</td>
<td>0.190</td>
<td>0.275 a</td>
</tr>
<tr>
<td></td>
<td>(0.400)</td>
<td>(0.385)</td>
<td>(0.392)</td>
<td>(0.448)</td>
</tr>
</tbody>
</table>

Note: a, b, and c refer to differences among hospitals significant at the 1, 5, and 10 percent levels, respectively, based on ANOVA F-statistics.
### Table 2: Probit estimates for the relationship between the choice of high-tech treatment and medical resource density at the sphere level

<table>
<thead>
<tr>
<th>Medical resource density at the sphere level</th>
<th>CATH Coefficient (Std. err.)</th>
<th>Marginal effect</th>
<th>PTCA Coefficient (Std. err.)</th>
<th>Marginal effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of high-tech hospitals (PTCA available) per 100,000 population</td>
<td>0.457 (0.152)</td>
<td>0.095 a</td>
<td>0.502 (0.154)</td>
<td>0.124 a</td>
</tr>
<tr>
<td>Number of low-tech hospitals (no PTCA available) per 100,000 population</td>
<td>-0.076 (0.032)</td>
<td>-0.016 b</td>
<td>-0.088 (0.033)</td>
<td>-0.022 a</td>
</tr>
<tr>
<td>Number of high-volume hospitals with more than 100 beds per 100,000 population</td>
<td>0.336 (0.208)</td>
<td>0.070</td>
<td>0.464 (0.217)</td>
<td>0.115 b</td>
</tr>
<tr>
<td>Number of physicians per 100,000 population</td>
<td>0.009 (0.005)</td>
<td>0.002 c</td>
<td>0.013 (0.006)</td>
<td>0.003 b</td>
</tr>
<tr>
<td>Number of hospital beds per 100,000 population</td>
<td>-0.001 (0.001)</td>
<td>-0.0002 b</td>
<td>-0.002 (0.001)</td>
<td>-0.0004 a</td>
</tr>
<tr>
<td>Population density (per square kilometer)</td>
<td>-0.0003 (0.0001)</td>
<td>-0.00005 b</td>
<td>-0.0003 (0.0001)</td>
<td>-0.00007 b</td>
</tr>
<tr>
<td>Mean taxable income (log value)</td>
<td>3.194 (3.1012)</td>
<td>0.665</td>
<td>3.231 (3.1547)</td>
<td>0.800</td>
</tr>
<tr>
<td>Constant</td>
<td>-52.776 (47.273)</td>
<td>-56.336</td>
<td>-56.336 (47.964)</td>
<td></td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-249.163</td>
<td>-227.691</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: For PTCA, we exclude 49 patients with CATH who did not undergo PTCA. a-c indicate significance at the 1, 5, and 10 percent significance levels, respectively. In all regressions, patient characteristics, shown in Table 1 and including demographic characteristics, comorbidity indicators and severity measures, are controlled for.
<table>
<thead>
<tr>
<th>Estimation Method</th>
<th>CATH versus no CATH (CATH versus Low-Tech) (608 versus 149)</th>
<th>PTCA versus no PTCA (PTCA versus Low-Tech) (480 versus 149)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment effect (Std. err.) t-statistics</td>
<td>Treatment effect (Std. err.) t-statistics</td>
</tr>
<tr>
<td>1. Hospital expenditure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LS treatment effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment group</td>
<td>1,182,770 (153,240) 7.720</td>
<td>1,279,427 (149,857) 8.540</td>
</tr>
<tr>
<td>Control group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$ATT_{Kernel}$ with bootstrapping replication</td>
<td>843,320 (203,456) 4.145</td>
<td>912,044 (207,813) 4.389</td>
</tr>
<tr>
<td>Treatment group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 2. Hospital days |                                                           |                                                          |
| LS treatment effect |                                                           |                                                          |
| Treatment group  | 3.474 (2.096) 1.660                                      | 2.744 (2.083) 1.320                                      |
| Control group    |                                                           |                                                          |
| $ATT_{Kernel}$ with bootstrapping replication | 5.714 (2.948) 1.938 | 5.414 (2.596) 2.085 |
| Treatment group  |                                                           |                                                          |
| Control group    |                                                           |                                                          |

Note: For PTCA, we exclude 49 patients with CATH who did not undergo PTCA. In all regressions, patient characteristics, shown in Table 1 and including demographic characteristics, comorbidity indicators and severity measures, are controlled for.
Appendix Table 1: Fee schedule for reimbursement rates, number of high-tech hospitals and treatments performed in September 1993 and September 1996

<table>
<thead>
<tr>
<th></th>
<th>1993</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PTCA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fee schedule for reimbursement</td>
<td>13,800</td>
<td>15,500</td>
</tr>
<tr>
<td>Number of PTCA hospitals</td>
<td>381</td>
<td>609</td>
</tr>
<tr>
<td>Number of PTCA performed</td>
<td>3,648</td>
<td>5,818</td>
</tr>
<tr>
<td><strong>CABG</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fee schedule for reimbursement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>37,100</td>
<td>37,100</td>
</tr>
<tr>
<td>2 or more</td>
<td>60,500</td>
<td>60,500</td>
</tr>
<tr>
<td>Number of CABG hospitals</td>
<td>397</td>
<td>453</td>
</tr>
<tr>
<td>Number of CABG performed</td>
<td>2,699</td>
<td>2,814</td>
</tr>
</tbody>
</table>

Source: Ministry of Health, Labour and Welfare, *Shinryo Hoshu Tensu Hayamihyo* (Quick Reference Table of Fee Schedules) and *Iryo Shisetsu Chosa* (National Survey on Medical Treatment). Notes: Reimbursement rates for procedures are measured in points (1 point = 10 yen). The number of general hospitals in Japan was 8,752 in 1993 and 8,421 in 1996.