Daylight saving time shifts and incidence of acute myocardial infarction

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Background

• “Clock shifts may disrupt chronobiological rhythms, influence sleep duration and quality, and the effect lasts for several days after the daylight saving time change” (Janszky et al. 2012. p1)

• “after the springtime shift into DST, there is a modest increase in acute myocardial infarction (AMI) incidence which lasts for several days.” (Janszky et al. 2012. p1)
Questions

• Objectives:
  – To confirm changes in risk associated with daylight saving time (DST)
  – To investigate the role of individual factors (age, sex history of cardiac events, diabetes, hypertension, smoking, BMI, lipids, and medication) in enhancing or mitigating the risks associated with DST
Data

- RIKS-HIA registers: all patients admitted to the coronary care unit of participating hospitals
- 19 participating hospitals in 1995
- 74 hospitals participated in 2007 (over 95% of coronary care admissions in Sweden)
- All available patients with a diagnosis of AMI on RIKS-HIA registers.
- A recurrent myocardial infarction occurring within 28 days of an AMI was not considered as a separate event in primary analyses, but was examined secondarily.
Data

- Age, sex, history of heart failure, hypertension, diabetes, previous AMI, previous coronary revascularization procedures and medications
- Smoking habits and smoking status (never, current and former smoking); former smoking was defined as not smoking if given up more than one month before.
- BMI – obese (over 30kg/m²)
- Categorized total cholesterol, HDL cholesterol, and triglycerides
Data

• Daylight saving time (DST) – started last Sunday of Marcy; ended last Sunday of September; from 1996, DST ends last Sunday of October
Analyses

• Observed AMI incidence on the first seven days after the shift compared with the expected incidence.
• Expected incidence: mean incidence of the control weeks before/after the shift.
• Control weeks:
  – ‘before’: started on a Sunday two weeks before the DST shift
  – ‘after’: started on a Sunday two weeks after the shift
Analyses

- $IR = \frac{observed}{expected}$
  - Observed = sum of events during the first seven days after the DST shift
  - Expected = (sum of the number of events on the control week before the shift and the number of events on the control week after the shift)/2

- Confidence intervals: Sun et al. (1996)

- Easter, length of Sundays adjusted.
Results

• Transition into DST
  – Slightly elevated incidence
  – Higher
    • Low cholesterol and triglycerides
    • Cardiac medications – aspirin or CA channel blockers
    • Similar results for sensitivity analyses

• Transition out of DST
  – No evidence for a change in AMI incidence
  – Lower – hyperlipidemia, CA-channel blockers
  – Higher – never smoked
|                          | Expected  | Observed | IR (95% CI)   | P value  
|--------------------------|-----------|----------|---------------|----------
| All                      | 3115.5    | 3235.9   | **1.039 (1.003–1.075)** | 0.38     
| Men                      | 1987.5    | 2034.9   | 1.024 (0.980–1.069)     | 0.12     
| Women                    | 1128      | 1201     | 1.065 (1.006–1.127)     | 0.046    
| Age <65 years            | 867       | 877.4    | 1.012 (0.946–1.081)     | 0.46     
| Age ≥65 years            | 2248.5    | 2358.5   | 1.049 (1.007–1.092)     | 0.82     
| Any previous CHD event   | 1230.5    | 1308.8   | 1.064 (1.007–1.123)     | 0.37     
| No previous CHD events   | 1836      | 1884.8   | 1.027 (0.981–1.074)     | 0.22     
| Diabetes yes             | 776       | 843.1    | 1.087 (1.014–1.162)     | 0.22     
| Diabetes no              | 2339.5    | 2392.8   | 1.023 (0.982–1.065)     | 0.22     
| Hypertension yes         | 1159.5    | 1269.5   | 1.095 (1.035–1.157)     | 0.22     
| Hypertension no          | 1861.5    | 1891     | 1.016 (0.971–1.063)     | 0.22     
| Current smoker           | 609       | 603.4    | 0.991 (0.913–1.073)     | 0.22     
| Former smoker (>1 month) | 838       | 849      | 1.013 (0.946–1.084)     | 0.22     
| Never smoker             | 1377.5    | 1501.9   | 1.090 (1.036–1.147)     | 0.22     
| BMI ≥30 kg/m²             | 161.5     | 185.2    | 1.147 (0.987–1.324)     | 0.22     
| BMI <30 kg/m²             | 788       | 806.7    | 1.024 (0.954–1.097)     | 0.22     
| Cholesterol ≥5.2 mmol/L  | **563**   | **540.3**| **0.960 (0.880–1.044)**| 0.05     
| Cholesterol <5.2 mmol/L  | **685.0** | **752.7**| **1.099 (1.022–1.180)**| 0.05     
| HDL ≤1.03 mmol/L         | 416       | 426.1    | 1.024 (0.929–1.126)     | 0.07     
| HDL >1.03 mmol/L         | 756       | 786.2    | 1.040 (0.969–1.115)     | 0.07     
| Triglycerides ≥2.25 mmol/L| 231      | 206.5    | 0.894 (0.776–1.025)     | 0.07     
| Triglycerides <2.25 mmol/L| 984.5   | 1037.1   | 1.053 (0.990–1.120)     | 0.07     
| Beta blockade yes        | 1243.5    | 1337.5   | 1.076 (1.019–1.135)     | 0.07     
| Beta blockade no         | 1810      | 1847     | 1.020 (0.974–1.068)     | 0.07     
| CA channel blocker yes   | 502.5     | 573.3    | 1.141 (1.049–1.238)     | 0.07     
| CA channel blocker no    | 2544.5    | 2604.1   | 1.023 (0.984–1.063)     | 0.07     
| ACE inhibitors yes       | 647       | 717.2    | 1.109 (1.029–1.193)     | 0.07     
| ACE inhibitors no        | 2405      | 2464.3   | 1.025 (0.985–1.066)     | 0.07     
| Anticoagulants yes       | 164       | 173.9    | 1.060 (0.908–1.230)     | 0.07     
| Anticoagulants no        | 2888.5    | 3001.6   | 1.039 (1.002–1.077)     | 0.07     
| Aspirin yes              | 1280.5    | 1400.5   | 1.094 (1.037–1.153)     | 0.07     
| Aspirin no               | 1773      | 1794.1   | 1.012 (0.966–1.060)     | 0.07     
| Statins yes              | 583.5     | 634.7    | 1.088 (1.005–1.176)     | 0.07     
| Statins no               | 2463.5    | 2543.8   | 1.033 (0.993–1.074)     | 0.07     

<table>
<thead>
<tr>
<th></th>
<th>Expected</th>
<th>Observed</th>
<th>Incidence ratio (95% CI)</th>
<th>P value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>4095.5</td>
<td>4074.4</td>
<td>0.995 (0.965–1.026)</td>
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<tr>
<td>Men</td>
<td>2616</td>
<td>2614.2</td>
<td>0.999 (0.961–1.038)</td>
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<tr>
<td>Women</td>
<td>1479.5</td>
<td>1460.2</td>
<td>0.987 (0.937–1.039)</td>
<td>0.76</td>
</tr>
<tr>
<td>Age &lt;65 years</td>
<td>1122.5</td>
<td>1126.1</td>
<td>1.003 (0.945–1.064)</td>
<td>0.79</td>
</tr>
<tr>
<td>Age ≥65 years</td>
<td>2973</td>
<td>2948.2</td>
<td>0.992 (0.956–1.028)</td>
<td></td>
</tr>
<tr>
<td>Any previous CHD event</td>
<td>1608.5</td>
<td>1600.7</td>
<td>0.995 (0.947–1.045)</td>
<td></td>
</tr>
<tr>
<td>No previous CHD events</td>
<td>2417</td>
<td>2419.1</td>
<td>1.001 (0.961–1.042)</td>
<td>0.99</td>
</tr>
<tr>
<td>Diabetes yes</td>
<td>980.5</td>
<td>1011.7</td>
<td>1.032 (0.969–1.097)</td>
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<tr>
<td>Diabetes no</td>
<td>3115</td>
<td>3062.6</td>
<td>0.983 (0.949–1.019)</td>
<td>0.28</td>
</tr>
<tr>
<td>Hypertension yes</td>
<td>1555.5</td>
<td>1622.1</td>
<td>1.043 (0.993–1.095)</td>
<td></td>
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<tr>
<td>Hypertension no</td>
<td>2418</td>
<td>2355.9</td>
<td>0.974 (0.935–1.014)</td>
<td>0.09</td>
</tr>
<tr>
<td>Current smoker</td>
<td>804.5</td>
<td>796.3</td>
<td>0.990 (0.922–1.061)</td>
<td></td>
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<tr>
<td>Former smoker (&gt;1 month)</td>
<td>1091</td>
<td>1027</td>
<td>0.941 (0.885–1.001)</td>
<td></td>
</tr>
<tr>
<td>never smoker</td>
<td>1802</td>
<td>1887.3</td>
<td>1.047 (1.001–1.096)</td>
<td>0.07</td>
</tr>
<tr>
<td>BMI ≥30 kg/m²</td>
<td>239.5</td>
<td>244.8</td>
<td>1.022 (0.898–1.158)</td>
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</tr>
<tr>
<td>BMI &lt;30 kg/m²</td>
<td>1120.1</td>
<td>1120.1</td>
<td>1.035 (0.975–1.097)</td>
<td>0.89</td>
</tr>
<tr>
<td>Cholesterol ≥5.5 mmol/L</td>
<td>813.5</td>
<td>747.8</td>
<td>0.919 (0.855–0.988)</td>
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<tr>
<td>Cholesterol &lt;5.2 mmol/L</td>
<td>956.0</td>
<td>998.8</td>
<td>1.045 (0.981–1.112)</td>
<td>0.03</td>
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<tr>
<td>HDL ≤1.03 mmol/L</td>
<td>581.0</td>
<td>575.5</td>
<td>0.990 (0.911–1.075)</td>
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</tr>
<tr>
<td>HDL &gt;1.03 mmol/L</td>
<td>1063</td>
<td>1046.2</td>
<td>0.984 (0.925–1.046)</td>
<td>0.92</td>
</tr>
<tr>
<td>Triglycerides ≥2.25 mmol/L</td>
<td>333</td>
<td>294.2</td>
<td>0.883 (0.785–0.990)</td>
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</tr>
<tr>
<td>Triglycerides &lt;2.25 mmol/L</td>
<td>1366.0</td>
<td>1384.1</td>
<td>1.013 (0.961–1.068)</td>
<td>0.08</td>
</tr>
<tr>
<td>Beta blocker yes</td>
<td>1645.5</td>
<td>1680.5</td>
<td>1.021 (0.973–1.071)</td>
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<tr>
<td>Beta blocker no</td>
<td>2376</td>
<td>2329.4</td>
<td>0.980 (0.941–1.021)</td>
<td>0.26</td>
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<tr>
<td>CA channel blocker yes</td>
<td>735</td>
<td>662.4</td>
<td>0.901 (0.834–0.973)</td>
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</tr>
<tr>
<td>CA channel blocker no</td>
<td>3276</td>
<td>3334.4</td>
<td>1.018 (0.984–1.053)</td>
<td>0.02</td>
</tr>
<tr>
<td>ACE inhibitors yes</td>
<td>853</td>
<td>859.6</td>
<td>1.008 (0.941–1.077)</td>
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<tr>
<td>ACE inhibitors no</td>
<td>3163.5</td>
<td>3149.3</td>
<td>0.996 (0.961–1.031)</td>
<td>0.80</td>
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<tr>
<td>Anticoagulants yes</td>
<td>221.5</td>
<td>201.8</td>
<td>0.911 (0.790–1.046)</td>
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</tr>
<tr>
<td>Anticoagulants no</td>
<td>3797</td>
<td>3810</td>
<td>1.003 (0.972–1.036)</td>
<td>0.29</td>
</tr>
<tr>
<td>Aspirin yes</td>
<td>1735</td>
<td>1719.4</td>
<td>0.991 (0.945–1.039)</td>
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<tr>
<td>Aspirin no</td>
<td>2288.5</td>
<td>2293.5</td>
<td>1.002 (0.962–1.044)</td>
<td>0.77</td>
</tr>
<tr>
<td>Statins yes</td>
<td>849</td>
<td>778.9</td>
<td>0.917 (0.854–0.984)</td>
<td></td>
</tr>
<tr>
<td>Statins no</td>
<td>3167</td>
<td>3228</td>
<td>1.019 (0.984–1.055)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

* First week after the autumn clock shift.
Discussion

• Increase in risk for AMI after the transition into DST
• No effect of transition out of DST
• Acute sleep deprivation may trigger coronary events (ref 26)
• Limitations
  – delay in CCU admissions
  – No data on sleep