Is Occupation as Air Transport Pilot a Stroke Risk?

A Case-Control Study
Why this question?
Why?

- Shift & Night Work
- Sleep Restriction
- Air Transport Pilot Occupation

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**Ischaemic Stroke**
4% increased stroke risk for every 5 years of night shift in nurses

**Ischaemic Stroke**
Meta-analysis (n=559,252):
HR 1.15 (95% CI, 1.07-1.24) for short sleep

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Aim of Study

Hypothesis: Odds of long haul Air Transport Pilot occupation exposure versus non-exposed in stroke cases different to control cases? ($\alpha = 0.05$)

Air Transport Pilot vs Unexposed

Stroke Cases

Control Cases

All Australian Civilian Aviation Pilots and Air Traffic Controllers
Method
Ischaemic Stroke Cases & Controls

**Stroke Cases**
- Ischaemic Stroke or TIA
- First Event
- Diagnosis by Neurologist

**Control Cases**
- Random Selection
- No matching or restriction
- 4:1

All Australian Civilian Aviation Pilots and Air Traffic Controllers
“Air Transport Pilot Occupied in Medium to Long Haul Work”

Air Transport Pilot Licencing
- Maximum Take-Off Weight (Fixed Wing) > 15,000 kg
- Flight Hours Accumulated > 5000 hours
- Multicrew command
- Stated Employer a Medium to Long Haul Carrier
The Unexposed

- Private/recreational pilots (Class 2)
- Commercial pilots (Class 1, non-ATP)
- Air traffic controllers (Class 3)

Limited exposure to shift & night work and trans-meridian travel compared to Air Transport Pilots?
Confounder Management

Complete data on significant* ischaemic stroke risk factors was collected for each subject

*Age, sex, *hypertension, *current smoking, *diabetes, *other cardiac/vascular disorders, BMI.

Multivariable logistic regression modelling to adjust for confounding by these risk factors
Results?
Records: 1985 to 2017
Total subjects 464
18 years to 88 years age
Median age of 42 years in both groups
Mostly male (94.4%)
### Raw Numbers – Occupational Exposure

<table>
<thead>
<tr>
<th></th>
<th>Stroke = 88</th>
<th>Controls = 376</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Transport Pilot</strong></td>
<td>11 (12%)</td>
<td>24 (6%)</td>
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<tr>
<td><strong>Unexposed</strong></td>
<td>77 (88%)</td>
<td>352 (94%)</td>
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<tr>
<td><strong>Commercial Pilot</strong></td>
<td>14 (18%)</td>
<td>112 (32%)</td>
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<tr>
<td><strong>Private Pilot</strong></td>
<td>59 (77%)</td>
<td>234 (66%)</td>
</tr>
<tr>
<td><strong>Air Traffic Controller</strong></td>
<td>4 (5%)</td>
<td>6 (2%)</td>
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Explanatory Factors (Unadjusted)

- Age > 50 years
- Comorbid Vascular / Cardiac Factor
- Blood pressure > 140/90 or on Treatment
- Diabetes
- Sex = Male
- Body Mass Index > 30 kg/m2
- Smoker

Odds Ratio & 95% Confidence Intervals (log scale)
Association of Factor and Stroke
## Unadjusted Primary Association & Qualitative Confounder Relationships

<table>
<thead>
<tr>
<th>Unadjusted Odds Ratio of Air Transport Pilot Exposure and Stroke</th>
<th>Pooled Odds Ratio (Mantel-Haenzsel)</th>
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<tbody>
<tr>
<td><strong>2.09</strong> (95% CI: 0.98, 4.46; p = 0.068)</td>
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### Age

<table>
<thead>
<tr>
<th>Age &lt; 50</th>
<th>Age &gt; 50</th>
<th>Age</th>
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<tbody>
<tr>
<td>1.46</td>
<td>1.52</td>
<td>1.51</td>
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</table>

### Blood Pressure (BP)

- **Normal BP**
  - 4.00
- **BP > 140/90 or Treated BP**
  - 0.78
  - 2.70

### Body Mass Index (BMI)

- **BMI < 30**
  - 2.17
- **BMI > 30**
  - 1.96
  - 2.13

*Comorbid cardiac and vascular disease, gender, diabetes, and smoking not amendable to stratified analysis due to small number drop out in some strata.*
Primary Outcome – Air Transport Pilot Occupation

- OR = 2.09, p = 0.068
- OR = 2.51, p = 0.037
- OR = 2.81, p = 0.019
Discussion
2.8–fold Increased Risk of Stroke in Air Transport Pilot Occupation?
Weaknesses of this Study

- Modest Ischaemic Stroke Case Numbers
- Differential Case Selection in the Exposed Group (potential)
- Residual Confounding (potential)
Replicate or do better studies?
What is the difference between Air Transport Pilots and other Civilian Aviation Participants?

- Circadian disruption / sleep disruption?
- Prolonged hypobaric environment?
- Cosmic radiation? …
- Possible aeromedical safety risk implications?
Is Occupation as Air Transport Pilot a Stroke Risk?

Yes it could be
Acknowledgements

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Dr Derchieh Hung, Statistician CSL
Dr Craig White, FAFOEM
Is Occupation as Air Transport Pilot a Stroke Risk?

Yes it could be
Differential selection of stroke cases wrt ATP status

**SOURCE POPULATION**

Air Transport Pilots who developed stroke

vs

Other Pilots / ATCs who developed stroke

Some may not apply for re-certification
“Exploratory” Factors (Unadjusted)

- ATP vs Not
- Class 3 vs Not Class 3
- Class 3 vs Class 2
- Class 1 vs Class 2
- Flying Hours > 5000
- Flying Hours 1000-5000

Odds Ratio (Unadjusted)