The Healthy Worker Effect

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Healthy Worker Effect (HWE)

- Background information - epidemiology
- What is the Healthy Worker Effect?
- What causes the healthy worker effect?
- How to minimize it?
- How does it impact “remote” workers?
Epidemiology

– study of distribution and determinants of disease

Epidemiology of Breast Cancer

Distribution - Common ? Where ? Change over time ?

Determinants
– age, gender, race, shiftwork
Epidemiology

Comparisons are frequently made e.g. young vs old, male vs female, shift vs non-shiftworker

Cancer in Shift vs Non-shift workers

How do we know effect of shiftwork is not affected by age (or other) differences in the populations compared? i.e. is effect really caused by shiftwork? or other factors?

Mortality (SMR-, all causes) of gas workers compared with national experience

<table>
<thead>
<tr>
<th>Exposure Level</th>
<th>SMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Exposure</td>
<td>105</td>
</tr>
<tr>
<td>Intermediate</td>
<td>90</td>
</tr>
<tr>
<td>No Exposure</td>
<td>84</td>
</tr>
</tbody>
</table>

STANDARDISED MORTALITY RATE (SMR)
- rates after eliminating possible effect of age differences in workers and general population

SMR (non & intermediate exposed workers) - 84, 90

SMR < 100 - Experience less deaths compared to general population
### Notifications of tuberculosis for Singapore, 1984

<table>
<thead>
<tr>
<th>Population</th>
<th>Notifications</th>
<th>New case rate (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singapore</td>
<td>2,143</td>
<td>85</td>
</tr>
<tr>
<td>Taxi drivers</td>
<td>11</td>
<td>153</td>
</tr>
</tbody>
</table>

New case rate: \(\frac{153}{85} = 1.8\)

### New cases of tuberculosis among Singapore males, 1984

(Rates per 100,000 population)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Respiratory</th>
<th>Non-respiratory</th>
<th>All forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 29</td>
<td>65</td>
<td>9</td>
<td>72</td>
</tr>
<tr>
<td>30 – 39</td>
<td>66</td>
<td>8</td>
<td>71</td>
</tr>
<tr>
<td>40 – 49</td>
<td>133</td>
<td>8</td>
<td>138</td>
</tr>
<tr>
<td>50 – 59</td>
<td>264</td>
<td>13</td>
<td>270</td>
</tr>
<tr>
<td>&gt; 59</td>
<td>536</td>
<td>10</td>
<td>542</td>
</tr>
</tbody>
</table>

93% of cases were respiratory TB

65 % aged > 40 years    M:F ratio is 2 : 1

Source: Department of Tuberculosis Control. Singapore Tuberculosis Statistics, 1984
## New PTB cases (male taxi drivers) 1984

<table>
<thead>
<tr>
<th>Age Group</th>
<th>No. of Drivers</th>
<th>Obs. Cases</th>
<th>Exp. Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 29 yrs</td>
<td>24</td>
<td>0</td>
<td>0.016</td>
</tr>
<tr>
<td>30 – 39 yrs</td>
<td>1,817</td>
<td>1</td>
<td>1.199</td>
</tr>
<tr>
<td>40 – 49 yrs</td>
<td>2,641</td>
<td>5</td>
<td>3.513</td>
</tr>
<tr>
<td>50 – 59 yrs</td>
<td>1,634</td>
<td>3</td>
<td>4.314</td>
</tr>
<tr>
<td>&gt; 59 yrs</td>
<td>109</td>
<td>2</td>
<td>0.584</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,225</strong></td>
<td><strong>11</strong></td>
<td><strong>9.626</strong></td>
</tr>
</tbody>
</table>

**S.M.R. = 1.14**  95% C.I. 0.57 to 2.04

*Standardized for age and sex by indirect method based on age and sex specific incidence rate of PTB in the general Singapore population*
SMR

Reduction in SMR could lead us to conclude that the condition among workers is good and no harmful effect was seen.

Other factors may partially/completely mask excess mortality or morbidity caused by harmful exposure. e.g. Healthy Worker Effect.
Healthy Worker Effect

"HWE refers to the consistent tendency of the actively employed to have a more favourable mortality experience than the population at large."

McMichael 1976
Healthy Worker Effect

1885 - William Ogle
- mortality rate dependent on difficulty of occupation
- More vigorous occupations had a relatively lower mortality rate cf. “easier” occupations or unemployed

1974 – AJ McMichael
- introduced the term HWE to describe this phenomena
Importance of HWE

Most studies indicate that HWE will reduce the association between exposure and outcome by an average of 20-30%

SMR close to unity (100) is used as an indication of absence or a low degree of HWE

What causes the HWE?

Selection Bias

Occurs from:

- initial choosing of workers (mainly healthy)
- factors that influence the continuity of work e.g. leaving work because of sickness

Selection Bias

"Error due to systematic differences in characteristics between those selected for study and those not."
What causes the HWE?

Information Bias

- Information may be differently collected from workers and the general population

e.g.

- Different criteria in diagnosis, methods and quality of recording health outcomes in the 2 groups

- causes different degrees of misclassification
TB Screening

83% of active TB cases were undiscovered until a community survey (1975) c.f. taxi drivers who have annual screening CXRs i.e.

5X more cases detected in a screened population
# Tuberculosis in Taxi Drivers

<table>
<thead>
<tr>
<th>New case rate</th>
<th>Taxi Drivers</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted</td>
<td>153/100,000</td>
<td>85/100,000</td>
</tr>
</tbody>
</table>

- **Gender specific, From 1.8, reduced to** = 1.14
- **Age adjusted SMR**
- **Taking into account screening**

= 0.228

* 5X more TB cases picked up in a screened vs. unscreened population
Components of HWE

• Healthy Hire Effect

• Healthy Worker Survivor Effect

• Beneficial Effect of Work
Healthy Hire Effect

Employers reject certain persons for employment because of disabilities, poor general health

Selection also influenced by habits and physical conditions such as weight, smoking, or alcoholism

Effect varies according to labour situation
i.e. during labour shortages less fit workers could be selected, during labour surplus employers can be choosy
Healthy Worker Survivor Effect

Workers who aren’t motivated to work because of health problems do not present themselves for employment (self-selection). They change jobs frequently or retire early (change job for different reasons, incl. health). Effect is reduced after 15 years of entry to industry.
Beneficial Effects of Work

Improved access to healthcare
Routine disease screening
Physical exercise

? extent of beneficial effect

Doll considered low mortality a result of true benefit of work on health

Factors Affecting HWE

HWE is not constant
- varies depending on choice of comparison population

Factors affecting HWE vary between studies
Factors Affecting HWE

**Socioeconomic Status**
More qualified jobs, professional workers demonstrate a stronger overall HWE

**Gender**
– $\uparrow HWE$ for females or males?
Factors Affecting HWE

Time Related Factors

- Age at Hire

% of persons with required health level likely to ↓ as age at hire increases
## Age at Hire and Relative Risk (RR) for all causes of mortality

<table>
<thead>
<tr>
<th>Age at Hire</th>
<th>24-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65-74</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR for all causes of mortality</td>
<td>0.45</td>
<td>0.37</td>
<td>0.32</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Avoiding or Minimizing HWE

Avoid using general population as a reference group

Ideally - Use active workers from another industry who are unexposed
Avoiding or Minimizing HWE

Compare rates of health outcomes of interest between individuals with high and those with low or NO exposure

- Useful when the external reference group is not ideal

- ? Some industries may show uniform exposure
Avoiding or Minimizing HWE

HWE by including experience of every person who ever worked in a particular factory/industry
How does HWE impact “remote” workers?

Healthy worker effect is always prominent in shift work studies

Accentuated in offshore populations who are subjected to regular and stringent medical fitness reviews

HWE for offshore work

Applicants must pass medical examination to be physically and mentally fit to meet demands of environment and training in survival and fire fighting techniques

Continued employment is subject to regular medical checks
HWE for offshore work

Lifestyle

e.g. properly prepared food, including cooked meals, is available for night workers (thus, less snacks ?)

Relatively high pay
- tend to keep workers in such activity even when the health effects would dictate otherwise

No significant change in the BMI from 1995-2000

1995 - offshore workers BMI > general population

2000 - difference had disappeared

In effect, BMI of offshore population had remained static, but the BMI of the general population had caught up.


BMI remains a concern

? consoling to think that dietary education, better catering and increased fitness offshore may have a stabilizing effect on BMI

Summary

HWE – Working people are healthier!

Caused by – selection, beneficial effects of active work, screening, access to care

Beware: HWE can mask ill health caused by work