30 years of SWORD
Forging the links between research and practice to produce impact

Jennifer Hoyle
Surveillance of Work-Related and Occupational Respiratory Disease 1989

• Who and how was it started?
• Why?
• What was it meant to achieve?
Why?
Early detection of occupational hazards

“So far as we are aware, routine statistics of the type now available have never been responsible for the discovery of any new occupational disease”

“the detection of occupational hazards has often, perhaps usually, depended on astute clinical observation”

“Without prior definition of a precise question or null hypothesis, epidemiological methods are also ineffective”

Pre-SWORD 1989

1987- discussions between representatives of British Thoracic Society
And Society of Occupational Medicine

Plan for voluntary reporting by members
Proposal submitted to HSE- approved funding 1989-1991

Recruitment via letter sent to members of the organisations- Monthly
reports required

Protocol was extended to include – 3 monthly, 6 monthly and annual
reporting
Reports (via cards) in 1989 from:
   350 chest physicians (90% UK chest clinics)
   361 occupational physicians

Participants:
   Monthly reports of newly diagnosed cases of work-related respiratory disease
   Monthly digest of newly reported cases by diagnostic category
   Detailed analysis every quarter
   c. Annual publications in medical literature

Excluded recreational exposures
What was the purpose?
SWORD 1989

Objectives of scheme:

(1) To monitor the frequency of work-related respiratory disease
2101 cases reported

Asthma (26%)
Mesothelioma (16%)
Pneumoconiosis (15%)
Benign pleural disease (11%)
Hypersensitivity pneumonitis (6%)

Mineral dust diseases- lung cancer with pulmonary fibrosis, malignant mesothelioma and pneumoconiosis together - 34%

Incidence rates calculated against denominators
From Labour Force Survey
# Incidence of occupational asthma in high risk occupations

**SWORD 1989**

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>Rate (million/yr)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coach and spray painters</td>
<td>639</td>
<td>445 – 889</td>
</tr>
<tr>
<td>Chemical processors</td>
<td>424</td>
<td>288 – 601</td>
</tr>
<tr>
<td>Bakers</td>
<td>409</td>
<td>274 – 588</td>
</tr>
<tr>
<td>Plastics making and processing</td>
<td>409</td>
<td>270 – 505</td>
</tr>
<tr>
<td>Metal making and treating</td>
<td>249</td>
<td>136 – 417</td>
</tr>
<tr>
<td>Laboratory technicians and assistants</td>
<td>204</td>
<td>133 – 299</td>
</tr>
<tr>
<td>Welders/solderers/electronic assemblers</td>
<td>159</td>
<td>111 - 221</td>
</tr>
</tbody>
</table>

After Meredith et al, 1991
Total new cases reported to SWORD 1990-1997

Ross et al, 1999
SWORD 1989-94
Trends in suspected agents for asthma

Ross et al, 1995
Pneumoconiosis in the UK
SWORD 1989-1995

No. of reports to SWORD

Year

Ross et al, 1995
What was the purpose?
SWORD 1989

Objectives of scheme:

(1) To monitor the frequency of work-related respiratory disease

(2) To promote the early recognition and control of new problems
SWORD 1989-94
Trends in suspected agents for asthma

Ross et al, 1995
64 of 1031 cases of occupational asthma resulted from exposure to latex
• Fourth most frequently incriminated asthmagen
Annual Reports to SWORD of occupational asthma attributed to latex (1991-1997)

No.

Year

Ross et al, 1998
MDA Bulletin 1996, 117 million pairs of latex gloves were being supplied to the NHS annually in 1992, but few reports of latex sensitivity had been received at that time.

There is now sufficient evidence that healthcare workers are an occupational group at increased risk of latex allergy.
Medical Devices Agency

- June 1998 issued mandatory advice
  - aiming to increase awareness in glove users about previously published guidance on the allergic potential and risks associated with latex.
  - Subsequently, in November 2002, the England and Wales Court of Appeal (Civil Division) issued a Decision associated with a claimant
Trends in asthma attributed to latex
Legislation aiming to reduce asthma attributed to latex glove use

Time1. Pre-intervention
Time2. 1998 MDA
Time3. 2000 HSE guidance
Time4. 2004 COSHH amendment (effective 2005; ALARP but no WEL)

Occup Environ Med 2013;70:476-482 doi:10.1136/oemed-2012-101123
http://oem.bmj.com/content/70/7/476.full.pdf+html
Trends in asthma attributed to latex

- MDA
- HSE
- COSHH
- Court case
NRL glove purchase and occupational asthma in German acute care hospitals

After Allmers et al, 2002
Occupational asthma attributed to latex in the UK
Reports to SWORD 1991-2004

Year

Cases

91 92 93 94 95 96 97 98 99 0 1 2 3 4

Year
What was the purpose?
SWORD 1989

Objectives of scheme:

(1) To monitor the frequency of work-related respiratory disease

(2) To promote the early recognition and control of new problems

(3) To provide rapid feedback and information to participants
THOR
The Health & Occupation Research network

**SWORD**
1989 - present
Surveillance of Work-related and Occupational Respiratory Disease
Chest Physicians

**EPIDERM**
1993 - present
Occupational Skin Surveillance
Dermatologists

**MOSS**
1997- 2009
Musculoskeletal Occupational Surveillance Scheme
Rheumatologists

**SIDAW**
1996 - 2016
Surveillance of Infectious Diseases At Work
Consultants in Communicable Disease Control

**THOR-GP**
2005 - present
THOR in General Practice
General Practitioners

**OPRA**
1996 - present
Occupational Physicians Reporting Activity
Occupational Physicians

**THOR-EXTRA**
2006 – present
Special reports outside the Incidence Sampling Frame

**SOSMI**
1999- 2009
Surveillance of Occupational Stress and Mental Illness
Psychiatrists
THOR- SWORD reporters
SWORD reporters – March 2017

<table>
<thead>
<tr>
<th>Region</th>
<th>No.</th>
<th>Region</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyne and Wear</td>
<td>12</td>
<td>South West</td>
<td>38</td>
</tr>
<tr>
<td>Northumberland, Cumbria, Durham and Cleveland</td>
<td>14</td>
<td>West Midlands metropolitan county</td>
<td>25</td>
</tr>
<tr>
<td>South Yorkshire</td>
<td>12</td>
<td>Rest of West Midlands</td>
<td>13</td>
</tr>
<tr>
<td>West Yorkshire</td>
<td>9</td>
<td>Greater Manchester</td>
<td>27</td>
</tr>
<tr>
<td>North Yorkshire &amp; Humberside</td>
<td>11</td>
<td>Merseyside</td>
<td>12</td>
</tr>
<tr>
<td>East Midlands</td>
<td>25</td>
<td>Rest of North West</td>
<td>11</td>
</tr>
<tr>
<td>East Anglia</td>
<td>14</td>
<td>Wales</td>
<td>23</td>
</tr>
<tr>
<td>Inner London</td>
<td>49</td>
<td>Central Clydeside</td>
<td>12</td>
</tr>
<tr>
<td>Outer London</td>
<td>6</td>
<td>Rest of Scotland</td>
<td>25</td>
</tr>
<tr>
<td>Rest of South East</td>
<td>67</td>
<td>Northern Ireland</td>
<td>10</td>
</tr>
</tbody>
</table>

March 2016 equivalent figures shown in brackets

n = 415
Data requests by specialism

- Respiratory
- Skin
- Musculoskeletal
- Hearing
- Mental Ill Health
- Infectious
New cases of occupational asthma and mesothelioma reported to SWORD 1992-1999

Meyer et al, 2001
Proportional time lapse between month of symptom onset* and reporting month for actual cases of *asthma* reported to SWORD (2006-2016)

**Median:**
- All agents = 23 months
- Isocyanates = 24 months
- Flour/amylase = 27 months
- Laboratory insects = 24 months

*Based on both full (month, year) and partial (year) symptom onset data
Mesothelioma: Proportional contribution of occupation by five-year birth cohort; cases reported to SWORD 1996-1999

After Meyer et al, 2001
What was the purpose?
SWORD 1989

Objectives of scheme:

(1) To monitor the frequency of work-related respiratory disease

(2) To promote the early recognition and control of new problems

(3) To provide rapid feedback and information to participants

(4) To undertake collaborative investigations where indicated
SWORD 1989-94
Trends in suspected agents for asthma

% of total

Ross et al, 1995
ENOCCH

Investigation of the principal determinants (exposure and atopy) of occupational asthma, associated allergic symptoms and of specific sensitisation

Parallel cohort studies in newly employed
  laboratory animal workers
  bakery workers
  acid anhydride workers

Laboratory animal workers
  7 year follow up (Jan 1986 - Dec 1993)
  Levels of specific aero-allergen measured
  6 monthly questionnaire with SPT v RUP
  → 4 exposure categories

Nested matched case-referent analysis within cohort
ENOCH : Cohort study of laboratory animal workers

Exposure-response relationships in cases developing within 2 years of first employment

<table>
<thead>
<tr>
<th>Exposure category</th>
<th>Chest OR</th>
<th>95% CI</th>
<th>Eye/nose OR</th>
<th>95% CI</th>
<th>SPT v RUP OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (low)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.4</td>
<td>0.2 – 38.4</td>
<td>3.0</td>
<td>0.8 – 10.9</td>
<td>3.0</td>
<td>0.3 – 29</td>
</tr>
<tr>
<td>3</td>
<td>5.5</td>
<td>0.5 – 65.1</td>
<td>3.7</td>
<td>1.1 – 12.2</td>
<td>6.0</td>
<td>0.6 – 57.1</td>
</tr>
<tr>
<td>4 (high)</td>
<td>4.6</td>
<td>0.3 – 77.4</td>
<td>3.2</td>
<td>0.9 – 11.5</td>
<td>5.7</td>
<td>0.6 – 53</td>
</tr>
<tr>
<td>Atopy</td>
<td>2.7</td>
<td>0.8 – 9.7</td>
<td>0.4</td>
<td>0.2 – 1.0</td>
<td>2.9</td>
<td>1.1 – 7.9</td>
</tr>
</tbody>
</table>

“This study confirmed allergen exposure as the most important determinant of laboratory animal allergy. Measures to reduce exposure may be the most effective means to reduce its incidence”.

Cullinan P et al, 1999
ENOCHE: Exposure-response relationships for new chest symptoms in sensitised workers and new skin prick test responses v RUP

Nieuwenhuijsen M et al, 2002
Reporting schemes + disease recognition
SWORD + occupational lung disease

Problems of attribution
We recognise the visible with strong relationships
   e.g. Asbestos related diseases with specific markers
       (pleural thickening/calcification)
       or strong association (mesothelioma)

   Occupational asthma with specific characteristics

We do not recognise the less visible
   without specific markers or a strong association
   or with a strong association with another cause
   e.g. cigarette smoking with:
       lung cancer
       chronic bronchitis and emphysema
Respiratory cases reported by diagnostic category, SWORD, OPRA and THOR-GP (2006-2016)

OPRA annual average = 165

THOR-GP annual average = 15

SWORD annual average = 2002

- **Asthma**: 42%
- **Inhalation accidents**: 26%
- **Allergic alveolitis**: 2%
- **Non-malignant pleural disease**: 2%
- **Pneumoconiosis**: 4%
- **Other**: 7%
- **Bronchitis/emphysema**: 3%
- **Infectious disease**: 2%
- **Lung cancer**: 3%
- **Mesothelioma**: 10%
- **Other**: 1%

<table>
<thead>
<tr>
<th>Category</th>
<th>OPRA</th>
<th>SWORD</th>
<th>THOR-GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>42%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalation accidents</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergic alveolitis</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-malignant pleural</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumoconiosis</td>
<td>4%</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Infectious disease</td>
<td>2%</td>
<td></td>
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</tr>
<tr>
<td>Lung cancer</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Why?
Early detection of occupational hazards

“So far as we are aware, routine statistics of the type now available have never been responsible for the discovery of any new occupational disease”

From McDonald and Harrington,
Epidemiology of occupational hypersensitivity pneumonitis; reports from the SWORD scheme in the UK from 1996 to 2015 (After Barber 2016)

• 202 cases of Occupational HP reported

• Annual incidence UK 1.4 per million workers

• More likely seen in male workers than female
Hypersensitivity pneumonitis

Reports to SWORD 1996 - 2015

After Barber et al, 2016
Cases of respiratory disease attributed to milk powder/products, coffee, diacetyl (2017)

- 8 actual cases of work-related respiratory disease attributed to milk powder/products, coffee, diacetyl reported by chest physicians to SWORD (2006-2015)
- No cases reported to OPRA or THOR-GP

<table>
<thead>
<tr>
<th>Year</th>
<th>Diagnosis</th>
<th>Sex</th>
<th>Age</th>
<th>Industry</th>
<th>Job</th>
<th>Suspected agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>OBSTRUCTIVE BRONCHIOLITIS</td>
<td>M</td>
<td>37</td>
<td>FOOD</td>
<td>OPERATOR</td>
<td>DIACETYL</td>
</tr>
<tr>
<td>2006</td>
<td>OTHER RESPIRATORY DISEASE NOT SPECIFIED</td>
<td>M</td>
<td>38</td>
<td>FOOD</td>
<td>PRODUCTION OPERATIVE</td>
<td>DIACETYL</td>
</tr>
<tr>
<td>2014</td>
<td>ASTHMA SENSITISATION</td>
<td>M</td>
<td>44</td>
<td>FOOD</td>
<td>MAINTENANCE ENGINEER</td>
<td>GREEN COFFEE</td>
</tr>
<tr>
<td>2014</td>
<td>OCCULAR ALLERGY</td>
<td>M</td>
<td>50</td>
<td>FOOD</td>
<td>HGV DRIVER</td>
<td>GREEN COFFEE BEAN</td>
</tr>
<tr>
<td>2014</td>
<td>RHINITIS</td>
<td>M</td>
<td>41</td>
<td>FOOD</td>
<td>ENGINEER</td>
<td>GREEN COFFEE BEAN OR ALTERNARIA</td>
</tr>
<tr>
<td>2015</td>
<td>ASTHMA IRRITATION</td>
<td>M</td>
<td>47</td>
<td>FOOD</td>
<td>PACKAGING TECHNOLOGIST</td>
<td>BURNT COFFEE BEANS</td>
</tr>
<tr>
<td>2015</td>
<td>ASTHMA IRRITATION</td>
<td>M</td>
<td>47</td>
<td>FOOD</td>
<td>PACKAGING TECHNOLOGIST</td>
<td>BURNT COFFEE BEANS</td>
</tr>
<tr>
<td>2015</td>
<td>INHALATION ACCIDENT</td>
<td>M</td>
<td>47</td>
<td>FOOD</td>
<td>MAINTENANCE TECHNICIAN</td>
<td>GREEN COFFEE</td>
</tr>
</tbody>
</table>
SWORD 1989-objectives achieved

Objectives of scheme:

(1) To monitor the frequency of work-related respiratory disease
(2) To promote the early recognition and control of new problems
(3) To provide rapid feedback and information to participants
(4) To undertake collaborative investigations where indicated
Measuring Impact
Publications


Chapter


Comment/debate


Asthma incidence rates (per 100,000 employed)* for most frequently reported occupations, SWORD (2003-2008, 2009-2016)
Impact/Benefit
A personal reflection- 1998
SWORD- my first introduction

- Research-based on reported cases to SWORD
- Sponsored by HSE
- Based at Manchester University
- Followed on from Chronic Bronchitis research
Ferrous Foundry Data from SWORD promoted a legacy of

- At least 3 research studies, MD, PhD
- Training of consultants in NHS in OLD
- Onward training in others
- Training in research
- Occupational Hygiene research and training
Who benefits from SWORD?

• Workers and employers –

• in the prevention and identification of ill health in the working population.

• The HSE and others implement the appropriate preventive strategies based, at least in part, on data.

• THOR/SWORD then monitors the trends in incidence and helps evaluate the interventions.
Benefit- to clinicians- new diseases

- Chemical pneumonitis caused by silicone waterproofing spray
- Alveolitis from spraying fabric protector (? silicone) in furniture manufacturer
- Lipoid pneumonia from spray mount glue in a graphic designer
Benefit to society via education

- The HSE pocket book Bakers! – Time to clear the air was developed in response to THOR data identifying bakers and confectioners as a high-risk group.

- THOR data influenced the choice of trades and case studies highlighted on the HSE’s asthma website.
Benefit to society via policy

- **The Asthma Workplace Charter**, which was developed by Asthma UK in consultation with the HSE, uses THOR data as the basis for its list of the main occupations at risk from developing occupational asthma.

- The **House of Lords Science and Technology Committee inquiry into allergy** cited THOR as a source for its statistics (RA expert witness).
Impact

• Cultural-changes behaviour- e.g glutraldehyde
Timeline of events impacting on the use of glutaraldehyde based disinfectants in health care

- First used 1960s
- 1989 endorsed by British Society of Gastroenterologists first line disinfectant for endoscopes
- 1993 above reiterated but health risks recognised as significant
- 1999 First exposure limit introduced
- 2002 ‘Cidex’ (glutaraldehyde) withdrawn
- 2005 Exposure limit reduced further

(Stocks et al 2013)
Trends in asthma attributed to glutaraldehyde

The graph shows the incidence rate ratio of asthma from 1996 to 2010. The data is compared against all agents (red line) and glutaraldehyde with a shifted right trend (blue line). Key points of interest include:

- **MEL**: A peak in incidence rate ratio, followed by a decline.
- **Cidex withdrawn**: A significant decrease in incidence rate ratio post withdrawal.
- **WEL**: Another peak in incidence rate ratio.
The next 30 years?
Trends in Occupational Asthma reported to SWORD

Need to investigate further – real or artifactual? Driven by certain occupations? Agents?
Estimated annual changes in incidence of physician-reported occupational asthma (Stocks et al 2015)
Interventions aiming to reduce asthma attributed to flour

Time1. Pre-intervention
Time2. Introduction of a MEL (April 2001)
Trends in asthma attributed to flour

- All agents
- Flour

Incidence rate ratio

Beware the wolf in sheep’s clothing?
Example...industry sectors reported with case reports of work-related respiratory disease attributed to silica, reported by chest physicians to SWORD, 1996-2016

Actual cases = 195

- Mining of coal and lignite: 30%
- Mining of metal ores: 18%
- Other mining and quarrying: 10%
- Mfr of coke, refined petroleum & nuclear fuel: 8%
- Mfr of chemicals & chemical products: 7%
- Mfr of other non-metallic mineral products: 5%
- Mfr of basic metals: 3%
- Mfr of fabricated metals: 2%
- Mfr of machinery and apparatus n.e.c.: 1%
- Mfr of medical, precision & optical instruments: 1%
- Mfr of motor vehicles, trailers & semi-trailers: 1%
- Mfr n.e.c: 1%
- Construction: 1%
- Sale, maintenance & repair of motor vehicles: 1%
- Retail trade: 1%
- Education: 1%
- Health and social work: 1%
- Other service activities: 1%
- Total: 100%
Most frequently reported industries (%) for respiratory cases attributed to Isocyanates reported to SWORD (1996-2018)
Early identification of future risks

• Non-malignant **pleural disease** in process operator exposed to marinite (? cryptic asbestos)

• **Bronchiolitis** (? ketone peroxides) in fibre-glass laminators

• **Asthma** caused by heated triglycidyl isocyanurate (TGIC), a hardening agent used in powder paints etc
Is it value for money?
A few considerations to think about

• Impact/benefit
• Prevention of disease
• Wage loss/economy
• Cost of occupational asthma (£1.1 billion over 10 years, HSE 2006)
• Cost of lung transplantation in rarer diseases
• Etc.
What aspects are needed to maintain future performance?

- clinical reporters
- Astute observation by clinicians
- Leading to generation of hypothesis and research/intervention
- Dedicated team to collate information
Summary

- 30 successful years
- All aims objectives achieved
- ..but more work to be done
Acknowledgements

• Thank you to Prof Newman- Taylor
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• Annemarie Money
• Martie Van -tongeren