Work-related asthma: a brief review

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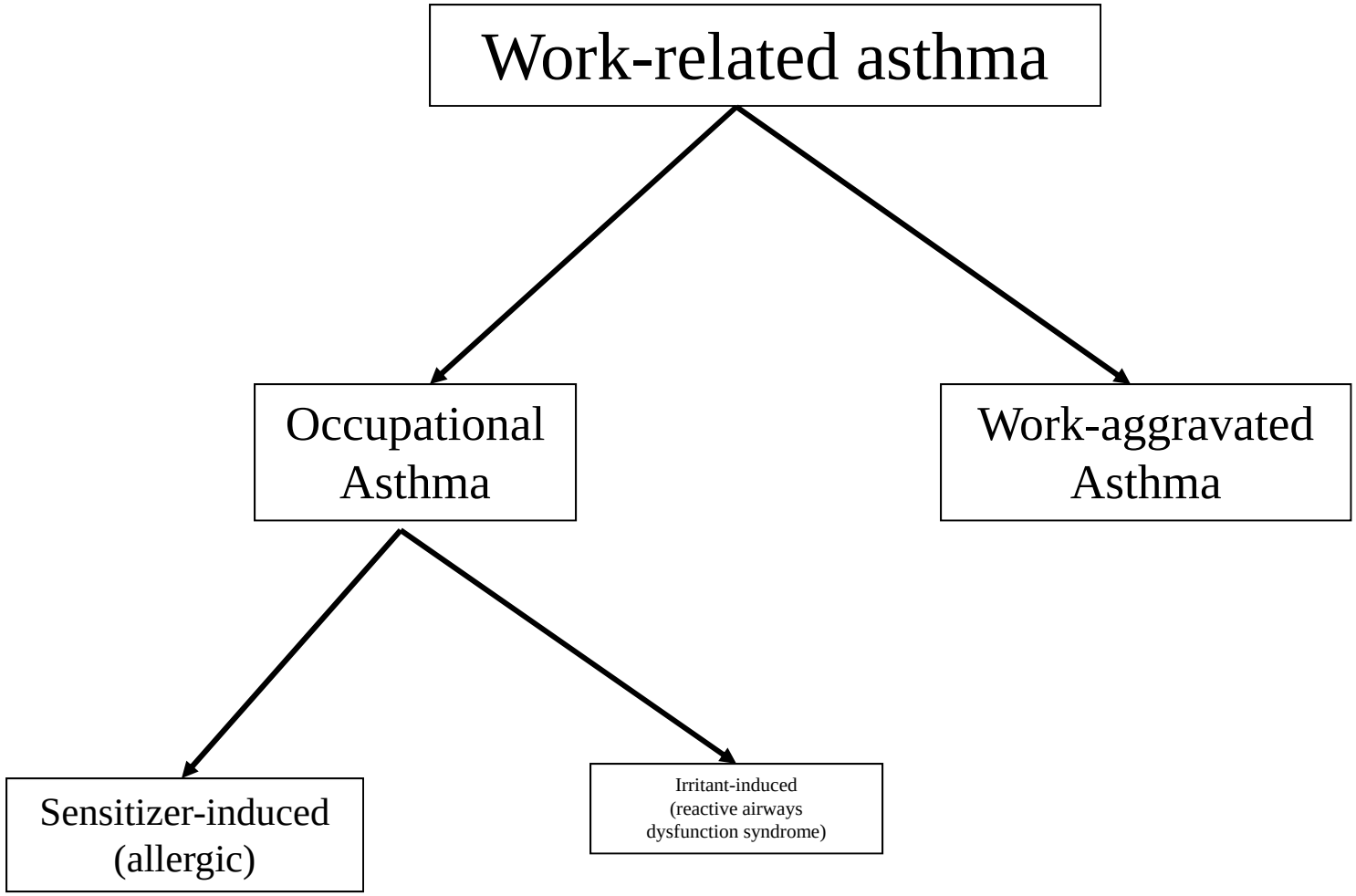
Mike Pysklywec MD MSc CCFP(EM) DOHS FCBOM


Work-related asthma
Occupational Asthma
Work-aggravated Asthma
Sensitizer-induced (allergic)
Irritant-induced (reactive airways dysfunction syndrome)

Epidemiology

Incidence data

Study	Country	Incidence (cases/million-year)
Kwon et al (2015)	Korea	3.31
Mazurek et al (2013)	United States	179
Hannaford-Turner et al (2010)	Australia	5
Bakerly et al (2008)	UK	42
McDonald et al (2005)	UK	20-111
Ameille et al (2003)	France	24
Esterhuizen et al (2001)	South Africa	17.5
Karjalainen et al (2000)	Finland	174
Kogevinas et al (2007)	Europe	250-300

OA Surveillance

- McDonald et al (2005) reported on 10 years of UK SWORD surveillance
- They estimate incidence rates from 22 to 87 cases/ million workers/year

Industry	Rate
mining	131
Food and organic	73
agriculture	51
petrochemical	46

Agent	percent
isocyanates	14%
Flour/grain	9
metals	5
Wood dust	4

OA Surveillance

- Bakerly et al (2008) reported on 15 years of OA surveillance through Shield surveillance program
  - 1 461 cases for annual incidence of 42 per million of working population

Occupation	Percent
Welders	9%
Health care	9%
Moulders	6%
Spray painting	5%

Exposure	Percent
Isocyanates	21%
MWF's	11%
Adhesives	7%
Chrome	7%
latex	7%

Incidence of WRA in Canada

- To et al (2011) describe the development of WRA reporting system in Canada
- Describe engagement by 49 physicians
- 34 cases of OA and 29 cases of WEA
- it is feasible to implement a voluntary reporting system, but long-term sustainability is questionable

Prevalence of WRA

Study	Prevalence of WRA
Henneberger et al (2011)	14 to 21.5%
Vila-Rigat et al (2014)	32.9%
Mazurek et al (2015)	9 to 23.1%
Lutzker et al (2010)	53%
MMWR (2012)	4.8 to 14.1%
Tice et al (2010)	10.6 to 44.5%
Johnson et al (2000)	16%
Tarlo et al (2000)	7%

Prevalence of WRA

- Kogevinas et al (2007)
  - 6837 participants from 13 countries: European Community Respiratory Survey
  - Population attributable risk for adult asthma related to work was **10 to 25%**

10 to 25% of adult asthma is related to work

Consider the denominator

- Prevalence of asthma in Ontario (age 12+) is 8.3%

  (Statistics Canada, Canadian Community Health Survey, 2010)

- Asthma prevalence has been increasing over the past 20 years

Poonai et al, 2005

- Surveyed 42 patients with OA to examine factors that delayed diagnosis (Toronto)
- Mean time to diagnosis = 4.9 years
- Length of time from symptom onset and reporting of symptoms = 0.61 years

Physician did not ask about work-relatedness	41%
Afraid of lost work time	37.5%
Afraid of forced job loss	33%
Underestimation of symptoms by patient	27%
Patient did not reveal that symptoms worse at work	18%

Mazurek et al (2014)

- Mazurek et al (2014)
  - Only 14.7% of asthma patients had discussed with their doctor the role work may have played in contributing to asthma
- Lemiere et al (2015)
  - Delay of onset of symptoms to diagnosis was 4.3 in Quebec in Ontario

Work-related asthma is not uncommon (10-25%) but often under-recognized

Prevention

PREVENTION CONTINUUM

Agent	Exposure	Early Symptoms	Clinical Signs	Disability
chemical	odour annoyance	cough/tight chest	↓ lung function	asthma

Primary Prevention	Secondary Prevention	Tertiary Prevention
At the source Along the path At the worker	Medical surveillance Assessment of symptoms	Managing disability

Diagnosis is a multi-step process

1. DIAGNOSE ASTHMA
2. SUSPECT WORK-RELATEDNESS
3. DETERMINE WORK-RELATEDNESS

2. Suspect work-relatedness!!!

- Careful history is key:
  - Are symptoms worse at work?
  - Did symptoms start in adulthood/with job change?
  - Are they in a high risk industry (e.g. painting, baking, health care)?
  - Are others similarly affected in the workplace?
  - Are symptoms related to unusual episodic exposures such as:

    a) chemical releases or building renovations?

    b) the introduction of new processes or materials?

Screening tools for WRA

- Killorn et al (2014)
  - Reported on the utility of a WRA screening questionnaire (WRASQ(L))
  - Compared a 14-item questionnaire with existing questions in an Asthma Care Map
  - Sample: n = 37; m:f = 27:73
  - Work-related symptoms in 38% and important exposures in 60% beyond the existing questionnaire
  - Authors acknowledged the difficulty in EMR incorporation

Management of WRA

- **OA (sensitizer-induced)**
  - ***Remove from exposure***:
    - Longer duration of exposure leads to increased risk of permanence and increased severity of disease
    - Workers can react to very small amounts of exposure

- **Irritant induced asthma (RADS)**
  - Remove from work until symptoms resolve
  - Return to work should be considered a trial – may react to exposures for long period (some cases up to 2 years)

- **Work Exacerbated Asthma (WEA):**
  - Control exposure - engineering efforts, modified work
  - Respirator is not a solution

Management of WRA

- Initiate a compensation claim
- Sentinel health event: consider that others may be similarly affected
- All workers need education and information about managing their asthma, recognition of triggers and what to do about them + + + support.
- Employers and workplace parties also need this information as well as support in determining how they will manage the worker and address exposure issues

Health Effects

- Majority of workers continue with symptoms and functional abnormalities even after removed from exposure
  - Airway inflammation can persist long after stopping exposure and can become permanent
  - **OA** -maximum improvement in the first 2 yrs once removed from exposure – still improvement but slower
    - If worker is **sensitized**, s/he can react to very small amounts of substance – even below detectable levels
  - **Irritant induced** – symptoms may persistent for months and years after exposure

Outcome of OA

- Systematic review of outcome of OA after cessation of exposure (Rachiotis et al, 2007)
  - Pooled estimate of rates of recovery was 32% (95% CI = 26 to 38%)
  - Lower recovery with increasing age
  - Shorter duration of exposure correlated with greater chance of recovery
  - HMW agents were associated with greater risk of persistent bronchial hyper-reactivity

Rachiotis et al, 2007

Implication of WRA

- Gannon et al, 1993
- UK follow-up study on workers with OA
- 32% continued to have exposure
  - These workers had ongoing decline in PFT's
  - Median loss of income = 35%
- 68% were removed from exposure
  - Median loss of income = 54%
  - FEV1 improved by 4.6%
  - Greater symptomatic improvement than those still exposed

- Significant physiological, vocation, social, psychological consequence of WRA

PREVENTION CONTINUUM

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Primary Prevention	Secondary Prevention	Tertiary Prevention
At the source Along the path At the worker	Assessment of symptoms Medical surveillance	Managing disability

Secondary prevention (early recognition)

Workplace – Occupational Health Program

- Medical Surveillance
  - Specific program to assess for health effects from specific exposures at pre-set intervals (e.g. annual, semi-annual)
    - e.g. isocyanates
    - Trend analysis – is there a group change? If yes, what is it due to?
- PFTs, symptom questionnaire
- Identification of a case of sensitizer-induced asthma should sound an alarm within the workplace – hygiene measures should be implemented to control exposure

Wilken et al, 2012

- Reviewed effectiveness of medical screening and surveillance pertaining to work-related asthma
- 72 reports evaluated pre-employment screening and medical surveillance; few of these reported effectiveness
- Recommendations:
  - use of a questionnaire-based tool for surveillance
  - pre-placement screening for sensitization for those in higher risk jobs with HMW allergens
  - utilization of specific IgE or SPT for surveillance of those regularly exposed to HMW allergens
  - consideration of pre-employment investigations in atopic individuals or asthmatics
  - risk stratification by diagnostic models may be used in surveillance to identify those needing further investigation

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Prevention Strategy:
General Guidelines for Exposure Control

1. • ***Identify***
2. • ***Eliminate***
3. • ***Substitute***
4. • ***Engineering Controls***
5. • ***Administrative Controls***
6. • ***Personal Protective Equipment***
7. • ***Exposure-monitoring program***
8. • ***Continual Improvement***

Training & Education

Primary prevention: health care

- Liss et al, 2011:
  - Described work-related asthma in healthcare in Ontario
  - Attribute low rates of OA in health care workers as being partially due to successful prevention efforts in this industry
- Kelly et al, 2011:
  - New latex sensitization decreased 16-fold after latex elimination in health care environments
  - 25% of previously sensitized employees reverted to negative skin tests

WRA and MSDS

Common asthma related statements on MSDSs:

- *The product is a respiratory tract sensitizer or causes respiratory sensitization,*
- *Asthma is a possible health effect*

Some potential sensitizers/irritants may not be listed on the MSDS.

WHMIS requires that any sensitizer be listed as hazardous if it is present at concentrations of 0.1% or greater.

-asthma may not be listed as a possible health effect, thus more in depth information would be required

WRA and MSDS

- Tarlo and Malo (2013): ATS proceedings from 4th Jack Pepys Workshop
  - MSDS sheets were felt to be “insufficient and inaccurate”.
  - The authors cited high proportion of isocyanate sheets that did not mention asthma
- Santos et al (2007)
  - lack of knowledge of the Workplace Hazardous Materials Information System and lack of awareness of sensitizing agents in the workplace contributed to delay in identifying work-relatedness of asthma.

Determining a safe level

- Ontario Regulation 833
  - Sets out specific occupation exposure limits
  - OEL compliance does not ensure safety for those with sensitizer-related issues
  - Sensitized workers can react to levels below the OEL

Summary

- Work-related asthma is not uncommon (10-25% of adult asthma) but is often unrecognized
- Tertiary prevention is challenging, but substantial morbidity can be averted with early recognition
- Secondary prevention should theoretically be effective
- Primary prevention is the ultimate goal: clearly requires engagement of workplace parties but is not without challenges