

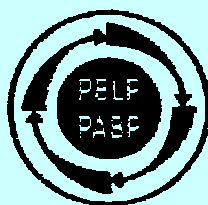
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**Practice Based Learning Programs (PBLP)
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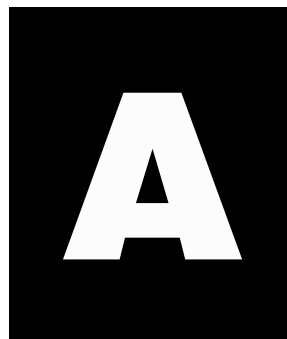
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**WORK-
RELATED
STHMA**

Work-related asthma is the most common *occupational* respiratory disorder in industrialized countries—with approximately 10% of all adult asthma attributed to workplace exposures. Early and accurate diagnosis, along with appropriate changes in the workplace, can make a significant difference—not only to the well-being of your patients but to that of their co-workers as well.

This module provides a practical framework for the diagnosis and management of work-related asthma. It is intended to help:

- ✓ screen for work-related asthma in all working adults with new-onset asthma or recent deterioration of existing asthma
- ✓ recognize and objectively diagnose work-related asthma
- ✓ provide optimum management to better control asthma symptoms, reduce or prevent workplace exposures and, where necessary, seek support for affected patients.

Note: While this module focuses on work-related asthma, leisure activities (e.g., hobbies) may also expose patients to sensitizers and irritants.

It is important to be aware that other serious respiratory illnesses (e.g., hypersensitivity pneumonitis), that are beyond the scope of this module, can also result from work-related exposure.

CASES

Case 1: Bill M., age 29, male

Bill has worked as a spray painter in an autobody repair shop for the past year. About 6 months after he started work there, he noticed that he would have a dry cough and chest tightness in the evenings after work. He sometimes will wake with these symptoms around 3 a.m.; he has no difficulty sleeping otherwise.

EDUCATIONAL MODULE

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Bill has a history of asthma as a child, and he is worried that the spray paint may have triggered its return. He has been careful to wear an air-supply respirator when spraying in the booth at work, but he does some spray painting each day on the shop floor with only a paper mask. Bill is a non-smoker. He does not identify any exposures to new irritants or substances outside of work.

Bill would like to be investigated, as he is not trained for any other work and would need support if he is required to change work for reasons of “occupational asthma.” A friend from work had similar symptoms, but he left the job before confirming a diagnosis objectively and his claim for worker’s compensation was denied for lack of evidence.

What further information would you need to confirm/deny potential work-related asthma? What objective evidence would you be requested to supply if there is a compensation claim?

Case 2: Maria V., age 47, female

Maria has been assessed by a respirologist and told that she has “baker’s asthma.” She and her husband operate an Italian bakery, that employs 3 other people part-time. For several years, she had been coughing at night and feeling short of breath during the day for no obvious reason, as her health was otherwise fine. She had been treated with inhalers and pills for asthma but they didn’t help very much.

After her diagnosis, she realized that when she got away from the bakery, especially for a few weeks, her symptoms cleared up and she didn’t even need her inhaler. She understands that if she quit the bakery, she would be much better physically, but financially that’s not a real option for her and her family. She’s tried using a dust mask that maybe helps a little. She’s wondering if there’s a better respirator that she could use.

How would you advise Maria? What would be your obligation to other workers at the bakery?

Case 3: Jim F., age 42, male

Jim is a machine operator employed in a large automotive machining operation. He has a history of mild asthma, that has been well controlled with daily inhaled corticosteroid (Flovent® 250 mcg bid). However, he is concerned about his risk of worsening his asthma at work. His fellow workers and the union have been anxious, because many people at the plant

are said to be using puffers and a few have developed serious respiratory symptoms. One of his fellow employees was told he had developed “occupational asthma”; others have left the plant and are having trouble finding a reasonable job.

Jim’s work involves precision grinding of parts. In the process, coolants (also known as metalworking fluids) are used. A fine mist of these substances is often noticeable in the air at work.

How would you counsel Jim about his risk of work-related asthma? What approach would you take with Jim?

Case 4: George W., age 50, male

George has been a wheat farmer all his life. Over the past few years, he has been noting an increasing tendency toward cough, undue shortness of breath and wheezing—especially when he shovels wheat, even outdoors on the truck. Often he gets these symptoms in the evening after working, but he also notices them at other times.

He has been a smoker of a pack of cigarettes daily for 20 years. Other than this breathing trouble, he describes his health as excellent—although he does acknowledge a productive cough in the mornings for the past year or two.

A few years ago, his brother left grain farming and went into beef because of symptoms like the ones George has been having. His brother had a skin test for grain dust extract but it was negative. George loves the farming life, and he has managed to save a little money. He wants your advice about what he can do to continue wheat farming.

How would you assess George clinically? What are the prospects for George continuing as a wheat farmer and how might he do this?

INFORMATION SECTION

BACKGROUND

Classification

1. Work-related asthma is classified into the following categories:
 - ***Occupational asthma:*** new-onset asthma that is directly *caused* by exposure to an agent in the workplace.¹ Occupational asthma is then further categorized into two forms, distinguished

by a latency period from initial exposure to symptom onset:

- a. *Sensitizer-induced (allergic)*—occurs after a latency period, which can be as short as several weeks or as long as 30 years.⁴ Over 90% of occupational asthma cases fall into this category.^{1,2}
 - b. *Irritant-induced* or reactive airways dysfunction syndrome (RADS)—usually occurs immediately after single or repeated exposures to non-specific irritants at high concentrations.^{1,2,5,6}
- **Work-aggravated asthma:** pre-existing or concurrent asthma that is *aggravated* by workplace exposure to irritants.^{2,3}
2. Although it is important to understand the categorization, differentiating these different types of work-related asthma is often a very difficult task—even for specialists in this area.

Epidemiology

3. The incidence of asthma is on the rise. From 1994-2001, there was a steady increase of new cases of asthma among Canadians aged 20-75+ years, with incidence peaking in those aged 35-44 years. This increase during the working lifespan *may* be associated with work-related asthma.⁷
4. A recent Canadian survey found the prevalence of asthma (adults currently using asthma medication) to be 4-6% for men and 5-10% for women (age 22-44).⁸
 - a. A review and synthesis of the literature (1966-1999) found that 10% of all cases of adult asthma are attributed to workplace exposures, including new onset disease and reactivation of pre-existing asthma.⁹
 - b. In a typical family practice of 2000 patients, at least 10 patients would have work-related asthma.
5. Current prevalence figures may be significantly underestimated, however, because of low recognition and reporting rates.
 - a. A US survey of adults with asthma found that only 15% of medical records indicated that primary care physicians asked about work-related symptoms.¹⁰
 - b. In a controlled study of new apprentice machinists exposed to aerosolized metal working fluids, *none* of the apprentices who developed new symptoms or had significant increase in airway responsiveness were diagnosed with occupational asthma."¹¹
6. Surveillance of work-related asthma in four US states (1993-1995) found that 80.9% of cases were classified as new-onset asthma and 19.1% as work-aggravated asthma.¹²
7. The most common industries implicated in work-related asthma include transportation equipment manufacturing (19.3%), health services (14.2%), and educational services (8.7%), with the specific occupations of operators, fabricators and labourers associated with the highest percentage (32%) of work-related asthma overall.¹² See Appendix 1 for a more complete listing of high-risk industries and occupations.

CAUSES/RISK FACTORS

Occupational Asthma

Sensitizer-induced (allergic)

8. More than 250 agents are known to cause sensitizer-induced occupational asthma, and the list continues to grow each year.³ These agents often are sub-divided based on molecular weight.⁴ (See Appendix 1 for a list of sensitizers.)
9. Western red cedar is a common cause of occupational asthma on the west coast of North America; worldwide, isocyanates and flour are the most common causes, with latex becoming important in recent years.¹³
10. The role of metalworking fluids as a cause of sensitizer-induced asthma has been controversial. While it is unclear which components of metalworking fluids are responsible, studies have shown that workers exposed to these fluids experience symptoms that suggest work-related asthma.^{12,14} A 2-year longitudinal study found that the average change in bronchial responsiveness in machinists exposed to metalworking fluids was double that of control subjects, and these machinists were more likely to have developed asthma-like symptoms.¹⁴
11. Added to sensitizer-exposure risks (as outlined above) are other risk factors for the development or aggravation of asthma:¹⁵
 - atopy and aeroallergen exposure
 - cigarette smoking
 - co-existing respiratory infections
 - multiple medications including beta-blockers and nonsteroidal anti-inflammatory drugs (NSAIDs)
 - susceptibility genes

Irritant-induced

12. This type of occupational asthma is typically caused by high-level, accidental exposures to agents that are non-specific (e.g., sulfur dioxide, nitrogen dioxide, chlorine gas, ozone and ammonia).⁶

Work-aggravated Asthma

13. Exposure to workplace irritants (see Appendix 1) or exertion at work may aggravate pre-existing or concurrent asthma, particularly in patients who have moderate or severe asthma, or who are uncontrolled because they are not receiving optimal treatment.²

DIAGNOSIS OF WORK-RELATED ASTHMA

14. The diagnosis of work-related asthma can be complex and, where possible, early referral (while the patient is still employed) to a specialist in occupational lung disease is recommended (Level 3A and consensus). However, testing can be initiated by family physicians—especially if referral is not possible or will be delayed.¹⁶

Note: Even in areas where referral to a respirologist is feasible, respirologists will have varying levels of interest and/or experience in managing work-related asthma.

15. “Unless the patient’s asthma is severe and cannot be controlled, the primary care physician should advise the patient *not* to stop working until the diagnosis has been confirmed.”²

Step 1. Be Suspicious

16. The most important first step in diagnosing work-related asthma is to suspect it in all working adults with new-onset symptoms of asthma or recent clinical deterioration in known asthma.⁴

Step 2. Confirm Asthma⁴

17. The diagnosis of asthma should be objectively confirmed (or refuted) by airway function tests, including:¹⁷

- spirometry— $\geq 12\%$ improvement in FEV₁ from baseline after administration of a bronchodilator is significant **OR**
- peak expiratory flow (PEF)— $>20\%$ daily PEF variation (morning and afternoon, pre- and post-bronchodilator) is significant
- airway hyperresponsiveness to methacholine inhalation challenge—PC20* <16 mg/ml is typically considered diagnostic of asthma, although false positives may occur in the range

of 4-16 mg/ml. False positives are rare when PC20 <4 mg/ml.

* PC20—the concentration of methacholine required to reduce FEV₁ by 20%.

18. Ideally, these investigations are scheduled while the patient is still employed, and performed within 24 hours of his/her usual work exposure— preferably at the end of a work-week or similar period in the workplace. A diagnosis of work-related asthma is virtually ruled out by normal results, particularly to the methacholine challenge,² unless the test has been performed after a period away from work.

Step 3. Determine if asthma is work-related⁴

19. A thorough medical history is needed to confirm the association between symptoms and the patient’s workplace. Establish:¹⁵

- upper and lower respiratory complaints before and after workplace exposures
- nature and time of symptom onset during and after exposure
- occupational exposures (see below)
- non-occupational exposures (e.g., smoking or hobby-related exposures)

20. It is recommended that an extensive review of all previous employment and work-relatedness of exposures be documented.⁴ However, this may not be feasible in family practice. The following simple detection maneuver may be used:¹⁸

- Is there anything at work that may be causing your symptoms?
- Do your symptoms change according to your work schedule?

Providing a work history questionnaire to patients may be a time-efficient way to “flesh out” an employment history. See first patient information sheet at end of module for a sample questionnaire.

21. Familiarity with common sensitizers/irritants and high-risk occupations/industries can help you to ask patients specific questions about occupational exposures.^{3,15}

- a. Many patients may be unaware of their workplace exposures, so it will be essential for them to obtain material safety data sheets (MSDSs) from their workplace. “Employers are required to have MSDSs on site for any hazardous material that accounts for 0.1% or more of any workplace substance.”^{19,20}
- b. Additional agents are identified each year and may not be listed on MSDSs.¹⁹

22. The following factors *suggest* the presence of work-related asthma:^{3,4,16}

- a. symptoms that worsen at work (or in the hours immediately after work) and improve when away from work (e.g., weekends, holidays), although this pattern can change with disease progression (see box below)
 - b. symptom onset following exposure to high concentrations of workplace irritants
 - c. known exposure to a causal agent (See Appendix 1)
 - d. co-workers with similar respiratory tract symptoms
23. A normal physical examination does not rule out a diagnosis of work-related asthma, due to the lack of sensitivity of physical exam and the intermittent nature of asthma.¹⁵

The pattern of off-work symptom improvement usually occurs only in the early stages of work-related asthma, and prolonged exposure may alter this pattern. "A common misconception of clinicians is to assume that because symptoms don't improve away from work, the asthma must not be work-related...Exposure of an asthmatic patient to an agent that is known to cause asthma should be considered sufficient to trigger further investigation of cause, even in the absence of a clear "work-related" pattern of symptoms."³

24. In the primary care setting, serial peak flow monitoring is the most practical and inexpensive way to determine the impact of workplace exposure on airway obstruction.¹⁵
- a. Peak flow changes at work versus off work are more sensitive than shifts in methacholine PC20. Therefore, peak flow monitoring as well as methacholine tests (when available) are useful for assessment.
The patient must record PEF rates 4 times per day, *and* complete symptom and medication diaries during periods on and off work. (See patient information sheet, "Peak Flow Diary", at end of module.) Ideally, asthma medication is kept at stable, regular doses to control but not completely suppress symptoms.²
 - b. Limitations of peak flow monitoring include lack of standardized method of interpretation, uncertain reliability and poor patient compliance.^{2,4} In one study of peak flow monitoring, over 40% of subjects demonstrated poor compliance and fabrication of results.²¹
Where feasible, referral to a respirologist can facilitate accurate interpretation of PEF results.

Step 4. Determine if the workplace exposures are causing or aggravating asthma⁴

25. Distinguishing irritant-induced occupational asthma (reactive airways dysfunction syndrome [RADS]) from other work-related asthma is relatively straightforward, as it is typically characterized by an high-level (often accidental) exposure to a workplace irritant* that usually requires immediate medical attention. Symptom onset and duration, and history of asthma aid the diagnosis.^{4,22} (See Appendix 2.)
- * The "workplace irritant" is an agent that, in low concentrations, causes only irritation, but in high-level exposures is inflammatory (which causes RADS).
26. Differentiating sensitizer-induced occupational asthma from work-aggravated asthma is more difficult. Although history of symptom onset and relation to work schedule is helpful, objective investigations are required to make a diagnosis.^{2,4}
- a. Serial PEF measurements may not differentiate these two forms of work-related asthma (see Appendix 2).
 - b. Methacholine challenges at the end of a work week and again after a period away from work (at least 2 weeks in duration) may be more helpful (see Appendix 2). A threefold or greater decline in methacholine responsiveness after a period away from work strongly suggests occupational asthma, rather than aggravation of asthma. However, no change (or a less significant change) does not exclude occupational asthma, since hyperresponsiveness may persist for several months or years.²
 - c. Consultants may arrange other special investigations:
 - i. Specific challenges with workplace agents can provide a more definitive diagnosis, and is considered the gold standard for establishing a causal relationship between workplace exposures and asthma symptoms. However, this testing is not widely available.¹⁶ (Level 3A evidence)
 - ii. Induced sputum cell counts, done at the same time or after the methacholine challenge, can demonstrate a work-related eosinophilia in occupational asthma. However, reliable measurements are currently available for clinical use only at specialized respirology centres.
27. Skin testing or other immunological tests with most workplace allergens are of limited diagnostic value—they are generally not available or are poorly

standardized, and can be difficult to interpret¹⁶ (Level 3A evidence).

While a positive skin test suggests a diagnosis of occupational asthma if accompanied by appropriate pulmonary function changes, it is not diagnostic as a sole investigation.¹³ Skin tests should be performed when the exposure is to known allergens, particularly high molecular weight agents such as animal proteins and flour. A negative test is against the presence of sensitization but does not exclude sensitization if the extract used is of poor quality or is not of the allergen responsible.

MANAGEMENT (see Appendix 3)

28. The main components in management of work-related asthma are: (1) treat the asthma per usual guidelines, (2) address workplace exposure, and (3) initiate compensation claim.

Treat the Asthma

29. Current evidence-based guidelines for management of asthma are available, and they are equally applicable to work-related asthma.^{23,24}

30. Because asthma symptoms (and the patient's assessment of control) correlate poorly with the level of airway obstruction, the use of peak flow meters can provide a simple and effective way to monitor this condition.²⁵

Strategies to Reduce Workplace Exposures

31. In patients with *sensitizer-induced* occupational asthma, the **best** medical prognosis is achieved with early and complete removal from the causal agent.^{16,19} (Level 2A evidence)

- a. Unfortunately, studies indicate that 50-60% of these patients may not fully recover despite removal from the workplace exposure.^{3,15}
- b. Studies also have shown that attempts to reduce asthma severity by early removal of individuals from their workplace often results in a decline in socioeconomic status.^{3,26} However, reassignment to a low-exposure area within the workplace may be possible for some patients.

32. Occupational hygiene measures can reduce or, better yet, prevent workplace exposures to irritants and sensitizing agents. These measures include:^{2-4,6,19}

- health and safety education
- better containment and handling of agents
- elimination of the offending agent (if possible)

- improved engineering controls (e.g., ventilation, enclosures)
- use of respiratory masks (can be useful for short periods but are not recommended for continuous exposure, because respirators are uncomfortable and cumbersome to wear for long periods)

33. If reducing exposure is not readily achieved or straightforward, then consultation is recommended with an industrial hygienist, who is trained in the identification, measurement and control of workplace exposures.⁶ Referral to an occupational medicine clinic may be needed, as most occupational health clinics have an industrial hygienist on staff (see Appendix 4 for contact details).

Setting up a workplace assessment is usually beyond the purview of a family physician, and even an industrial hygienist cannot assess a workplace without the company's consent. However, the family physician or patient can initiate the process by contacting the workplace (for example, management or worker member of the health and safety committee) and indicating that an assessment of the relevant workplace exposures and controls is desired. Pertinent information on types and levels of exposures may have already been gathered. If not, it may be necessary to gather it by contacting:

- the company's hygienist or hygiene consultant (if there is one)
- Ministry of Labour
- other services (e.g., Occupational Health Clinics for Ontario Workers)

Note: There is no cost to the patient or employer for workplace assessments and other services provided by provincial ministries or occupational health clinics.

34. Occupational hygiene measures (above), when combined with appropriate pharmacologic therapy, typically allow workers with irritant-induced occupational asthma or work-aggravated asthma to return to work. For patients with sensitizer-induced asthma, these measures "may be the only practical alternative to prolonged unemployment when the possibilities for alternative jobs are limited, or when a career depends on continuing a particular type of work."¹⁹ Studies investigating the long-term effects of reducing exposure to the causal agent show that "asthma remained stable or improved in 68%, and worsened in 32% of workers who remained exposed to 'lower' levels of the offending agent."¹⁹

Diagnosis of sensitizer-induced occupational asthma should be considered a "sentinel event." Collaborative efforts should be undertaken with the company, union and occupational physicians to identify other workers who may have been exposed to the sensitizer, and to implement occupational hygiene measures to avoid or limit further workplace exposure.¹⁶ (Level 3A evidence) Similarly, identification of patients with asthma linked to high exposure to irritant agents should lead to appropriate workplace investigation and control strategies.

Compensation

35. When a diagnosis of occupational asthma has been made, and the patient is eligible to apply for workers' compensation, it is the physician's responsibility to initiate this claim with the patient's consent.¹⁶ (Level 3A evidence)
- Objective documentation that supports the diagnosis must be provided.¹⁶
 - Laboratories supplying the supportive data must conform to appropriate standards for the procedures.¹⁶

Note: In some areas, *work-aggravated asthma* also may be accepted for compensation if work days have been missed due to occupational exposure.^{2,16}

Practice Tip

For anything other than the most straightforward injury, compensation forms can be confusing and awkward to use. It may be preferable to write a short letter briefly describing:

- the exposure
- the asthma outcome and treatment
- the links between the exposure and outcome
- any relevant non-work-related information

Attach any pertinent consultation reports and investigation results. And be sure to mark "Re: Work-related Asthma Claim" at the top of the letter to ensure it reaches the people who can process the claim more quickly.

THE BOTTOM LINE

- Suspect work-related asthma in all working adults with new-onset asthma or recent clinical deterioration of pre-existing asthma.
- Objectively confirm diagnosis of asthma first; then determine if it is work-related.
- Promote exposure elimination/reduction for patient (and co-workers).
- Where appropriate, initiate compensation claims for patients (with their consent).

CASE COMMENTARIES

Case 1: Bill M., age 29, male

What further information would you need to confirm/deny potential work-related asthma?

Based on what Bill has said, it is quite possible that his symptoms are related to occupational exposure but additional history is needed to establish a closer link to work exposure. In the real case, Bill's symptoms were definitely worse at night after work, and he had no symptoms on weekends off work. He felt very well on a recent holiday (Info point 22). Asking Bill to complete "Your Work History" (patient information sheet) may be helpful. One of the issues is whether this is "occupational asthma" caused by a sensitizer at work (isocyanate exposure commonly occurs in spray painting) or "work-aggravated asthma" (especially if his childhood asthma had not completely resolved) [Info point 26, Appendices 1,2].

Objective testing with spirometry pre- and post-bronchodilator, serial peak flows (see box on next page) and/or methacholine challenge (timed appropriately with workplace exposure and with removal from workplace) also are needed—first to confirm asthma recurrence and then to determine its work-relatedness (Info points 24, 26). The timing of testing will depend on Bill's work schedule. For instance, if he works from Monday to Friday, the workplace relationship can be assessed by testing on Friday (at the end of the working week) and again after a minimum of 2 weeks off work (Info point 26b). Although a workers' compensation board may approve paid leave for patients who require this type of testing, usually these tests will need to be coordinated with holiday periods. Alternatively, you might consider applying for sick benefits for Bill for this purpose (see Appendix 3).

As patient compliance with peak flow monitoring can be poor (Info point 24b), it would be important to clarify Bill's willingness to collect the necessary information, and then instruct him about proper steps:

- Set the meter's scale to zero. Sit up straight or stand, and slowly take a big deep breath. Place the mouthpiece in your mouth, sealing your lips tightly around it, and blow as hard and quickly as you can.
- Read the scale (where the arrow points) and record the number. Repeat the process two more times, recording the highest of your three values in your diary card. Do not average the readings.
- Record PEF rates 4 times per day, *and* complete symptom and medication diaries during periods on and off work (e.g., weekends and holidays) (Info point 24).

It may be helpful to give the patient information sheet, "Peak Flow Diary" to Bill to reinforce proper use when he is at home.

What objective evidence would you be requested to supply if there is a compensation claim?

Providing evidence of an exposure-related response to the methacholine challenge and PEFs are the objective criteria for making a compensation claim. The results of skin prick tests for exposures are inconsistently related to asthmatic responses (Info point 27) and in-vitro tests for sensitization to diisocyanates and other substances are currently only research tests.

When submitting a claim, a short note (accompanying the results of the methacholine challenge and PEFs) usually will suffice. The note should include some documentation concerning the degree of his childhood airways hyperresponsiveness and the extent to which this had resolved. If it can be confirmed to have resolved, then Bill will have an easier time demonstrating that he has a new onset work-related asthma, rather than aggravation of pre-existing asthma.

In addition, some details concerning the nature and degree of exposure to sensitizers or irritants will be needed. These might be obtained from Material Safety Data Sheets and inspection or hygiene reports from the workplace. If the data gathering and interpretation become onerous, referral to an occupational medicine service might be considered.

Case 2: Maria V., age 47, female

How would you advise Maria?

As Maria has been diagnosed with sensitizer-induced occupational asthma, complete removal from the bakery (i.e., quitting) would provide the best health outcome for her (Info point 31). However, this is not likely an option for her from a financial standpoint.

Considering her workplace and how to reduce her exposures is the 'next best' approach. Several occupational hygiene control measures may be of partial benefit—such as improved ventilation and dust control (Info point 32). Perhaps Maria could be involved in a different portion of the work that didn't involve flour.

It would also be important to make sure that the patient's treatment is optimized (e.g., proper inhaler technique, doses of inhaled corticosteroid and long-acting beta agonist, etc.). Given that Maria will likely continue to work at the bakery in some capacity, she should be followed with spirometry (as well as reviewing her symptoms) to detect any worsening of her disease. If this occurs, further discussion about removal from the work environment would be indicated.

Another option may be a simple, disposable respirator that Maria might use for short periods in high exposures. These respirators can be purchased at safety supply stores, and at most larger hardware or drug stores. Unfortunately, respirators do not constitute a long-term solution, as they are uncomfortable and impractical to wear on an ongoing basis (Info point 32). Furthermore, respirators are unlikely to provide adequate exposure reduction if potent sensitizers are involved.

Consultation with an industrial hygienist is recommended (Info point 33). This person can inspect Maria's workplace, and talk to both of you about appropriate workplace changes. Industrial hygienists are associated with occupational health clinics (see Appendix 4). The Ministry of Labour or workers' compensation board (prevention services) may provide similar services.

However, none of these measures carry the same benefit as removal from exposure. It would be wise to periodically re-examine the possibility of Maria moving to a different work environment (without flour), as her asthma may become progressively worse if she stays in the bakery, even with reduced exposure to flour.

What would be your obligation to other workers at the bakery?

As Maria has been diagnosed with sensitizer-induced occupational asthma, it would be important to consider the possibility that her co-workers are affected as well. In general, the lower the exposure, the lower the

incidence of occupational asthma—so some cases of baker's asthma can be prevented (in those who are susceptible) if exposures are *very* low.

It would be appropriate to ask Maria: "Does anyone at work have symptoms?" While this is a good screen, keep in mind that some patients may be reluctant to talk about problems at work (see box below). Helping Maria and her husband to implement hygiene control strategies (as discussed above) will be important for the health of other workers.

Patients who have concerns about their work-related health often are reluctant to discuss them, as they fear losing their job or being penalized with harder work or loss of opportunities. However, you can often protect your patients' confidentiality **and** help resolve their occupational health concerns.

- Let patients know that you won't act without their permission or involvement, except if there are life-threatening hazards to themselves or others at work.
- Begin to address the work-related issue:
 - ▶ If health is not yet affected but there are exposure concerns:
 - (a) in a larger non-unionized workplace, it would be appropriate to ask the provincial health and safety agency to investigate and remediate.
 - (b) if the workplace is unionized, often the union can be helpful.
 - (c) if the workplace is small and without a union, there may be no alternative to disclosing your patient's identity to the workplace but with firm support from you and the provincial health and safety agency, if necessary.
 - ▶ If there are work-related health effects, your patient's reluctance to submit a claim is not usually tenable over the longer term because their condition may eventually require intervention. A recognized claim provides reasonable protection against arbitrary action by employers.

Case 3: Jim F., age 42, male

How would you counsel Jim about his risk of work-related asthma?

Although Jim is at increased risk of work-aggravated asthma given his personal asthma history (Info point 13, Appendix 2), there is controversy regarding any association between asthma and exposure to metalworking fluid (Info point 10). However, Jim may be exposed to other causal agents or known sensitizers in

the workplace (e.g., isocyanates, dyes and metals). Jim's company is required to provide a list (MSDS) of the chemicals used in the workplace (Info point 21).

While some co-workers have developed respiratory symptoms [which raises the index of suspicion for work-related asthma (Info point 22)], Jim presently perceives his asthma as being in good control. This would be an important time to order baseline spirometry and have Jim document his status by keeping a record of regular peak flow measurements (see patient information sheet, "Peak Flow Diary") and to ensure that his asthma management is optimal (Info points 29,30). He would be investigated for work-related asthma only if he develops work-related symptoms himself.

What approach would you take with Jim?

You might encourage Jim to call the local occupational clinic (see Appendix 4 for contact details) and ask about exposure control measures (Info point 32). For instance, work practice issues at his company may need improving:

- Does the company use high pressure hoses to clean up equipment? (This practice can disperse particulates.)
- What procedures are in place to maintain metalworking fluids? (These fluids can readily become contaminated with microorganisms.)

Ideally, an industrial hygienist would visit Jim's workplace and recommend appropriate changes (Info point 33). Cooperation of Jim's company and union in implementing exposure control measures would be important.

You might also suggest that Jim take the time to learn more about work-related asthma in his occupation. See Appendix 5 for a list of patient Internet resources.

If he developed a clinical picture of work-related asthma, it would be prudent to advise Jim not to leave his job until a definite diagnosis has been made (Info point 15), since co-workers, who have resigned, are having difficulty finding other employment.

Case 4: George W., age 50, male

How would you assess George clinically?

George's symptoms strongly suggest that he has airways hyperresponsiveness related to grain dust exposure (Info point 22). They also indicate that he may be developing chronic bronchitis or COPD. Spirometry would both rule out COPD and help confirm asthma (Info points 17,18). Additional investigation to determine

the relationship of his asthma to grain dust exposure is warranted (Info point 24). The seasonal nature of his work will facilitate investigation with a peak flow or methacholine challenge during and away from exposure. In addition to the pulmonary function tests, an x-ray would help rule out the possibility of hypersensitivity pneumonitis ("extrinsic allergic alveolitis").

Grain dust is complicated by factors such as contamination (e.g., fungi, bacteria, mites), making it difficult to identify the specific component responsible for asthma. Skin tests with grain dust extracts are frequently negative in asthma caused by grain dust, but they warrant being done with cereals and mites because, if positive, would strongly suggest occupational asthma.

George's exposure to wheat dust lasts a couple of months a year at most, but grain dust levels over 5 mg/m³ can cause decline in lung function comparable to that caused by smoking a pack of cigarettes daily. Periodic spirometry could detect decline in lung function in excess of that expected with age.

What are the prospects for George continuing as a wheat farmer and how might he do this?

He would be well advised to quit smoking as a first step.

For some aspects of the work, it may be possible to use an air supplied respirator system. However, use of regular face mask respirators is not feasible for George (Info point 32), because he works in season for several hours per day in grain dust exposure, usually under conditions of physical exertion and high temperatures. Consultation with an industrial hygienist is advisable (Info point 33). There likely are simple and inexpensive ways to move the grain with less direct exposure to dust and to ventilate indoor operations (Info point 32). An additional reason for reducing dust levels is to prevent dust-related explosion.

As an independent businessman, George is not required to take out workers' compensation coverage and he has not done so. Thus, he cannot look to financial support from this source if he cannot continue in wheat farming.

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While every care has been taken in compiling the information contained in this module, the Program cannot guarantee its applicability in specific clinical situations or with individual patients. Physicians and others should exercise their own independent judgement concerning patient care and treatment, based on the special circumstances of each case. Anyone using the information does so at their own risk and releases and agrees to indemnify The Foundation for Medical Practice Education and the Practice Based Small Group Learning Program from any and all injury or damage arising from such use.

Strength and Quality of Evidence

Categories for quality of evidence on which recommendations are made

- Level 1:** Evidence from at least one randomized controlled trial.
- Level 2:** Evidence from at least one well designed clinical trial without randomization, from cohort or case-control analytical studies, preferably from more than one centre, from multiple time series or from dramatic results in uncontrolled experiments.
- Level 3:** Evidence from opinions of respected authorities based on clinical experience, descriptive studies or reports of expert committees.

Category of strength for each recommendation

- A. Good evidence to support a recommendation for use.
- B. Moderate evidence to support a recommendation for use.
- C. Poor evidence to support a recommendation for use.
- D. Moderate evidence to support a recommendation against use.
- E. Good evidence to support a recommendation against use.

Adapted from:

Report on the working group for the Canadian Asthma Consensus Conference. A joint report from the Canadian Thoracic Society, Canadian Paediatric Society, Canadian Society of Allergy and Clinical Immunology, Canadian Association of Emergency Physicians, College of Family Physicians of Canada and Family Physician Asthma Group of Canada. *Can Respir J* 1996;3(Suppl B): B-448.

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Appendix 1. ETIOLOGIC AGENTS OF WORK-RELATED ASTHMA

| Category | Types of Agents | Examples of Related Occupations |
|--|---|--|
| High-molecular-weight sensitizers | <ul style="list-style-type: none"> • cereals • flour • animal danders/allergens • fish & shellfish • arthropods • wood • vegetables • plants (including natural rubber latex) • enzymes • pharmaceuticals | <ul style="list-style-type: none"> • bakers, millers, grain handlers, farmers • laboratory workers, animal handlers • seafood processing workers • carpenters • detergent workers • carpet makers • pharmaceutical workers • health care workers |
| Low-molecular weight sensitizers (generally defined as < 1 kilodalton) | <ul style="list-style-type: none"> • chemicals (e.g., solder fluxes, dyes, diisocyanates, acid anhydrides, amines, plicatic acid) • metals (e.g., platinum, chromium nickel) • drugs (e.g., antibiotics) | <ul style="list-style-type: none"> • manufacturers of plastics, rubbers or foam • workers using surface coatings (plastics, epoxy resins) • spray painters, shellac and lacquer handlers • janitors, cleaners • textile workers • hairdressers • solderers, refiners • electronics workers • insulation installers • adhesives handlers • hospital staff • pharmaceutical, health professionals • forest workers, carpenters, cabinetmakers |
| Irritants | <ul style="list-style-type: none"> • dusts • fumes, gases • cold, dry air • smoke • sprays | <ul style="list-style-type: none"> • bakers, millers, grain handlers, farmers • janitors, cleaners • carpenters, cabinetmakers • bartenders • hairdressers |

Sources: Balkissoon R, Newman LS. Occupational Asthma. *Med Gen Med* 1999; 1(3); Montanaro A. The Difficult Asthmatic. *Occupational Asthma. Immunology and Allergy Clinics of North America* 2001; 21(3); Tarlo SM, Boulet LP, Cartier A, Cockcroft D, Cote J, Hargreave FE et al. Canadian Thoracic Society guidelines for occupational asthma. *Can Respir J* 1998; 5(4):289-300. PMID:9753529.



Appendix 2. HISTORY AND INVESTIGATIONS: TYPICAL FEATURES*

| Feature | Sensitizer-induced Occupational Asthma | Irritant-induced Occupational Asthma | Work-aggravated Asthma |
|---|--|--|---|
| History | | | |
| Symptom onset | <ul style="list-style-type: none"> during working life | <ul style="list-style-type: none"> within 24 hours of exposure (and lasting at least 12 weeks) no previously documented asthma or other chronic lung disease | <ul style="list-style-type: none"> before or during working life |
| Relation to work schedule | <ul style="list-style-type: none"> worsens during or after shift diminishes when away from work (evenings, weekends, holidays) | <ul style="list-style-type: none"> not applicable (N/A) | <ul style="list-style-type: none"> worse while at work |
| Workplace exposure | <ul style="list-style-type: none"> exposure to known sensitizer | <ul style="list-style-type: none"> exposure to large quantities of irritant | <ul style="list-style-type: none"> exposure to irritants (e.g., smoke, dusts, fumes)[†] |
| Investigations | | | |
| Serial PEF monitoring | <ul style="list-style-type: none"> worse during work periods than when off work | <ul style="list-style-type: none"> N/A (unless irritant is also a sensitizer)[‡] | <ul style="list-style-type: none"> worse during work periods than when off work |
| Non-specific (methacholine) challenge | <ul style="list-style-type: none"> results worse at end of work week than at end of holiday period | <ul style="list-style-type: none"> N/A (unless irritant is also a sensitizer)[‡] | <ul style="list-style-type: none"> no difference between periods on and off work |
| Sputum cell counts | <ul style="list-style-type: none"> eosinophilia at work | <ul style="list-style-type: none"> uncertain (probably intense neutrophilia)[‡] | <ul style="list-style-type: none"> possible trivial nonspecific neutrophilia |
| Specific challenges with suspected workplace agent(s) | <ul style="list-style-type: none"> positive response | <ul style="list-style-type: none"> N/A (unless irritant is also a sensitizer)[‡] | <ul style="list-style-type: none"> negative response |

† The mechanism of work-aggravated asthma is one of irritation, not (usually) of sensitization. Sensitization generally (but not always) occurs at levels of exposures to the sensitizer that are not irritating.

‡ Some agents, such as diisocyanates, can act as an irritant to cause asthma during high-level accidental exposure, but, at the same time, may sensitize the patient so that they respond in the same way as sensitizer-induced asthma (with worsening of asthma on even low exposures of diisocyanates).

* Adapted from: Tarlo SM, Liss GM. Occupational asthma: an approach to diagnosis and management. *CMAJ* 2003;168(7):867-871.



Appendix 3. MANAGEMENT*

| Feature | New Onset Asthma | | Pre-Existing Asthma |
|----------------|---|--|--|
| | Sensitizer-induced Occupational Asthma | Irritant-induced Occupational Asthma | Work-aggravated Asthma |
| Symptoms | Treat asthma as per Canadian guidelines (Info point 29) (Level 3A evidence) Note: Pharmacologic treatment is not as effective in preventing lung function deterioration if patient remains exposed to causal agent.** | Treat asthma as per Canadian guidelines (Info point 29). | Improve asthma treatment: <ul style="list-style-type: none"> • limit/minimize exposure to environmental allergens and non-occupational irritants (Info point 32) • optimize pharmacotherapy • educate patient about drug use and compliance |
| Exposure | <u>Prevent</u> further exposure to workplace agent: <ul style="list-style-type: none"> • if asthma controlled, advise patient not to give up job until claim decision is made • if asthma not controlled, patient should be off work on sickness benefits pending decision (Level 3A evidence, consensus) | Patient may be able to remain in job, but measures should be taken to eliminate risk of further exposure of high-inhaled concentrations of irritant. (Info point 29) (Level 3A evidence) | Patient may be able to remain in job, but measures should be taken to reduce exposure to triggers (Info point 32). |
| Compensation | Initiate compensation claim after the diagnosis is objectively confirmed. | Initiate compensation claim. | Initiate compensation claim if days missed due to workplace exposure. This is done only if the exposure has been excessive and the asthma is otherwise controlled. |
| Other measures | Identify if other workers are also at risk. If your patient and others remain at risk, initiate remediation through the workplace, consultants or other resources (if not underway). If the patient has to be off work during the investigation, apply for sick benefits. | Identify if other workers are also at risk. If your patient and others remain at risk, initiate remediation through the workplace, consultants or other resources (if not underway). | Identify if other workers are also at risk. If your patient and others remain at risk, initiate remediation through the workplace, consultants or other resources (if not underway). |

* Adapted from: Tarlo SM, Liss GM. Occupational asthma: an approach to diagnosis and management. *CMAJ* 2003;168(7):867-871.

** Tarlo SM, Vandenplas O. VIII Diagnosis and Management of Occupational Asthma. In Proceedings of the First Jack Pepys Occupational Asthma Symposium). *Am J Respir Crit Care Med* 2003; 167:450-471.



Appendix 4. OCCUPATIONAL HEALTH CLINICS

The Association of Occupational and Environmental Clinics

Their website lists clinics across Canada, as well as the US: <http://www.aoec.org/ClinList.htm>
Phone: 1-888-347-AOEC x2632

The Canadian Centre for Occupational Health and Safety

Provides lists of clinical and occupational health resources in Canada

Website: www.ccohs.ca

Phone: 1-800-668-4284 (toll-free in Canada and USA)

1-905-570-8094

Fax: 1-905-572-2206

In addition to those clinics listed on these websites, there are also:

McMaster Occupational Health Clinic

1200 Main Street West, Hamilton, ON L8N 3Z5 (905 525 9140 x22333)

LAMP Occupational Health Centre

185 Fifth Street, Etobicoke, ON M8V 2Z5 (416 252 6471)

Occupational Lung Disease Clinic, Toronto Western Hospital

399 Bathurst Street, Toronto, ON M5T 2S8 (416 603 5177)

St. Michael's Occupational Health Clinic

30 Bond Street, Toronto, ON M5B 1W8 (416 864 5074)

Alberta Workers Health Center

111-10451 170 Street, Edmonton, Alberta T5P 4T2 (780 486 9009)

There are also other academically-affiliated agencies that may provide clinical services, such as the **Institute of Agricultural Rural and Environmental Health** at <http://iareh.usask.ca/>

The following websites provide information about governmental agencies, most of which have local offices.

<http://www.canoshweb.org/en/programs.html>

<http://www.canoshweb.org/en/map.html>

In some regions, compensation boards and the ministry of labour also cover some of these functions.

Haz-Map is a relational database of hazardous chemicals and occupational diseases available on the internet at <http://www.haz-map.com/OA.htm>; it provides a brief overview of occupational asthma and the chemical and biological agents associated with occupational asthma.



Appendix 5. INTERNET RESOURCES FOR PATIENTS

Occupational Safety and Health Association (OSHA)

<http://www.osha.gov/SLTC/occupationalasthma/>

OSHA is part of the U.S. Department of Labour. Its mission is to ensure safe and healthful workplaces in America. A portion of its website focusses in on Safety and Health Topics. The occupational asthma section pinpoints what OSHA standards apply, what occupational asthma is and what are the health effects, possible workplace solutions, and where to find additional information.

American Academy of Allergy, Asthma, and Immunology

<http://www.aaaai.org/patients/publicedmat/tips/occupationalasthma.htm>

The AAAAI is the largest professional medical specialty organization in the United States, representing allergists, asthma specialists, clinical immunologists, allied health professionals, and others with a special interest in the research and treatment of allergic disease. This web-site contains information for patients, consumers and professionals including handouts, surveys, medication guides, research findings, and where to find a specialist.

American Lung Association

<http://www.lungusa.org/asthma/astoccasthm.html>

The American Lung Association is the oldest voluntary health organization in the United States. The web-site contains information on all forms of lung disease, with special emphasis on asthma, tobacco control and environmental health. Other sections include occupational health, air quality, living with lung disease, school programs, and research and statistics.

Haz-Map (database of hazardous chemicals and occupational disease)

<http://www.haz-map.com/OA.htm>

Haz-Map web-site is a relational database of hazardous chemicals and occupational diseases. It provides a brief overview of occupational asthma and the chemical and biological agents associated with occupational asthma.

HE&W Distance Learning in Occupational Medicine and Occupational Hygiene

<http://www.agius.com/hew/resource/ocasthma.htm>

The HEW (Health, Environment and Work) web-site is developed by the Center of Occupational and Environmental Health at the University of Manchester, England. It provides many academically based educational resources (also available as FAQs), a search facility, as well as well examined and updated 'links' relating to Occupational and Environmental Health and Medicine. This site focusses on primary, secondary and tertiary prevention, health surveillance, case studies, research and links.

Cambrian College

<http://homepages.cambrianc.on.ca/johs/pages/Asthma.htm>

Cambrian College, in Sudbury, Ontario provides an overview of occupational asthma including definition, symptoms, medical tests, treatment, prevention, where to go for help, and references.

InterAsma

<http://Asmanet.com>

InterAsma, a non-profit organization that operates world-wide, has created the AsmaNet. The aim of the AsmaNet is to develop and broaden the basis of knowledge about asthma by promoting person-to-person contact using modern means of communication, such as the Internet. This server has been designed, in both French and English, as an Occupational Asthma diagnostic tool for doctors dealing with asthma in the workplace. It is an html-based relational database consisting of asthma cases, each one being described by a special form. Each occupational asthma case can be retrieved either directly from the list of all cases, or by the name of a specific agent causing occupational asthma, or according to the type of job patient is performing. The best place to start is: <http://www.remcomp.com/asmanet/asmapro/asmawork.htm>



Your Work History

By completing this sheet, you will help your doctor to identify substances at work that may be causing a work-related problem (like asthma) or making it worse.

Name:

Date you completed this form: (day/month/year)

Current job title/occupation and company name:

Length of time in current job:

Are you a smoker? No Yes

What have you been exposed to in your workplace? (It is important to include substances in your work area—whether you use them yourself or co-workers use them.)

- | | |
|------------------------------------|---------------------------|
| G Fumes | Please describe: |
| G Dust | Please describe: |
| G Chemicals | Please describe: |
| G Solvents | Please describe: |
| G Pesticides | Please describe: |
| G Animals | Please describe: |
| G Cigarette smoke (second hand) | Please describe: |
| G Other → | Please list and describe: |

Note: You may need to ask for material safety data sheets for all chemical compounds that you use or that are used in your work area.



PEAK FLOW DIARY

Peak Flow Meter

A peak flow meter measures how fast you can blow air out of your lungs. It is a useful tool for checking your lung function, and helping to find out if your symptoms are related to your workplace.

How To Use

- Set the meter’s scale to zero.
- Sit up straight or stand. (Do it the same way each time—*either* sitting or standing.)
- Take as *deep a breath* as possible and then put the mouthpiece in your mouth.
- Blow out as hard and quickly as you can.
- Read the scale (where the arrow points) and record the number.

Perform these steps 2 more times and record the **highest** reading in your diary card. Do **not** average the readings. Record your peak flow rates 4 times a day.

It is important to use the same peak flow meter each time, as peak flows will vary from device to device. Many types of monitors are available and can be purchased from oxygen supply companies and some pharmacies.

Other Information

Be sure to complete symptom and medication diaries when you’re working and when you’re off work (e.g., weekends and holidays). Along with your peak flow rates, this is vital information that can help your doctor determine if your asthma is work-related.

| Date | Medications | Symptoms | Peak Flows | |
|------|-------------|----------|------------|-----------------|
| | | | Time | Highest Reading |
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Adapted from: Asthma Management: Home Peak Flow Monitoring. Lung Association.
www.lung.ca/asthma/manage/peakflow.html

