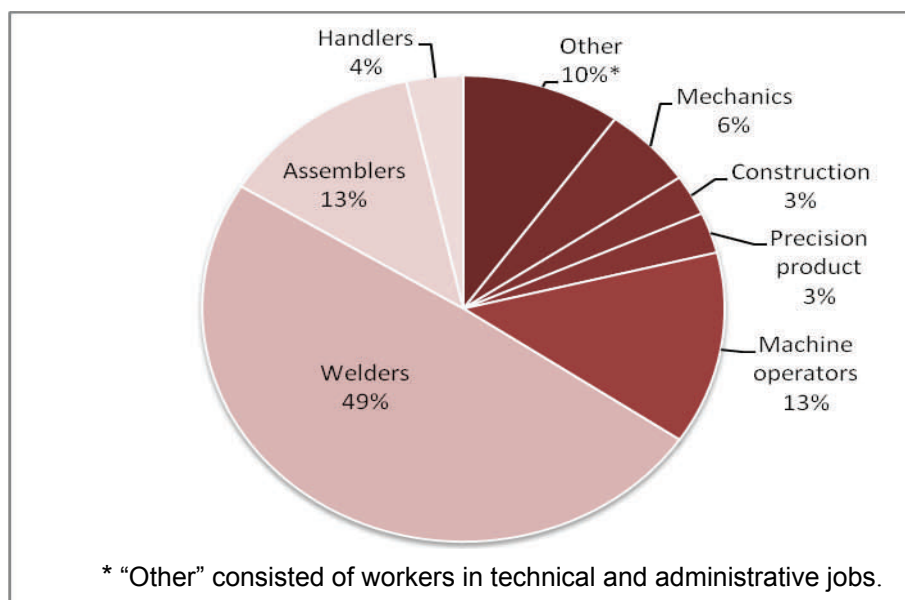


ASTHMA AND WELDING

Welding fumes are the fifth leading cause of work-related asthma (WRA) reported in Michigan, with 142 (5.4%) of the reported cases associated with exposure to welding fumes. More than 15,000 welders are employed in Michigan. The process of joining pieces of metal at a point that has been made soft by heating is referred to as welding. Depending on the type of metal being welded, the welding electrode being used, and the welding technique, different types of fumes and particulates are released. In addition to classic welding, brazing and soldering involve melting a filler metal with a lower melting point than the metal being fused, rather than the adjacent edges of the metal being joined. Welding can occur in a highly industrialized setting such as automobile manufacturing where there are 1,000 welds per car, or on an intermittent basis in other industries such as construction or farming, performing activities such as equipment repair.

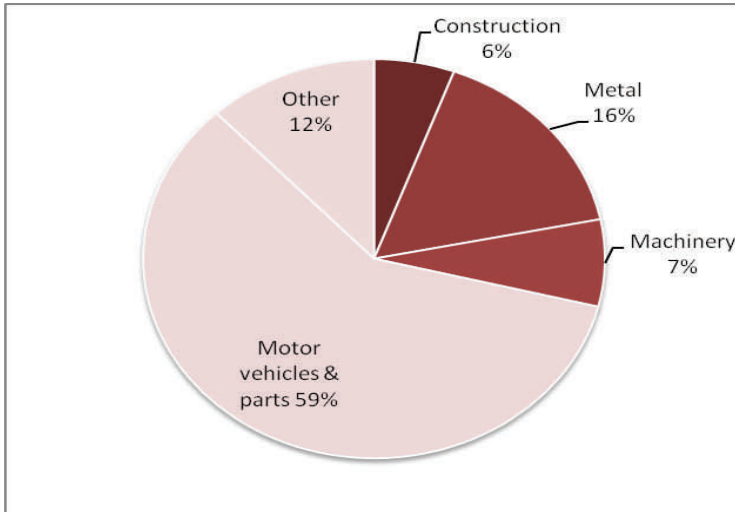
Ninety-four (66.2%) of the reported Michigan welding-related asthma cases were men and 93 (65.5%) were Caucasian. Half (72, 50.7%) were non-welders but worked around welding fumes (Figure 1).

Figure 1. Job Designation of Workers with WRA associated with Exposure to Welding Fumes



The non-welders were either assisting the welders or considered themselves machine operators even though they were operating a welding machine or were engaged in other activities such as assembling in the same environment. In this group, females with WRA from welding fumes were more likely to be classified as 'non-welders'. In addition, 59% of the individuals had worked in car manufacturing but many other industries were also represented (Figure 2).

Figure 2. Industry of Workers with WRA associated with Welding Fumes



These findings highlight the importance of taking a detailed occupational history beyond a simple job title and industry classification for individuals working in an environment where welding is performed, and considering welding fumes as a possible cause of WRA among non-welders.

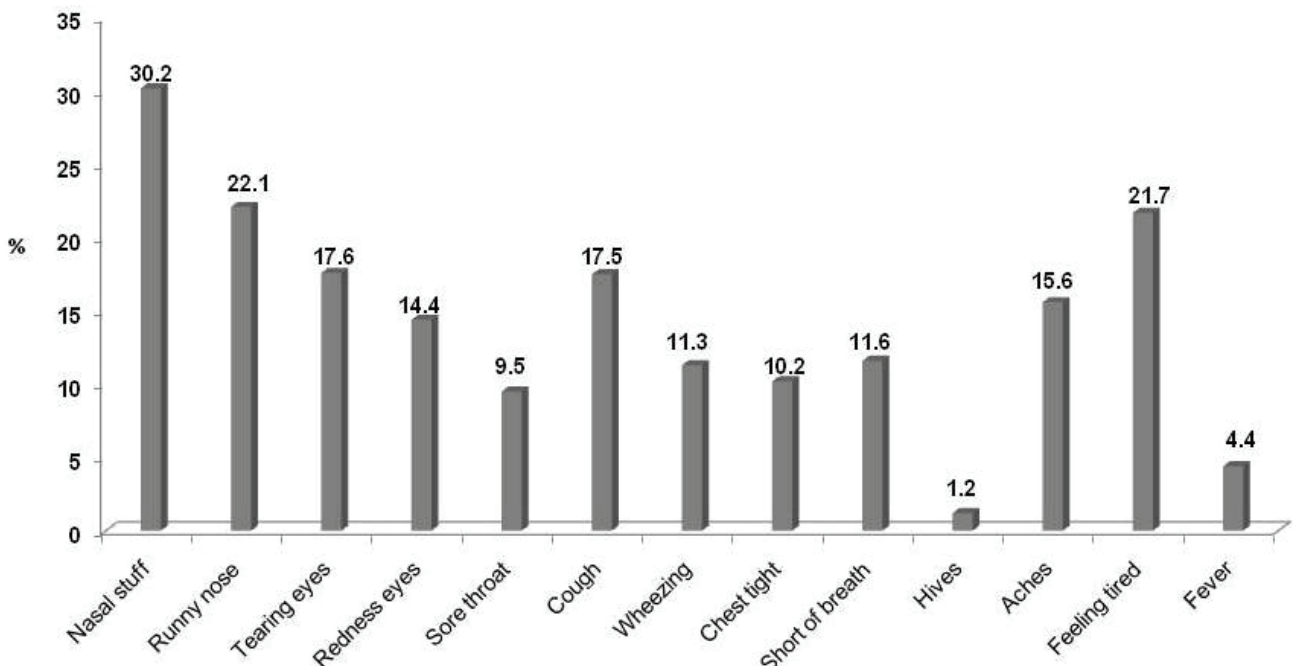
The median duration from the start of respiratory symptoms to when an individual was diagnosed with WRA was three years. This long lag time illustrates the lack of recognition of the association of welding fume exposure with WRA.

The duration between beginning exposure to welding fumes and development of symptoms was highly variable, ranging from within the first year to more than 40 years, with a median of 7 years. This long latency period is suggestive that the pathophysiological mechanism is repeated irritation of the lungs and is consistent with our findings that 129 (91%) of the cases were associated with non-stainless steel welding; no allergen has been identified as yet for this type of welding. In contrast, stainless steel welding produces fumes containing chromium and nickel, which are two well documented allergens.

In a separate initiative, welding exposures were assessed in 71 companies where 720 welders (age 38.6±10.5 years; 82% men) completed questionnaires. The major types of welding identified in these 71 Michigan companies were arc welding and resistance welding.

The 720 welders reported frequent irritation-type symptoms at work on a daily or weekly basis, with nasal symptoms being the most common (30.2%), and lower respiratory symptoms occurring daily or weekly at work in 10% of the welders (Figure 3).

Figure 3. Frequency of Daily or Weekly Symptoms among 720 Welders



Among these 720 workers, eye and lower respiratory symptoms were associated with arc welding while nasal, upper respiratory and systemic symptoms were associated with resistance welding (Table 1).

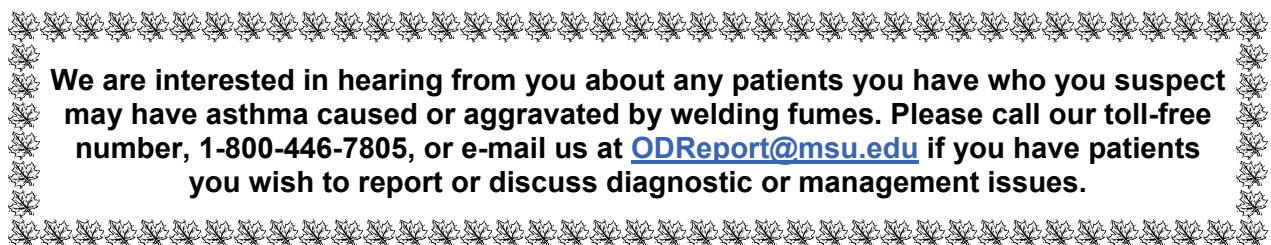
Table 1. Association of Various Symptoms with Different Welding Techniques

	Arc Welding RR (95% CI)	Resistance Welding RR (95% CI)
Nasal stuffiness	0.72 (1.01-.44)	1.79 (1.22-2.62)**
Runny nose	0.96 (0.68-.36)	1.97 (1.34-2.88)***
Tearing/burning of eyes	1.75 (1.24-.47)**	1.34 (0.93-1.93)
Redness of eyes	1.93 (1.35-2.76)***	1.18 (0.82-1.69)
Sore throat	1.08 (0.77-1.52)	2.12 (1.47-3.05)***
Cough	1.28 (0.92-1.79)	1.57 (1.09-2.26)*
Wheezing	1.49 (1.0-2.21)*	1.03 (0.69-1.54)
Chest tightness	1.58 (1.08-2.31)*	1.30 (0.88-1.90)
Shortness of breath	1.32 (.92-1.92)	1.39 (0.95-2.03)
Hives	0.94 (0.49-1.8)	1.87 (0.98-3.54)
Fever/sweats	1.15 (0.75-1.78)	1.70 (1.10-2.62)*
Chills	1.022 (0.65-.60)	1.82 (1.16-2.87)**
Aches all over	1.17 (0.82-1.67)	1.84 (1.27-2.66)**
Unusual tiredness	0.92 (0.65-1.29)	1.93 (1.34-2.78)***

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Air monitoring levels at the 71 companies showed that only 9 facilities had exposures that were above the allowable standard for either welding fumes or a specific metal component of the welding fumes. This finding highlights the fact that if a company's air levels are within the OSHA standard this does not preclude the development of symptomatic individuals.

The fumes produced from welding come from the metals being welded, the chemical fluxes that may be used to prevent oxidation and facilitate joining and coatings or the degreasing agents that may not have been properly removed from the metal before beginning to weld. The most important gases generated during welding are ozone, oxides of nitrogen, carbon monoxide and phosgene. All but carbon monoxide are irritants and may cause acute eye, mucosal and respiratory symptoms. Various metal particulates are released and may include aluminum, copper, magnesium iron, titanium and trace amounts of cobalt and lead. Welding metal coated with zinc (galvanized metal) releases zinc oxide which can cause work-related asthma. Asthma from exposure to zinc oxide fumes needs to be distinguished from a more common condition, metal fume fever, which is a flu-like illness that occurs within hours after exposure and clears within 24-48 hours, although it has been reported to last up to five days. Unlike sensitization to zinc, metal fume fever occurs in previously unexposed individuals or in someone who has not been recently exposed. Individuals repeatedly exposed to zinc oxide became tolerant and no longer experience flu-like symptoms.


We are interested in hearing from you about any patients you have who you suspect may have asthma caused or aggravated by welding fumes. Please call our toll-free number, 1-800-446-7805, or e-mail us at ODReport@msu.edu if you have patients you wish to report or discuss diagnostic or management issues.

*Project
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In this issue: v21n4: Asthma and Welding

*PS Remember to report all cases of occupational disease!

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