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## Paint and Pregnancy

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Many pregnant women are exposed to paint under a variety of circumstances. Medical health providers are often questioned about the potential risks of paint exposure to the developing fetus. This issue of the RISK||NEWSLETTER addresses paint exposure during pregnancy under different circumstances: recreational use, occupational exposures, and household exposures.

### CONSTITUENTS AND TYPES OF PAINT

A paint consists of pigment particles suspended in a liquid medium called, a “vehicle”. Pigments are almost always metal-based inorganic substances, including salts of lead, zinc, barium, magnesium, or aluminum. White or pastel paints usually contain titanium compounds that are replaced by other metals when a color change is desired (Gosselin et al., 1984). “Extenders”, also known as translucent pigments, are often added to improve the quality of paint appearance. Vehicles are derived from a variety of sources, such as natural oils and pure or synthetic resins. Examples of natural oils include soybean, castor, safflower, linseed and perilla. Copal, rosin, shellac, and manila are examples of resins derived from trees. Thinners, solvents (ethylene glycol and glycol ethers), rust inhibitors and biocides are often found in addition to the basic ingredients of paint (Scialli, 1989).

There are three broad categories of paint. Latex paints comprise the majority of those used for the household. They are commonly based on emulsions of polyvinyl acetate or acrylic resins, and can be thinned by water. Oil paints contain an alkyd resin or oil varnish. They are commonly thinned by mineral spirits, also known as petroleum distillates (Gosselin et al., 1984). Enamel paints are similar to oil paints, except with more vehicle and smaller particles (Scialli, 1989).

The potential for paint toxicity depends on which components are present in the paint. However, the degree of toxicity during pregnancy is difficult to predict, since there are no methods to quantify actual exposure. Limitations are due to the nature of inhalation and skin contact exposures. Dosage and duration are variable. Current data on potential teratogenicity of paint have been limited to abusive sniffing and occupational exposures (Scialli, 1989).

### RECREATIONAL PAINT USE

Toluene, an aromatic organic solvent, is believed to be the agent that causes euphoria among those who sniff paint. Organic solvents (refer to RISK||NEWSLETTER Vol 3. No. 4) have been shown to increase the rate of miscarriage following high levels of exposure. Although there have not been many studies, available data suggest an association between paint abuse during pregnancy and an increased risk for birth defects.

Three children whose mothers sniffed paint were reported to have microcephaly, midface hypoplasia, short palpebral fissures, low-set ears, micrognathia, dysmorphic fingers, hypotonia, and hyperreflexia. The authors noted characteristic similarities to fetal alcohol and fetal hydantoin syndromes (Hersh et al., 1985). Five additional pregnant women who sniffed paint and presented with renal tubular acidosis were subsequently studied. Intrauterine growth retardation was seen in the infants of three women. One of these infants had deformed ears, ventricular septal defect, micrognathia, and fetal alcohol syndrome facies. Hydronephrosis was present in one of the infant who was not growth retarded. The other three infants were reported to be phenotypically normal (Goodwin, 1988).

Higher levels of exposure are expected with recreational paint use than with occupational or household uses. An increased risk for teratogenicity exists.

## OCCUPATIONAL EXPOSURES

The effects of occupational exposure to paint are difficult to assess with respect to teratogenicity. The amount of paint inhalation and possible skin contact cannot be accurately epidemiologic studies on occupational paint exposure and effects on pregnancy.

A study from a Danish county of Funen collected information on reproductive histories from women, including 76 painters working in various occupations. The control group included shop assistants and vegetable warehouse workers whose exposure to chemicals was lower. The purpose of the study was to see if chemical exposures increased the likelihood of miscarriage. Upon controlling for gravidity, pregnancy order and age, self-reported miscarriages among painters were increased with an odds ratio of 2.9 (95% CI 1.0 to 8.8). However, when only hospital documented miscarriages were considered, the odds ratio became significant at 1.4 (95% CI 0.4 to 2.5). This discrepancy may have been due to recall bias (Heidam, 1984).

A separate study conducted in the same county looked for associations between parental occupational exposure to organic solvents and birth defects in children. A computerized registry was used to identify infants with central nervous system, intestinal and limb malformations and to obtain control cases with abnormalities not known to be due to teratogenic effects. None of the mothers were painters. Fathers who were painters showed a significant increased odds ratio (4.9, 95% CI 1.4 to 17.1) of having children with defects involving the central nervous system. Other paternal occupations with similar chemical exposures did not show a significant association. This correlation has been challenged, since multiple comparisons were made in this study. Therefore, the association may have been due to chance (Olsen, 1983).

Daniell and Vaughn (1988) looked for associations between paternal occupations and pregnancy outcomes in a U.S. retrospective cohort study. Fathers who worked as auto body painters were found to have significantly higher numbers of low birthweight infants born after 37 weeks (odds ratio 1.6, CI 1.1-2.4) than the control group. No other increased risk was noted. Since multiple comparisons were made in this study, it is possible that this association was also due to chance.

Precautions toward minimizing occupational exposures included wearing protective clothing and working in a well ventilated area.

## Spray Paints

Spray paints can contain a variety of organic solvents (Paul, ed., 1993). As previously mentioned, high levels of exposure to organic solvents have been associated with a higher rate of miscarriage. The concern with spray paints is that due to the larger quantity of mist generated, the amount of solvent inhaled may be considerably greater. Spray painting in an occupational setting will more likely release more airborne solvent than spray painting around the home or for art projects. It is recommended that precautions be taken to minimize exposure and reduce any potential risk, e.g., keeping the painted area

ventilated and wearing protective clothing.

### Association with Childhood Cancer

In 1974, Fabia and Thuy reported a possible association between childhood cancer, especially leukemias, and paternal exposure in hydrocarbon-exposed occupations, including the paint industry. This study initiated a surge of interest on the topic. Many studies have been performed since 1974 on both maternal and paternal effects and risks for childhood cancer (Lindquist et al., 1987; VanSteensel-Moll et al., 1985; Lowengart et al., 1987; Zack et al., 1980; Kwa et al., 1980; Peters et al., 1981; Hakulinen et al., 1976; Hemminki et al., 1981; Sanders et al., 1981). Most of the studies focus on paternal exposures because only a small number of women work as architectural or industrial painters. Unfortunately, analysis of all the findings did not prove a causal relationship due to contradictory results. Although some studies have been criticized on methodological grounds, this issue of concern cannot be completely disregarded.

### HOUSEHOLD EXPOSURES

There are no publications, which specifically assessed the effects of household painting on pregnancy. It is often assumed that exposures are lower and less frequent in the home than in the workplace. However, minimizing household exposures is still recommended since levels of paint, and thus solvents, are difficult to determine when present in the air.

#### Painting the Walls

Household paints are classified as interior or exterior paints, and can be latex or oil based. Most of the paints intended for use around the home are latex paints, which are thinned by water. Organic solvents are sometimes added in small amounts to improve the overall quality of the paint. Glycol ethers are the most commonly added organic solvents in latex paints. Ethylene glycol ethers are toxic and are gradually being substituted by less toxic propylene glycol ethers. The concentration of organic solvents is significantly less in latex paints than oil paints, which makes latex the paint of choice if painting is necessary during pregnancy (Paul, ed., 1993).

#### Removing Old Paint

Caution should be taken when considering home renovations due to the possibility of lead exposure. Increased maternal blood lead levels have been associated with fetal toxicity and a variety of minor anomalies (Wong et al., 1992). Please refer to RISK||NEWSLETTER Vol.3 No.3 for more information on lead exposure during pregnancy. Homes built before 1977 were mostly painted with lead-based paint. Even though the Consumer Product Safety Commission (CPSC) in 1977 determined the maximum allowable lead content in household paints to be 0.06% (600 parts per million lead by dry weight), homes built after this date may still be a major source of lead exposure (ATSDR, 1988). A trained professional before removal should check all wall paint for lead.

#### Painting as a Hobby

Art paints contain two general types of pigments, organic and inorganic. Inorganic pigments contain various toxic elements such as lead, chromium, cadmium, cobalt, mercury, nickel and manganese. Flake white (white lead) and Naples yellow (antimony yellow) are the two lead-containing pigments used in oil paints that raise the most concern (Hersh et al., 1985).

Artists commonly use spray paints that can contain organic solvents. Care should be taken to minimize spraying of these products during pregnancy. Brush painting is recommended over spray or air-brush techniques to prevent mist generation and subsequent inhalation (Paul, ed., 1993).

Significant exposure to toxic chemicals can occur if artists mix their own paint. Use of premixed paint

is suggested. In general, water colors, acrylic, and tempura paints are recommended over oil paints for projects (Paul, ed., 1993).

The Center for Safety in the Arts (212-227-6220) or Arts, Crafts, and Theater Safety (212-777-0062) can be contacted for more information regarding art hazards and ways to lessen exposure levels.

#### SUMMARY

Data are insufficient in quantity and quality to determine the safety of paint exposure during pregnancy. Questions will continue to be asked and therefore counseling skills are important in communicating the ambiguity of our present knowledge. Studies do not suggest an increased incidence of miscarriage or congenital anomalies in children born to men or women exposed to paint, but these possibilities cannot be excluded. Toxicity is likely to be dose-related as shown by the studies of paint abuse for recreational purposes.

In general, to reduce any potential risks to the developing fetus, it is advised that paint exposures be kept to a minimum. If an occupational exposure is unavoidable, protective clothing (including gloves and masks) and effective ventilation of the workplace will reduce the level of possible risk. Paint exposures around the home are likely to be less than those at the work site. However, it is still recommended that home painting projects be completed before conception. When the removal of old paint is anticipated, it is important not to do so until the paint is determined to be lead-free. Latex paints containing solvents such as ethylene glycol ethers and biocides should be avoided. Art hobbyists should take care in minimizing exposure to toxic constituents in paint products. In general, water colors, acrylic, and tempura paints are recommended over oil paints.

It is important to inform individuals that these recommendations are made without conclusive data. Paint has not been proven to be teratogenic. However, all precautions would serve as an additional safety measure and would most likely decrease any potential risk to the pregnancy and the fetus.