

# Chapter 3

## Workplace Health Promotion Interventions Concerning Women Workers' Occupational Hazards

Ioannis Polychronakis, Elena Riza, Pania Karnaki and Athena Linos

### Introduction

In the European labor market, women today constitute an increasing part of the working population, equaling about 42 percent of the European workforce (European Agency for Safety and Health at Work 2003a) as a result of their dynamic entrance in the labor market during the last few decades. While women have occupied posts even in professions that so far have been considered as “traditionally male,” the European labor market retains a high degree of segregation regarding women’s participation rates in certain occupational sectors (European Agency for Safety and Health at Work 2003a; 2005).

The European Union (EU) has so far applied a *gender-neutral* approach (European Agency for Safety and Health at Work 2003a; 2005) to policies and legislation concerning Occupational Safety and Health (OSH) to comply with World Health Organization (WHO) guidelines for equality in health standards and access to health service. However, this approach does not seem to suffice for effectively meeting gender-specific issues of occupational hygiene and safety that have emerged concerning female workers in particular.

The female working population carries certain characteristics that have to be taken into consideration through the process of design and implementation of OSH policies, because their interaction with the occupational environment may produce additional hazardous effects for women employees:

### Women at work: Points to consider

#### *The Double Role of Female Workers*

Women’s workday concerns arising from their roles as mothers, spouses, or carers for the elderly, add an extra load on the mental and physical fatigue they sustain in their workplace (Artazcoz et al. 2004; Artazcoz, Borrell & Benach 2001). Everyday household tasks amount to hours of unpaid overtime on top of the 8-hour working day, increasing their total physical and psychological strain. As a consequence,

women workers are more easily affected by *burnout effect* or suffer more frequently from work-related stress than their male colleagues, who continue to participate significantly less than women in house tasks.

### ***Task Design***

Working conditions in terms of ergonomics, working pace, managing heavy workloads, and using tools or personal protective equipment (PPE) (Tapp 2003; Murphy, Patton, Mello, Bidwell, & Harp 2001) are often designed according to the size and the physical strength of an average male worker.

This is a consequence of the fact that many occupational sectors were, until recently, almost exclusively staffed by men, and even today employ an overwhelming majority of male workers. Despite the increase in the participation of female workers in many professional fields, the high cost of adequate interventions still constitutes a forceful barrier to adjusting the modern workplace to female employee's needs for health and safety.

### ***Female Reproductive Health***

Because women of child-bearing age constitute a significant part of the female workforce, the protection of women's reproductive health is an issue of great concern for EU policymakers, in terms of legislation. This applies to factors and working conditions that both directly and indirectly influence the female reproductive system, including fertility (biological, physical, or chemical hazards-e.g., endocrine disruptors that affect women's ability to conceive), pregnancy (detrimental factors for the foetus during intrauterine development), and lactation. One also has to underline the fact that pregnant women are in need of specially designed ergonomic workplaces (Niedhammer, Saurel-Cubizolles, Piciotti & Bonenfant 2000), that consider changing physical and biological conditions and needs throughout the gestation and post-partum period.

### ***Physical Strength***

Biological predisposition determines that women employees have reduced physical strength in comparison with their male colleagues (Hooftman, van der Beek, Bongers, & van Mechelen 2005). This fact creates a comparatively higher burden for female workers who perform the same tasks as men, and creates a greater risk for musculoskeletal strain. Furthermore, women's reduced average muscle force places

them in an unfavorable position in cases of bullying and physical violence at their workplace, both from co-workers or the public (e.g., psychiatric ward nurses).

### ***Male Predominance in the Workplace***

Women workers are still a minority group in certain professional fields (e.g., construction, mineral extraction, heavy industry), and in most cases they remain in lower managerial positions in comparison with men. Under these circumstances, women employees have limited control over administrative decisions (European Agency for Safety and Health at Work 2005) concerning occupational health and safety, and often lack access to the appropriate communication channels to report cases of bullying, mobbing, or even sexual harassment-especially when superiors are involved.

### ***Immigrant Workers***

In certain areas of industrial production (e.g., the textile industry), the female working population consists predominantly of immigrant workers with poor literacy skills, or difficulty communicating. This language barrier may, in some situations, cause work-related accidents, as well as expose workers to occupational hazards due to misconception or ignorance of safety instructions or warning labels and signs.

### ***Part-time Employment***

Women in Europe present higher percentages of part-time employment than men, as shown in Figures 3.1 and 3.2.

In many occupational sectors (e.g., cleaning industry, cashiers), the overwhelming majority of women work part time. In addition, female employees show a higher turnover rate during their career and seem to spend shorter periods, on average, in the same position (McDiarmid & Gucer 2001). Because of this effect, women's occupational diseases are, in many cases, significantly underreported, introducing a systematic bias in many studies on occupational hazards and creating the misperception that female workers generally occupy *safer* jobs. To make matters even worse, women in this kind of unstable employment pattern have, in most cases, only limited access to occupational health services and workplace health promotion activities, even though they constitute a high-priority group for similar interventions.

It should be underlined, however, that under no circumstance does this gender-specific approach lead to the false conclusion that women workers constitute a

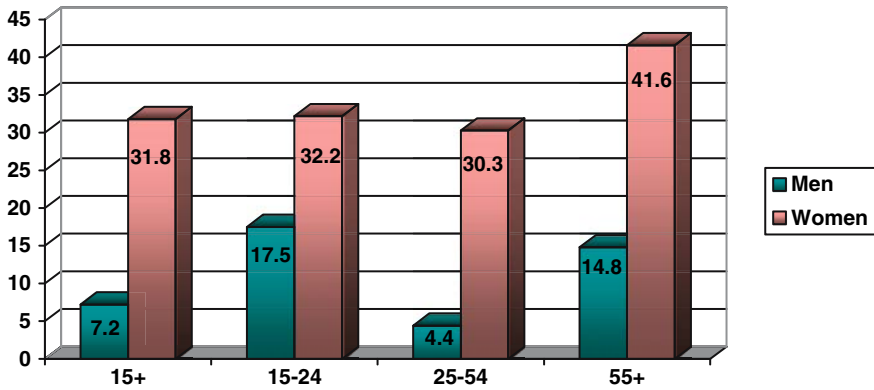


Fig. 3.1 Part-time employment as a percentage (%) of the working population of men and women for different age groups in EU 25 (Romans & Hardarson 2006)

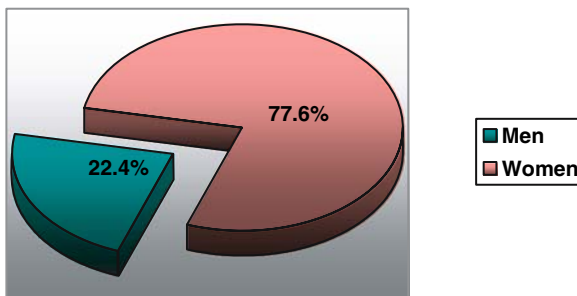


Fig. 3.2 Percentage of men and women employees working part-time in EU 25 (Total: 36.2 million employees/Source: EUROSTAT) (Jouhette & Romans 2006)

high-risk group requiring preferential treatment over issues of occupational safety and health in comparison to male workers. Such a misinterpretation could cause unacceptable discrimination against women and, in some cases, their exclusion from occupational sectors where female workers have for a long time now proven their worthiness as employees.

### Occupational hazards and gender differences— The epidemiological evidence

Even though available research data in the literature may suggest that certain traits or characteristics connected with gender could possibly influence the occupational risk of female employees, they fail to identify occupational hazards that are *selectively* or *exclusively* harmful to women.

At this point, it is useful to categorize all gender-related parameters that have been identified as distinguishing occupational health and safety issues between male and female workers. According to previous studies, three fields of possible gender influence (Kennedy & Koehoorn 2003) on estimated occupational risk can be identified.

### ***Difference in the Source of Occupational Hazards***

#### **Workforce Segregation**

Because of job and task segregation observed among the European workforce, OSH studies based on occupational categorization alone have been insufficient in assessing potential health risks for women, because their tasks may vary significantly from men's even if they carry the same professional title (Östlin 2000). Women follow different time patterns of exposure through part-time or shift work, and usually carry out tasks requiring more precise, repetitive movements than male workers (Hooftman et al. 2005; Stellman 2000).

### ***Gender Characteristics Affecting the Exposure to Hazardous Factors and its Impact on Working Population***

#### **Differences in Exposure**

- Female workers have smaller (on average) body dimensions (Hooftman et al. 2005), which differentiates their occupational exposure:
  - a. In professions involving manual handling, greater physical workload may be required by women to perform the same tasks as men.
  - b. In cases of chemical exposure through the skin, the female body provides smaller available surface for absorption.
  - c. Protective equipment is often ineffective for women employees (protective clothing, gloves, masks, and respirators) (Han DH 2000). Protective equipment originally designed for male workers does not fit appropriately to the shape and size of the female body and does not fully prevent exposure to hazardous agents.

#### **Biological Differences in Absorption-Metabolism**

- Under normal conditions, women present lower alveolar ventilation rate and cardiac output (Brown, Shelley & Fisher 1998), which reduces the input rate of volatile chemicals into their body

- In the case of benzene (a proven carcinogen) and other volatile organic compounds (VOCs), it has been experimentally demonstrated that women present higher blood/air partition coefficients (Brown et al. 1998) (greater blood / air concentration fraction), increasing the amount of chemicals diffused from alveoli to the blood compartment
- Concerning the metabolism of chemical compounds, potential gender-related disparities in enzymic activity (Gandhi, Aweeka, Greenblatt & Blaschke 2004) (e.g., cytochromes P450, transporting enzymes) have been reported, although research results are contradictory
- In the case of exposure to metals, women appear to absorb greater amounts of cadmium through digestion, possibly due to a common absorption pathway for iron and cadmium (Vahter, Berglund, Åkesson & Lidén 2002) (especially for menstruating women with low body-iron storage)

### **Differences in Body Distribution-Retention of Chemicals**

- Chemicals absorbed into the bodies of women workers are distributed in a relatively smaller body mass than men, because their body mass index (BMI) is lower (Gandhi et al. 2004). As a further consequence:
  - a. Women present a relatively higher organ blood flow, which increases the rate at which chemical substances circulating in blood compartment are delivered to the tissues.
  - b. Women's renal clearance (Gandhi et al. 2004) (a parameter that is directly related to body weight) is slower in comparison with men's, and therefore their capacity to excrete toxic compounds, as well as their metabolites, through daily production of urine is low.
- Bodily distribution of chemicals in women also differs in regard to their concentration in plasma. Experiments on gender influence on the distribution of certain drugs, indicate that (Gandhi et al. 2004):
  - a. Plasma volume is generally lower in females (the same total-body chemical burden may produce more toxic plasma concentrations in women).
  - a. The concentration of certain binding proteins for drug metabolites or other chemicals in plasma depends heavily on hormonal status—especially estrogens (e.g., pregnancy, menstrual phase, and menopause).
- The female body carries a greater proportion of adipose tissue than that of males (Brown et al. 1998; Gandhi et al. 2004), and as a result it demonstrates a different pharmacokinetic response to lipophilic metabolites (e.g., prolonged retain and increased metabolism of benzene).
- In professions involving exposure to inorganic lead, blood concentrations do not provide a reliable criterion of chronic exposure in the case of female employees. As the metal gradually accumulates in the bone tissue, demineralization of women's skeleton during periods of increased bone turnover (as in pregnancy

or menopause) releases significant quantities of lead into their bloodstream (Vahter M et al. 2002).

### **Modifying Factors (Nonoccupational)**

- Women present different social and dietary habits, such as smoking (e.g., cadmium absorption) (Vahter M et al. 2002) and alcohol or coffee consumption (McGovern 2003), which may act as modifiers to environmental exposures
- The use of chemical substances for household tasks (e.g., cleaning products), hobbies (e.g., fertilizers in gardening), or other activities involving application of potentially harmful agents (including cosmetics and artificial hair dyes) may subject women to further exposure outside their daily work hours
- Wearing jewelery is an additional nonoccupational source of skin exposure to metals for women (e.g., nickel) (Vahter M et al. 2002), increasing the burden of metal-induced occupational dermatitis for women employees
- Female employees in occupations involving manual tasks may also have to sustain additional workloads arising from family demands, especially in large families with children under 15 years old, or elderly persons over 65 years old (Artazcoz et al. 2001), which may contribute to producing symptoms of physical fatigue or musculoskeletal strain.
- Increased family demands of female workers, combined with strenuous job tasks may also have a serious impact on women's mental health (disturbed work-life balance, inadequate leisure time, lack of personal life) (Artazcoz et al. 2001)

### **Differences in Response**

- Besides the immediate toxic effects of certain metals such as cadmium on humans (affecting both men and women), there is ongoing research on possible estrogen-like activity as well as its potential association with breast cancer through the activation of estrogenic receptors (Brama M et al. 2007)
- The manifestation of certain gender-specific cancers (e.g., breast cancer, which occurs almost exclusively in women) seems to involve among others, interaction between genetic expression (e.g. Atm tumor suppressors) (McGovern 2003) and environmental exposures
- The manifestation of autoimmune diseases (highly frequent among the female population) might be triggered or accelerated by substances or agents commonly used in certain professions (as in the case of lupus erythematosus and mercury exposure) (McGovern 2003)

### ***Gender-related Methodological Implications in Assessment of Occupational Risk***

- The varying composition of the labor force in different occupational sectors may have introduced a significant bias in epidemiological studies concerning occupational hazards for women:

- a. Especially in the heavy industry and construction sectors, which employ almost exclusively male employees, the small minority of women who work alongside their male co-workers in various positions may have been overlooked (Niedhammer et al. 2000) in OSH studies, introducing *exclusion bias* (concerning women workers) because of the difficulties researchers had in finding women employees to participate in their studies.
  - b. On the other hand, women-focused OSH research has concentrated on the relatively small number of professions that master the majority of the female work-force. This fact probably explains the relatively large volume of studies on health-care professions (which are easily accessible to research), while women workers remain heavily underrepresented in OSH studies in other sectors (Messing & Stellman Mager 2006 )
  - c. The majority of studies that focus exclusively on women workers deal with mental health issues and psychological parameters (Messing & Stellman Mager 2006; Niedhammer et al. 2000), while other work-related hazards such as exposure to chemicals, radioactive material, biological factors, electromagnetic fields, noise, or ergonomic factors are either indirectly examined by surveys on mixed working populations (where results are adjusted for gender), or even worse, by generalizing epidemiological evidence of OSH conducted among male employees.
- The segregation of tasks performed within the same job department or even under the same occupational title, may introduce *misclassification* bias when the influence of gender on occupational risk is under study. Any observed excess risk among women workers (e.g. musculoskeletal injuries) in comparison with men, should not necessarily be attributed to the role of gender, especially when such results are based only on job title (Hooftman et al. 2005). In such cases, further quantification of exposure (job exposure matrices, stratification according to tasks) is essential in determining whether the declination in study results arises from differences in performed tasks, or is truly related to gender—e.g., the excess risk for developing carpal tunnel syndrome in female workers seems to be eliminated in professions with strictly defined tasks (McDiarmid, Oliver, Ruser & Gucer 2000).
  - Other forms of bias related to gender have been identified in the design of clinical, as well as OSH, studies:
    - a. An observer error due to adopting “male perspective and way of thinking”(Pinn 2003) in interpreting epidemiological data.
    - b. The “male norm” bias, arising from the use of male workers as *standard* (Pinn 2003), even for occupational health and safety issues where both sexes are affected (e.g., occupational cancer).
  - There are indications that many of the existing studies on women workers—especially those concerning occupational musculoskeletal injury—may suffer from *perceptual bias* (the increased likelihood of employees to report injuries), or overrating the severity of related symptoms in questionnaire surveys according



to the way they perceive their working environment or their degree of job satisfaction (Strazdins & Bammer 2004). Taking into account that female workers are generally occupied in less satisfactory, underpaid jobs with repetitive-monotonous tasks (Hoofman et al. 2005), over-reporting may contribute significantly to the excess risk found by many relevant studies for female employees.

- For the majority of female workers employed outside the *dangerous* industrial or construction sectors, there is little public awareness of the occupational exposures they sustain from their working environment because they usually do not face immediate danger of acute toxic effects or death. This fact may introduce a significant *recall bias* in relative studies because women workers are either unable to identify potentially harmful agents they have been exposed to, or tend to underestimate the extent of such exposures (e.g., unawareness of types of agents involved in their tasks that may constitute reproductive hazards) (Bauer, Romitti & Reynolds 1999).
- In mixed working populations, the *healthy worker effect* appears stronger for male than female employees (Lea et al. 1999), which is possibly attributable to the fact that men are hired to perform more physically demanding tasks than women and are therefore subjected to more rigorous selection during the hiring process.

## Summary

The existing research evidence indicates a widely accepted false sense of safety in many of the professional sectors employing predominantly women, which has been recognized in earlier occupational health and safety studies in the United States as the so-called *Generally Recognized as Safe* (GRAS) status (McDiarmid & Gucer 2001) for most of the *female* professions. This is partially due to the fact that male workers, especially in heavy industry (construction workers, miners, welders, heavy machinery operators), are expected to face a higher number of severe or even fatal incidents or occupational diseases (Niedhammer et al. 2000), than those in the *safe* tertiary sector. GRAS reflects the commonly held belief that certain drugs and chemicals are *safe* if empirical knowledge obtained by their wide use over a period of years does not indicate they are detrimental to the population. As a consequence, this approach is also adopted in occupational sectors, where such materials have been widely used—the majority of which involve female-dominated professions where, until recently, OSH research has been considered nonessential.

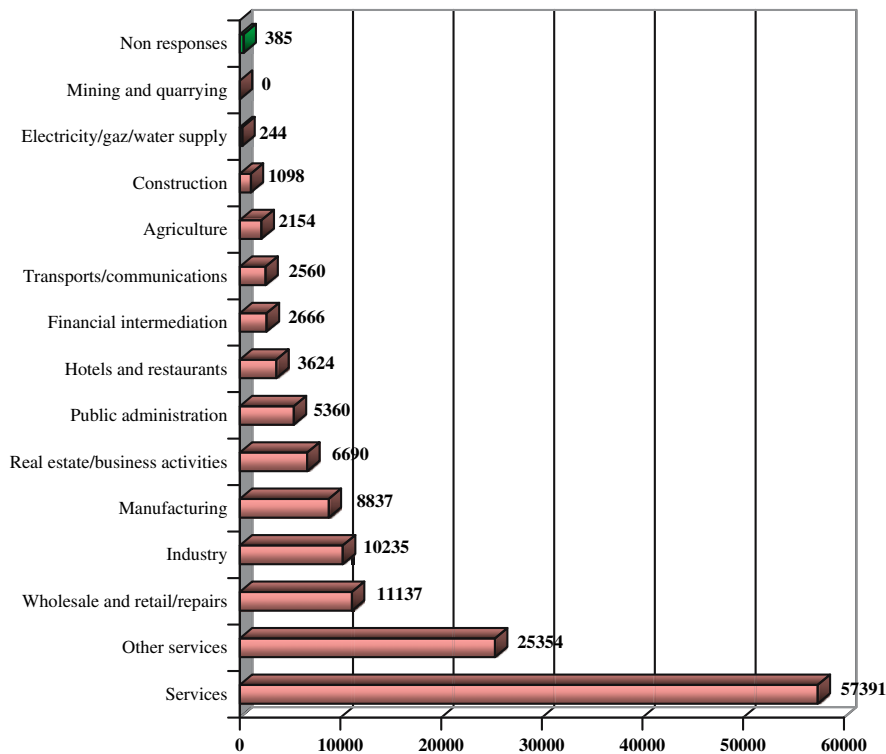
Contemporary *evidence-based medicine*, however, requires more solid epidemiological data to conclude whether this group of occupations is as *safe* as is currently presumed. In addition, there is an increasing need to study the possible side-effects on health from exposure to thousands of chemical compounds present in jobs generally considered as nonhazardous (cleaning agents, drugs, cosmetics, food preservatives).

The latter translates as a need to expand the field of occupational health and safety research and place the so-called *female* professions under a more thorough and systematic investigation.

### Female professions and their corresponding occupational hazards

According to official statistics of the European Agency for Safety and Health at Work, certain occupational sectors (health professionals, education workers) employ mostly females while the percentage of women in other professions (construction workers, heavy industry) (European Agency for Safety and Health at Work 2005) remains relatively low. Figure 3.3 presents the distribution of the female working population in different occupational activities, in the European Union.

For many of the professions where women are highly represented, research has explored specific occupational hazards. In Tables 3.1 through 3-13, reference



**Fig. 3.3** Employment of women by economic activity in EU 15, in thousands of workers (Total: 70.165.000 employed women/ Source: EUROSTAT; Eurostat 2002)

**Table 3.1** Health service sector workplace hazards

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- **Violent behavior** (M. Denton, Zeytinoglu, & Webb, 2000; Kindy, Petersen, & Parkhurst, 2005; McPhaul & Lipscomb, 2004; Presley & Robinson, 2002) from patients or relatives
  - **Sexual harassment** (Chuang & Lin, 2006; M. A. Denton, Zeytinoglu, & Davies, 2002)
  - **Intense psychological stress** (Artazcoz Lazcano, Cruz i Cubells, Moncada i Lluís, & Sanchez Miguel, 1996; Stordeur, Vandenberghé, & D'Hoore, 1999) (decreased sense of control of work pace, low degree of job satisfaction)
  - **Musculoskeletal problems** (Ando et al., 2000; Nathenson, 2004) (patient lifting(De Castro, 2004; De Castro, Hagan, & Nelson, 2006; Edlich et al., 2004), manual handling of heavy loads)
  - **Exposure to ionizing radiation** (x-ray & computed tomography departments, nuclear laboratories, patients treated with radioactive drugs)
  - **Reproductive hazards** (volatile compounds (Smith & Wang, 2006; Takigawa & Endo, 2006; Xelegati, Cruz Robazzi, Palucci Marziale, & Haas, 2006), anaesthetic gases, cytotoxic drugs(Krstev, Perunicic, & Vidakovic, 2003; Polovich, 2004; Tomioka & Kumagai, 2005; Udeger, Basaran, Kars, & Guc, 1999b; Weaver, McDiarmid, Guidera, Humphrey, & Schaefer, 1993), viruses(Ku, Liu, & Christian, 2005))
  - **Infectious diseases** (Cesana, Arduca, Latocca, & Sirtori, 1998; Chandra & Gupta, 2001; Gurubacharya, Mathura, & Karki, 2003) (airborne, blood borne (Parra Madrid, Romero Saldana, Vaquero Abellan, Hita Fernandez, & Molina Recio, 2005; Porta, Handelman, & McGovern, 1999))
  - **Dermatitis** (allergic, irritative)
  - **Disturbance of the regular circadian -metabolic rhythm** (shift work)
  - **Exposure to inhaled chemicals** (Cesana et al., 1998; Gimeno, Felknor, Burau, & Delclos, 2005) and micro particles(Biggins & Renfree, 2002; Lea et al., 1999)
- 

is made to some of the sources of occupational risk by profession, according to existing literature. Tables 3.1 through 3-13 follow the codification of the European Agency for Safety and Health at Work concerning gender and occupational risk assessment (European Agency for Safety and Health at Work 2003b).

### *Health Service Sector*

In the health services sector, women are employed in various positions (e.g., nurses, laboratory technicians, emergency room technicians) and face a multitude of occupational risks, some of which are cited in Table 3.1.

### **Educative—Pedagogic Sector**

Women are also often employed in the education sector, especially in nursery and primary education, and therefore face diverse occupational risks, some of which are specific to the profession (e.g., voice disorders). Table 3.2 presents some of the related occupational hazards for this category of workers.

### *Cleaning Industry*

While affected by many occupational hazards, some of which are cited in Table 3.3, women working in the cleaning industry are also disadvantaged due to the fact that

**Table 3.2** Educative—Pedagogic sector workplace hazards

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- **Exposure to infectious diseases** (Gavana, Tsoukana, Giannakopoulos, Smyrnakis, & Benos, 2005; Gyorkos et al., 2005; Nakazono, Nii-no, & Ishi, 1985; Skillen, Olson, & Gilbert, 2001; Valeur-Jensen et al., 1999)
  - **Vascular problems** (Kovess-Masfety, Sevilla-Dedieu, Rios-Seidel, Nerriere, & Chee, 2006) **of the lower extremities** due to extended standing (Sandmark, Wiktorin, Hogstedt, Klenell-Hatschek, & Vingard, 1999) in upright position
  - **Voice disorders** due to overuse of vocal chords (De Jong et al., 2006; Duff, Proctor, & Yairi, 2004; Kooijman et al., 2006; Kosztyla-Hojna, Rogowski, Ruczaj, Pepinski, & Lobaczuk-Sitnik, 2004; Roy, 1999; Sliwinska-Kowalska et al., 2006; Sulkowski & Kowalska, 2005; Thibeault, Merrill, Roy, Gray, & Smith, 2004; Williams, 2003)
  - **Exposure to increased levels of noise** (Behar et al., 2004)
  - **Musculoskeletal problems** (Fjellman-Wiklund, Brulin, & Sundelin, 2003; Sandmark, 2000; Yamamoto, Saeki, & Kurumatani, 2003) (handling and lifting small children in day care centres, physical education teachers, inadequate body posture)
  - **Work-related stress** (Fjellman-Wiklund et al., 2003; Zidkova & Martinkova, 2003)
  - Children's or adolescent's **violent behavior** (Lawrence & Green, 2005)
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**Table 3.3** Cleaning industry workers workplace hazards

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- Exposure to **infectious agents**
  - Dermatitis due to direct skin contact with **irritating substances** (Weisshaar et al., 2006)
  - **Dermal infections** (staphylococcus, fungi) (McBryde, Bradley, Whitby, & McElwain, 2004)
  - Inhalation of irritating **vapours and airborne micro-particles** containing dust or other allergens (J. J. Jaakkola & Jaakkola, 2006)
  - **Musculoskeletal disorders** due to handling or lifting heavy objects, inadequate body posture (Balogh et al., 2004; Mondelli et al., 2006)
  - **Fall injuries** (stairs, slippery floors) (Kines, Hannerz, Mikkelsen, & Tuchsén, 2007)
  - **Workplace violence** (Chen & Skillen, 2006)
  - **Sexual harassment**
- 

**Table 3.4** Food production industry workers workplace hazards

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- Inhalation of **airborne allergens** emitted from food processing (e.g., artificial dyes, flour, animal proteins)
  - **Dermal infections** (staphylococcus, b-haemolytic streptococcus, bacillus anthracis, fungi)
  - **Dermatitis** (allergic or irritating) from skin contact to foods themselves or substances used for their processing (Jappe, Bonnekoh, Hausen, & Gollnick, 1999; Kanerva, Estlander, & Jolanki, 1996)
  - Exposure to **zoonoses** (processing animal products)
  - **Musculoskeletal disorders** (handling and lifting excessive loads, inappropriate body postures, poor ergonomic design of workstations, repetitive strain) (Chyuan, Du, Yeh, & Li, 2004)
  - **Injuries** (falls due to slippery floors, burns, lacerations from knives or used tools) (Courtney et al., 2006)
  - Exposure to **extreme temperatures** (cold in refrigerators, excessive heat in kitchens)
-

their occupation is often unregulated, and thus no occupational safety and health services are available to them.

### ***Food Production Industry***

The food production sector involves various types of work, from food preparation to packaging, storing, and more, involving mainly biological and chemical hazards due to immediate contact with food. Table 3.4 presents a non-exhaustive lists of related occupational hazards.

### **Hospitality Services Industry—Restaurant Workers**

A large number of women are employed in the sector of hospitality services (e.g., waitresses, cooks, bar attendants) and are subject to a number of risks, some of which are listed in Table 3.5.

### **Textile Industry—Clothing Manufacturing**

The textile sector is heavily industrialized, and women working in this sector face many and serious risks, some of which are cited in Table 3.6.

### ***Laundry Workers***

Laundry workers are also faced with heavy tasks such as long hours on their feet, exposure to extreme temperatures, and lifting heavy loads, as can be seen in Table 3.7.

**Table 3.5** Hospitality services industry—restaurant workers' workplace hazards

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- Exposure to **extreme temperature conditions** (excessive heat in cookers)
  - **Musculoskeletal injury** due to handling or lifting heavy objects—repetitive movements—strenuous workload (Chyuan et al., 2004; Dempsey & Filiaggi, 2006)
  - **Dermatitis** induced by skin contact with foods or cleaning agents (Jappe et al., 1999; Kanerva et al., 1996)
  - **Dermal infections** (skin contact to infected food surfaces, development of fungal infections due to extended exposure to humidity)
  - **Injuries** (falls due to slippery floors, falling objects, skin lacerations from sharp objects, burns from heat-emitting objects or appliances) (Courtney et al., 2006; Horwitz & McCall, 2004)
  - **Inhalation of micro-particles** (food-cooking, passive smoking, poor ventilation) (Svendensen, Jensen, Sivertsen, & Sjaastad, 2002)
  - Workplace **violence** (Graham, Bernards, Osgood, & Wells, 2006)
  - **Sexual harassment**
  - **Work-related stress** (low levels of job satisfaction, stressful working conditions)
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**Table 3.6** Textile industry-clothing manufacture workplace hazards

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- Exposure to **increased levels of noise** (weaving machines) (Bedi, 2006; Cardoso, Oliveira, Silva, Aguas, & Pereira, 2006)
  - Increased concentration of **fibres, micro-particles and organic solvents** (artificial dyes, chemicals used in textile processing) in workplace environment (Bakirci et al., 2006; Ghio et al., 2006)
  - **Musculoskeletal injury** (poor ergonomic design (Choobineh, Lahmi, Hosseini, Shahnava, & Jazani, 2004) of the production line, repetitive movements (Bjorksten, Boquist, Talback, & Edling, 1996), lifting and handling heavy objects)
  - **Visual fatigue**
  - Injuries (entanglement in moving parts of equipment, skin lacerations by sharp objects)
  - Intense work-related stress (strenuous workload, intense work pace in production lines, low level of job satisfaction)
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**Table 3.7** Laundry workers' workplace hazards

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- Exposure to **infectious agents** (e.g. infectious biological material in hospital linen) (Keeffe, 2004)
  - Exposure to **extreme heat** (in combination with high humidity) (Belinda Thielen, 2003; Brabant, 1992)
  - **Musculoskeletal injury** (poor ergonomic design of equipment, repetitive muscle strain, handling and lifting heavy objects) (Nemecek & Buchberger, 1987)
  - **Injuries** (e.g., slippery floors) (Kines et al., 2007)
  - Exposure to **volatile cleaning chemical agents** (Belinda Thielen, 2003; Hruska, Furth, Seifer, Sharara, & Flaws, 2000) (e.g., tetrachlorethylene)
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## *Ceramics Industry and Pottery*

Ceramic and pottery workers face a series of specific occupational risks connected with the nature of their profession, as presented in Table 3.8.

## *Light Manufacturing*

Light manufacturing includes many types of industries, employing mainly non-specialized workers and therefore involving diverse types of exposure. Table 3.9 presents some of the hazards involved in these occupational activities.

**Table 3.8** Ceramics industry and pottery workers' workplace hazards

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- Exposure to **inhaled lead dust, silica fibres and solvents** (poor ventilation design) (Plovets'ka, 2000a, 2000b)
  - Exposure to **extreme heat and fumes** emitting from blast-furnaces (Dorevitch & Babin, 2001)
  - **Musculoskeletal injury** due to poor ergonomic design, handling heavy loads, repetitive muscle strain, vibrations (Martinelli & Carri, 1996)
  - **Stressful working conditions** – strenuous work pace in production lines
-

**Table 3.9** Light manufacture workers' workplace hazards

- 
- **Musculoskeletal injury** due to poor ergonomic design (equipment, tools and workstations that don't fit the physical dimensions of female workers), handling and lifting heavy loads, repetitive movements (Bjorksten et al., 1996; Roquelaure et al., 2002)
  - **Visual fatigue** (Untimanon et al., 2006)
  - **Exposure to chemical agents** (e.g., metals & solvents in electronic circuits manufacture, drug by-products in the pharmaceutical industry) (Clapp, 2006; LaDou, 2006)
  - **Stressful working conditions** in production lines
- 

### *Call Center and Computer Workstations*

Call center work is a newly developed sector that employs mostly women who are faced with risks such as visual fatigue, musculoskeletal disorders, and other hazards as presented in Table 3.10.

### *Hairdressers and Beauticians*

Hairdressing is a female-dominated sector that, until recently, has been regarded as a safe occupation. However, current literature associates this profession with various hazards, some of which are included in Table 3.11.

### *Office Employees*

The tertiary sector—especially office workers—are faced with hazards arising mainly from poor ergonomic design and poor indoor air quality, as shown in Table 3.12.

### *Agriculture & Livestock-farming*

Hazards in agriculture are linked mainly to a high risk of injuries and to the use of chemical substances such as pesticides, herbicides, and others, as shown in Table 3.13.

**Table 3.10** Call center and computer workstation workers' workplace hazards

- 
- **Musculoskeletal injury** from inadequate body postures during work, poor ergonomic design of workstations, repetitive movements (Hush, Maher, & Refshauge, 2006; Iwakiri et al., 2004)
  - Hearing impairment induced by continuous **exposure to increased levels of noise**
  - Dysphonia due to **overuse of vocal chords** (telephone operators) (Lehto, Alku, Backstrom, & Vilkmann, 2005)
  - **Visual fatigue** in computer screen users (poor ergonomic design, inadequate lighting) (Ustinaviciene & Januskevicius, 2006)
  - **“Sick building syndrome”** (inadequate ventilation, high concentration of micro-particles) (Abbritti & Muzi, 2006; M. S. Jaakkola, Yang, Ieromnimon, & Jaakkola, 2007)
  - **Sexual harassment** at the workplace
  - **Job related stress** (strenuous working conditions, low job satisfaction)
-

**Table 3.11** Hairdressers and beauticians' workplace hazards

- 
- **Musculoskeletal injury** (Best et al., 2002) (inadequate body postures (Osteras, Ljunggren, Gould, Waersted, & Bo Veiersted, 2006), poor ergonomic design(Boyles, Yearout, & Rys, 2003))
  - **Vascular problems of the lower extremities** due to prolonged standing in upright position
  - **Dermal infections** (Ballas, Psarras, Rafailidis, Konstantinidis, & Sakadamis, 2006; Schroder, Merk, & Frank, 2006) (skin lacerations from scissors or other sharp tools (Moghadam, Mazloomi, & Ehrampoush, 2005), dermal fungi from continuous exposure to humidity)
  - **Dermatitis** (Khrenova, John, Pfahlberg, Gefeller, & Uter, 2006; Perkins & Farrow, 2005) (irritating or allergic) (Cavallo et al., 2005; Doutre, 2005) induced by contact to cosmetics (Amado & Taylor, 2006; Iorizzo, Parente, Vincenzi, Pazzaglia, & Tosti, 2002; Katugampola et al., 2005; Sosted, Hesse, Menne, Andersen, & Johansen, 2005), artificial hair dyes (Belinda Thielen, 2003; Rastogi, Sosted, Johansen, Menne, & Bossi, 2006) or even protective gloves (Foti et al., 2005)
  - **Allergic asthma** (Akpinar-Elci, Cimrin, & Elci, 2002; Allmers, Nickau, Skudlik, & John, 2005; Macchioni et al., 1999; Moscato et al., 2005) induced by exposure to volatile substances (Baur, 1999; Berges & Kleine, 2002; Gala Ortiz et al., 2001; Hoerauf, Funk, Harth, & Hobbahn, 1997; Hollund & Moen, 1998; Labreche, Forest, Trottier, Lalonde, & Simard, 2003; Piipari & Keskinen, 2005) and particles (cosmetics, hair sprays(Albin et al., 2002; Montomoli, Cioni, Sisinni, Romeo, & Sartorelli, 2004), dryers
  - **Job-related stress** (strenuous working conditions, low job satisfaction)
- 

**Table 3.12** Office employees' workplace hazards

- 
- **Musculoskeletal injury** from inadequate body postures during work, poor ergonomic design of workstations, repetitive movements (Hush et al., 2006)
  - **Inhalation of volatile chemical compounds and micro-particles** emitted from various office-work activities (computer's electronic circuits, photocopying equipment, cleaning agents, dust)
  - **Poor air quality** (insufficient ventilation system, indoor plants) (Abbritti & Muzi, 2006; M. S. Jaakkola et al., 2007)
  - **Visual fatigue** (extended use of VDUs, poor illumination)
  - **Job related stress** (monotonous-repetitive work, low job satisfaction)
  - **Violence** (verbal or physical abuse) at the workplace
  - **Sexual harassment**
- 

**Table 3.13** Agriculture and livestock-farming workplace hazards

- 
- **Injuries** (falls, accidents due to inappropriate use of equipment e.g. tractors or chainsaws, injuries from domestic animals) (Hard, Myers, & Gerberich, 2002; Pryor, Carruth, & LaCour, 2005)
  - **Musculoskeletal injuries** (strenuous work, repetitive movements, handling heavy loads, poor design of equipment) (McCoy, Carruth, & Reed, 2002)
  - Prolonged skin exposure to **solar radiation** (dermal cancers)
  - Exposure to **noise** (McBride, Firth, & Herbison, 2003; Perry & May, 2005)
  - Exposure to **zoonoses** due to close contact with animals or animal products (bacillus anthracis, mycobacterium, brucellosis, viral infections e.g. avian influenza)
  - Exposure to **chemical compounds** during transportation, storage, mixing or application of fertilizers, pesticides or herbicides (Buranatrevedh & Roy, 2001; Garcia, 2003)
  - **Exposure to allergens** through inhalation or direct skin contact (pollen, animal proteins, fungi) (Linaker & Smedley, 2002)
  - **Exposure to natural phenomena** (extreme heat, frost, thunderstorms, floods)
  - **Job related stress** (stressful working conditions, job insecurity, low income, low job satisfaction)
  - **Violence at the workplace** (verbal or physical abuse)
  - **Sexual harassment**
-



## **Workplace Health Promotion and Women's Occupational Hazards**

### ***The Case of Reproductive Health of Female Workers***

This section will focus on how theories and models of health promotion can be put into practice for the design and implementation of workplace interventions concerning OSH issues targeted at female workers. The example that will be used is *work-related reproductive disorders*.

The specific health topic has been selected as an example for three primary reasons:

- Reproductive disorders have been associated with a wide range of occupational hazards (e.g. physical, chemical, biological agents)
- A large number of professions employing women involve exposure to hazards such as those mentioned in the above point
- Further research is needed on this topic because many of the *traditionally female* professions considered generally safe may involve unidentified risks for women's reproductive health

## **Identification of the Problem**

### **Literature Search**

Reproductive hazards constitute a field of increasing interest for occupational hygienists and health professionals across the world. There is little or no information at all about the possible effects on female reproductive health of the vast majority of chemical substances introduced by the thousands every year in industrial production (Lawson et al. 2006).

Even in cases of widely used chemicals, the existing literature of their possible detrimental effects on women's reproductive physiology is relatively poor. For most of the agents considered as hazardous for the reproductive system, their causal relationship to problems in human reproduction has not been adequately documented and gender differences in exposure or toxicity have not been thoroughly examined.

Because female workers constitute a nonhomogenous population of diverse occupational categories, various physical, chemical, and biological exposures are under examination concerning their potential risks on the reproductive health of women. A non exhaustive list of factors under investigation concerning their potential harmful effects on female reproductive health is presented in Table 3.14.

**Table 3.14** Occupational hazards and potential effects on female reproductive system

Hazard	Reproductive Health Effects	High Risk Occupations
<b>Chemical Hazards</b>		
<b>Smoking</b>		
Active and passive smoking(60% of non smokers)(Hruska et al., 2000; Mlynarcikova, Fickova, & Scsukova, 2005)	<ul style="list-style-type: none"> <li>• Infertility</li> <li>• Reduced fecundity</li> </ul>	<ul style="list-style-type: none"> <li>• All occupational categories (e.g. office workers)</li> </ul>
<b>Volatile pharmaceutical compounds</b>		
Nitrous Oxide (anaesthetic gases)	<ul style="list-style-type: none"> <li>• Reduced fecundity (Hruska et al., 2000)</li> <li>• Mutagenicity in experimental animals (Burm, 2003)</li> </ul>	<ul style="list-style-type: none"> <li>• Operating room personnel</li> </ul>
Cytotoxic drugs (e.g., methotrexate) (Dranitsaris et al., 2005; Undeger, Basaran, Kars, & Guc, 1999a)	<ul style="list-style-type: none"> <li>• Infertility</li> <li>• Fetal loss</li> <li>• Congenital defects, mutagenesis</li> <li>• Low birth weight</li> </ul>	<ul style="list-style-type: none"> <li>• Health care workers</li> <li>• Hospital cleaners</li> <li>• Pharmacists</li> </ul>
<b>Metals</b>		
Lead and compounds (HAZ-MAP, 2006f)	<ul style="list-style-type: none"> <li>• Spontaneous abortions</li> <li>• Premature birth</li> <li>• Developmental disorders</li> </ul>	<ul style="list-style-type: none"> <li>• Battery manufacturing industry workers</li> <li>• Ceramics industry workers</li> <li>• Semi-conductors manufacturing industry workers</li> <li>• Painters</li> <li>• Jewelry workers</li> <li>• Passive smokers</li> </ul>
Cadmium and compounds (HAZ-MAP, 2006b)	<ul style="list-style-type: none"> <li>• Increased fetal loss and congenital defects in experimental animals</li> </ul>	<ul style="list-style-type: none"> <li>• Battery manufacturing industry workers</li> <li>• Ceramics industry workers</li> <li>• Semi-conductors manufacturing industry workers</li> <li>• Painters</li> <li>• Jewelry workers</li> <li>• Passive smokers</li> </ul>
Nickel and compounds (HAZ-MAP, 2006g)	<ul style="list-style-type: none"> <li>• Congenital defects in highly exposed experimental animals</li> </ul>	<ul style="list-style-type: none"> <li>• Battery manufacturing industry workers</li> <li>• Ceramics industry workers</li> <li>• Semi-conductors manufacturing industry workers</li> <li>• Painters</li> <li>• Jewelry workers</li> </ul>

**Table 3.14** (continued)

Hazard	Reproductive Health Effects	High Risk Occupations
		<ul style="list-style-type: none"> <li>• Oil refinery workers</li> <li>• Hair dressers</li> <li>• Passive smokers</li> </ul>
<b>Solvents</b> Perchloroethylene (HAZ-MAP, 2006h; Hruska et al., 2000)	<ul style="list-style-type: none"> <li>• Increased time to conception</li> <li>• Increased spontaneous abortion rates (HAZ-MAP, 2006h)</li> </ul>	<ul style="list-style-type: none"> <li>• Dry cleaning industry workers</li> <li>• Metal degreasing</li> <li>• Occupations exposed to glues and adhesives (HAZ-MAP, 2006h)</li> </ul>
Toluene	<ul style="list-style-type: none"> <li>• Reduced fecundity (Hruska et al., 2000)</li> <li>• Increased incident of spontaneous abortions (HAZ-MAP, 2006i)</li> </ul>	<ul style="list-style-type: none"> <li>• Printing industry workers</li> <li>• Semiconductor manufacturing (HAZ-MAP, 2006i)</li> </ul>
Carbon disulfide $C_2S_2$	<ul style="list-style-type: none"> <li>• Menstrual disorders</li> <li>• Increased incident of spontaneous abortions (HAZ-MAP, 2006c)</li> </ul>	<ul style="list-style-type: none"> <li>• Textile manufacturing industry workers (HAZ-MAP, 2006c) (Viscose- rayon)</li> </ul>
Ethylene glycol ethers (HAZ-MAP, 2006e)	<ul style="list-style-type: none"> <li>• Fetal loss</li> <li>• Increased risk for congenital defects</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic industry workers</li> <li>• Lithography(after 1990 they are being replaced by PMGEA) (HAZ-MAP, 2006e)</li> </ul>
<b>Fumigants</b> Ethylene oxide (HAZ-MAP, 2006d)	<ul style="list-style-type: none"> <li>• Menstrual disorders (Makowiec-Dabrowska, Hanke, Sprusinska, Radwan-Wlodarczyk, &amp; Koszada-Wlodarczyk, 2004)</li> <li>• Increased risk for spontaneous abortions (limited data)(congenital defects in experimental animals)</li> </ul>	<ul style="list-style-type: none"> <li>• Health care workers (equipment sterilization procedures) (HAZ-MAP, 2006d)</li> </ul>
<b>Plastic Monomers</b> Beta- Chloroprene (HAZ-MAP, 2006a)	<ul style="list-style-type: none"> <li>• Increased incident of spontaneous abortions</li> </ul>	Synthetic rubber industry (neoprene)

**Table 3.14** (continued)

Hazard	Reproductive Health Effects	High Risk Occupations
<b>Pesticides</b> (Hanke & Jurewicz, 2004)		
Dicamba	<ul style="list-style-type: none"> <li>● Prolonged time to pregnancy</li> <li>● Spontaneous abortions</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Gluposate	<ul style="list-style-type: none"> <li>● Prolonged time to pregnancy</li> <li>● Spontaneous abortions</li> <li>● Congenital defects</li> <li>● Preterm delivery</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Phenoxy herbicides	<ul style="list-style-type: none"> <li>● Prolonged time to pregnancy</li> <li>● Spontaneous abortion</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Triazines	<ul style="list-style-type: none"> <li>● Spontaneous abortions</li> <li>● Preterm delivery</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Organophosphate pesticides	<ul style="list-style-type: none"> <li>● Infertility</li> <li>● Fetal loss</li> <li>● Preterm delivery</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Perythroids	<ul style="list-style-type: none"> <li>● Prolonged time to pregnancy</li> <li>● Low birth weight</li> <li>● Fetal loss</li> </ul>	<ul style="list-style-type: none"> <li>● Agriculture industry workers</li> <li>● Pesticide production workers</li> </ul>
Mankozeb & Maneb	Congenital defects	Agriculture industry workers Pesticide production workers
<b>Physical Hazards</b>		
Ionizing radiation	<ul style="list-style-type: none"> <li>● Infertility</li> <li>● Foetal loss</li> <li>● Congenital defects-mutagenesis</li> <li>● Low birth weight</li> <li>● Developmental disorders</li> </ul>	<ul style="list-style-type: none"> <li>● Health care workers</li> <li>● Hospital cleaners</li> </ul>
Strenuous labor (prolonged standing, handling heavy loads)	<ul style="list-style-type: none"> <li>● Fetal loss</li> <li>● Premature birth</li> </ul>	<ul style="list-style-type: none"> <li>● Health care workers</li> <li>● Production line workers</li> <li>● Occupations that demand prolonged standing and manual handling</li> </ul>

**Table 3.14** (continued)

Hazard	Reproductive Health Effects	High Risk Occupations
Shift work (especially working at nights)	<ul style="list-style-type: none"> <li>• Disturbance of menstrual cycle</li> </ul>	<ul style="list-style-type: none"> <li>• Occupations that demand 24h rotating shifts (e.g. nurses, police women)</li> </ul>
<b>Biological Hazards</b>		
Cytomegalovirus CMV	<ul style="list-style-type: none"> <li>• Fetal loss</li> <li>• Congenital defects-developmental disorders</li> <li>• Low birth weight</li> </ul>	<ul style="list-style-type: none"> <li>• Health care personnel</li> <li>• Teachers-educative personnel</li> <li>• Nursery workers</li> </ul>
Hepatitis B (Yavuz et al., 2005)	<ul style="list-style-type: none"> <li>• Low birth weight</li> <li>• Congenital infection</li> </ul>	<ul style="list-style-type: none"> <li>• Health care workers</li> <li>• Sexual workers</li> </ul>
HIV	<ul style="list-style-type: none"> <li>• Low birth weight</li> <li>• Congenital infection</li> </ul>	<ul style="list-style-type: none"> <li>• Health care workers</li> <li>• Sexual workers</li> </ul>
Rubella	<ul style="list-style-type: none"> <li>• Fetal loss</li> <li>• Congenital defects</li> <li>• Low birth weight</li> </ul>	<ul style="list-style-type: none"> <li>• Health care personnel</li> <li>• Teachers-educative personnel</li> <li>• Nursery workers</li> </ul>
Parvovirus B19	<ul style="list-style-type: none"> <li>• Fetal loss</li> </ul>	<ul style="list-style-type: none"> <li>• Health care personnel</li> <li>• Teachers-educative personnel</li> <li>• Nursery workers</li> </ul>
Varicella zoster virus VZV	<ul style="list-style-type: none"> <li>• Congenital defects</li> <li>• Low birth weight</li> </ul>	<ul style="list-style-type: none"> <li>• Health care personnel</li> <li>• Teachers-educative personnel</li> <li>• Nursery workers</li> </ul>
Toxoplasmosis	<ul style="list-style-type: none"> <li>• Fetal loss</li> <li>• Congenital defects-developmental disorders</li> <li>• Low birth weight</li> </ul>	<ul style="list-style-type: none"> <li>• Livestock-farming workers</li> <li>• Veterinarians</li> </ul>

NOTE: Table adapted and modified from "The Effects of Workplace Hazards on Female Reproductive Health" DHHS (NIOSH) Publication No. 99-104.

## *Diagnostic Procedure*

### **Using the PRECEDE-PROCEED Model**

The PRECEDE-PROCEED model of planning will be used as a framework to guide the diagnostic phase of the suggested intervention (Gielen & McDonald 1997; Green & Kreuter 1991; Green, Kreuter, Deeds & Partridge 1980; National Cancer Institute 2005b; Ransdell. 2001). The outline of this theoretical model is presented in Figure 3.4.

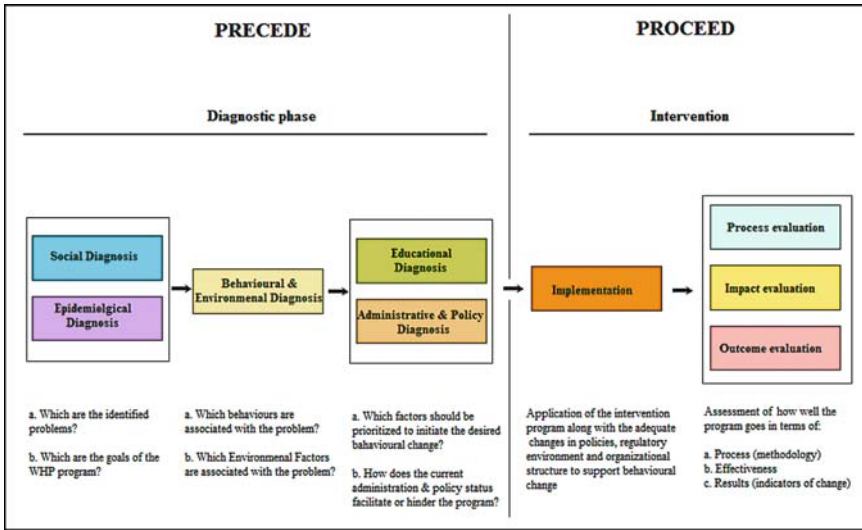


Fig. 3.4 The PRECEDE-PROCEED model

- PRECEDE provides the methodological framework for the design of tailored educational interventions targeting specific populations. It is based on the medical model, involving an initial diagnostic approach to the needs of a patient, before prescribing a specific treatment. As an analogy, PRECEDE constitutes a tool to design a specific educational plan, according to the identified needs of the target group.
- PROCEED has been an addition to the original model, to further include environmental determinants (e.g., policies, managerial and economic issues) that influence human attitudes towards specific health behaviors. This model follows a reverse course, towards the origin of certain health behaviors to target interventions for the causal factors themselves, rather than just the symptoms. The outline of the process that takes place in nine stages is presented in Figure 3.4.

For our example, only the diagnostic part of the model will be analyzed.

### Social Diagnosis

Despite the fact that we have already chosen occupational reproductive hazards as our intervention subject in this case, the stage of social diagnosis is supposed to have taken place before making our choice.

For any workplace health promotion effort to be effective, the key issue must be tailored according to the needs of the predefined target population. Even though women’s reproductive health may seem like a scientifically important field of intervention, our target group of women employees *may not* consider it to be a high-priority issue-either because they consider having more important health problems

or because they are not adequately informed on the possible impact of similar disorders on their personal health status.

The main focus of health professionals at this stage is to investigate:

- The target group's perception of their quality of life
- The most important determinants of their quality of life (e.g., career, family, health)
- Their expectations and concerns about their health status
- Whether reproductive health issues are considered an important enough factor for women that an intervention through a WHP program is valuable

### **Epidemiological Diagnosis**

The focus of health professionals during this phase is to identify—through analyzing epidemiological evidence—the impact of the specific problem on the predefined target group (e.g., female workers in a factory, women employed in a specific profession). Furthermore, this procedure aims at prioritizing the specific subgroups that face the highest risk of exposure to reproductive hazards and need more immediate preventive measures. This stage includes:

- Identification of work-related parameters, as well as individual behaviors that may influence the reproductive health status of women employees
- Evaluation of specific indicators of reproductive health disorders in our target population. Some of these indicators are listed in Table 3.15

One of the specific interests of health professionals at this stage is to locate groupings of reproductive disorder indicators in certain subgroups (specific job tasks, worksite-specific reproductive hazards) of the population, to prioritize them as intervention groups (e.g., focusing a WHP program for the prevention of reproductive disorders on oncology unit nurses in case they present higher incidence of congenital defects compared to the rest of health care personnel)

**Table 3.15** Potential indicators of reproductive disorders (Lawson et al. 2006)

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1.	<b>Increased infertility rates</b> among women of a specific industry
2.	A <b>prolonged conception period</b> among female workers
3.	Frequent reports of <b>menstrual disorders</b> and early menopause by female employees in the company's medical files
4.	<b>Male/female ratio of births</b>
5.	Reported <b>pregnancy complications</b> among employed pregnant workers (e.g., diabetes, hypertension, pre-eclampsia, etc.)
6.	Reduced (or increased) <b>average birth-weight</b> of infants
7.	Increased rates of <b>pre-term deliveries</b> (and miscarriages)
8.	Number of <b>sick-leave days</b> among pregnant employees (for problems related to pregnancy)
9.	Increased rates of <b>congenital defects</b> among infants of female workers
10.	Increased incidence of <b>neoplasms of reproductive organs</b> among employed women

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## Behavioural and Environmental Diagnosis

It is imperative during the initial design of a tailored WHP intervention program for the prevention of occupation-induced female reproductive disorders, to incorporate a set of behavioral and environmental change indicators that serve as general objectives for the program. WHP professionals, prior to the development of an intervention plan, should conduct behavioral and environmental diagnosis to identify existing key issues concerning OSH attitudes and beliefs and practices in the organization (employees, executives, and company administration) and the safety status of facilities, procedures, and equipment. These key issues may include (State of Alaska 2003):

- **Personal accountability:** This parameter is crucial for the success or failure of any prevention program, both on worksites and in the general population. It is important to adjust the program's aims and methods according to women's perceptions of its personal influence on their health status. Female employees should be able to recognize their personal responsibility and contribution to the effective implementation of the preventive measures and practices by the completion of the WHP intervention.
- **Attitude towards change:** A key component for the design of an effective intervention prevention program is taking into account the degree to which women agree with the proposed changes (safety behavior, practices, OSH regulatory environment), so that invention methods can be modified accordingly. At this stage, therefore, health professionals should evaluate the awareness status and the ability of female employees to adopt the desired safety practices introduced by the WHP program on both personal and collective levels to determine the kind of messages and strategies appropriate for the specific population.
- **Participation:** One of the primary targets of the WHP intervention is to achieve a high degree of participation in the program's activities, as it is one of the key elements that significantly influences results. It is important at this stage to recognize and alleviate barriers that are driving women to abstain from similar programs. Furthermore, there is a need to identify the subgroups of female workers where the focus of the intervention needs to be to promote their involvement.
- **Occupational hazard identification:** Apart from recognizing that female workers are at a high risk for reproductive disorders, the WHP program should also concentrate on specific protective measures and proposals for these groups of employees. It is essential, therefore, to identify and record existing working conditions of women in the specific organization in detail, to determine their possible detrimental effect on the reproductive physiology of those same women, and assess the existent OSH status of their job tasks. This process includes recording:
  1. **Procedures** (production line, manual tasks, strenuous work pace, extreme climate conditions, emission of fumes/particles, and stressful conditions)
  2. **Hazardous agents** (physical, chemical, and biological) involved in female workers' tasks or working environment
  3. **Equipment used** in specific tasks (radiation sources, vibrating parts, electromagnetic fields)



4. **Existing protective measures** (ventilation systems, separate mixing chambers for chemicals, lifting devices for manual handling, radiation shields, PPE, rotation of night shift workers, etc.) for women employees
5. **Potential for OSH improvement** (substitution of procedures or agents, automatization of tasks, amelioration of working conditions, change of job post, or rotation of workers)

### **Education and Organizational Diagnosis**

This part of the diagnostic process involves the identification of the educational needs of female employees, as well as the structural changes that are needed in the specific organization to effectively introduce the WHP interventions for the protection of women worker's reproductive health. This process will be used to shape our strategic approach towards the target population, through the analysis of determinants of compliance with safety practices at individual, collective, and organizational levels. Three categories of such factors may be identified—namely, *Predisposing*, *Enabling*, and *Reinforcing* factors, that will be further analyzed:

Predisposing Factors:

Health professionals may recognize multiple potential fields of intervention on which to focus the WHP program:

#### **Individual Level—**

- Lack of sensitization concerning female reproductive disorders because of limited access to information (limited media coverage, GRAS (McDiarmid & Gucer 2001) status of female employment, limited research on the specific topic)
- Low literacy among the population of female workers that causes difficulties in comprehending scientific literature on reproductive hazards
- Lack of adequate prevention skills (recognizing types of substances, interpretation of MSDS or safety labeling, use of PPE, existing best practices, emergency safety procedures)

#### **Collective Level—**

- Negative example of non-compliance with safety practices by peers (co-workers, supervisors)
- Widely accepted misbeliefs, and false sense of safety among female workers

#### **Organizational Level—**

- Lack of strict company policies and regulations on OSH practices for positions putting women at risk of exposure to reproductive hazards
- Inadequate surveillance of reproductive disorders for women employed in job tasks generally considered *safe*

### Enabling Factors:

The WHP program may introduce certain interventions to promote the desirable change to compliance in OSH practices.

#### **Individual Level—**

- Personalized information on female reproductive system and occupational risks involved
- Health awareness building on reproductive health issues and their importance

#### **Collective Level—**

- Wide dissemination of existing scientific evidence on reproductive hazards for women employees (population awareness)
- Creation of peer support systems among groups of women workers to promote compliance with safety procedures

#### **Organizational Level—**

- Detailed recording of job tasks for female employees and identification of sources of exposures to known or potential reproductive hazards
- Introduction of specific safety guidelines and policies for the prevention of reproductive disorders
- Establishment of clear communication channels between employees and administration to report their concerns or personal experience on relative issues
- Improvement of the existing surveillance system for reporting suspicious cases among women workers

### Reinforcing Factors

WHP program officials may utilize numerous tactics to support the desired prevention strategy at this field.

#### **Individual Level—**

- Provision of access to supplementary information resources on reproductive health issues and available prevention methods to the population of women employees
- Application of periodic follow-up sessions and use of frequent reminders (letters, telephone calls, e-mail messages) to retain an increased awareness level among female workers
- Dispensation of easily accessible screening services for exposure of employees to reproductive hazards

### **Collective Level—**

- Building a support network for the compliance of individuals with occupational safety practices by appointing safety committees that include female workers at risk for reproductive hazards
- Organization of group discussions among workers of specific occupational categories to share common experiences and concerns on related issues
- Projection of specific employees as models of good conduct in OSH issues involving reproductive hazards prevention
- Presentation of statistics on results of exposure level reduction, or outcomes, if available (e.g., reduction on rate of miscarriages)

### **Organizational Level—**

- Active participation of women employees in the decision-making process concerning applied safety policies in the company
- Representation of female workers from different occupational sectors within the organization in administrative issues regarding the design of workstations and job tasks, and the introduction of new technologies, materials, and procedures
- Introduction of incentives for the compliance of employees with safety policies

### **Administrative and Policy Diagnosis**

WHP professionals should conduct this final diagnostic procedure before the implementation of the prevention program, to determine whether the program's scope and activities are compatible with the administrative and policy framework of the organization. The main issues to be identified at this stage are:

- Whether the policies and safety regulations related to potential reproductive hazards are in accordance with the program's requirements and the existence of requisite modifications or complementary arrangements
- Whether the program introduces any interventions that are in conflict with the organization's operational framework
- Whether the selected form of intervention (information campaign, skill building sessions, group activities) is appropriate for the existing *company culture* in OSH issues
- Which of the existing structures and activities in the organization are useful to the program's strategic planning. Some examples of similar structures and activities are presented in Table 3.16.
- Whether the company's administration is sufficiently flexible to adopt the participatory decision model proposed by the program for the resolution of OSH issues
- Whether the organization's field of activities and operational status allows for alternative practices, procedures, and materials. Table 3.17 sites an indicative list of similar practices and procedures.

**Table 3.16** Structures and activities useful to the strategic planning of WHP for the prevention of reproductive disorders

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1. Systematic <b>record of occupational medical history</b> of workers
2. <b>Safety committees</b> appointed by company's employees
3. <b>Trade-union department specialized in OSH</b> issues for female employees
4. <b>Registry</b> of recognized occupational reproductive disorders
5. <b>Official forms for reporting</b> employees remarks on working conditions and related hazards
6. <b>Detailed registry of materials, substances and processes</b> utilized in each department of the organization (toxicity, carcinogenicity, potential for endocrine disrupting activity)
7. <b>Regular group meetings among workers</b> and administration representatives
8. <b>Periodic screening of working population</b> for hazardous occupational exposures

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**Table 3.17** Examples of alternative solutions

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1. Partial <b>automatization</b> of procedures
2. <b>Isolation of procedures</b> involving hazardous exposures
3. Use of <b>alternative materials</b> and chemical compounds
4. <b>Design modification</b> of production lines and workstations
5. Use of <b>ancillary equipment</b>
6. Change in <b>time schedule, staff rotation</b>

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- Whether the WHP program's focus of interest conforms to the health priorities identified by the company's administration
- Whether the segregation of tasks among different departments blocks the desired dissemination of the program and excludes certain categories of employees

### *Identification of the Target Population's Needs*

The primary concern of WHP professionals in the design of an educative intervention for women workers is to provide a tailored program according to the specific target population and its educational needs. The selection of a specific approach for this *educational needs assessment* depends heavily on the available resources (staff, time, expenditure limitation) of the program. Listed below are some of the available techniques, and the form in which they may be employed, to obtain related information from the female workers' population (National Cancer Institute 2005a; Pfizer 2004; Younger, Wittet, Hooks & Lasher 2001):

#### **Surveys**

Women employees can be accessed individually, either at their worksite or through telephone or Internet surveys, to fill in specifically designed questionnaires. Some of the questions that may be included in such a questionnaire are listed in Table 3.18.

#### **Focus Groups**

This approach involves two-hour sessions of small work groups of six to ten women employees who testify their individual concerns, experiences, and percep-

**Table 3.18** Outline of questionnaires

<b>Demographic Data:</b>	Age Marital status
<b>Subgroups:</b>	Ethnicity (Native, immigrant, ethnic minority) Religious groups (beliefs, attitudes)
<b>Occupational Category:</b>	Blue collar worker (manual handling, machine operator) Clerical employees Administrative-executive level
<b>Awareness Level:</b>	Previous participation to similar programs (sensitization) Existing knowledge on reproductive health issues Perception of personal susceptibility to reproductive disorders
<b>Required Practical Skills:</b>	Identification of occupational risk sources (MSDS, properties of chemical compounds) Training in safe practices (proper use of PPE, facilities) Identification of early warning symptoms of reproductive disorders Appropriate use of screening and other medical services
<b>Literacy Skills:</b>	Level of education

tions on work-related reproductive health issues. The activity takes place under the continuous supervision of an expert facilitator (health professional). The workgroup is selected on the basis of common socioeconomic and ethnic characteristics (e.g., representation of low literate immigrant female workers) as well as their specific job tasks. The application of this technique offers the WHP program a more comprehensive insight into the target population profile (Younger et al. 2001), as well as the specific needs of certain special subgroups of women workers (e.g., effective approach and training techniques, use of appropriate educative material).

### Individual Interviews

Women employees are interviewed in the form of open-ended questions, where they are encouraged to identify themselves and their educational needs by trained professionals (instead of being guided by specific queries). Even though this technique is the most time-consuming, it offers the most in-depth needs identification (Younger et al. 2001).

### Advisory Boards

These committees are formed by women employee representatives of specific at-risk populations, and consult WHP professionals on specific issues related to reproductive health disorders among certain categories of workers, contributing their own experiences and concerns.

## ***Available Actions***

The Ecological Model (McLeroy, Bideau, Steckler & Glanz 1988) that was presented in the first chapter of this book offers the opportunity to identify the determinants of individual behavior within the wider context of social groups or organizations to which a person belongs. This perspective can therefore be useful for implementing comprehensive WHP programs addressing specific health issues.

Analyzing the profile of a specific organization according to the five individual levels of the ecological perspective model—*intrapersonal*, *interpersonal*, *institutional*, *community*, and *policy*—one can identify multiple and multi-component potential interventions for the protection of female workers from the main categories of reproductive hazards recognized in the existing literature.

### **Intrapersonal Level Interventions**

At the intrapersonal level, workplace health promotion activities focus on individual skill building for female workers in the form of personal counseling on issues of reproductive health. The general scope of these interventions, some of which are presented in Table 3.19, is the introduction of a number of issues including:

- Identification of occupational reproductive hazards, personal risk factors, and related symptoms
- Requested behavioral changes towards prevention
- Skill-building in the correct use of equipment, materials, and safety practices
- Access to scientific resources and specialized health services

### **Interpersonal Level Interventions**

Workplace health promotion interventions at this level appeal to groups of working women instead of individuals. This stage of WHP involves skill-building sessions, team collaboration and support activities, and health education, which may vary in group size or duration according to the educational needs of a specific working population. These groups can be selected according to common epidemiological or social characteristics of the workers (e.g., age, education, ethnicity) to adequately tailor any intervention. Table 3.20 presents some of the group activities that may take place within the context of WHP:

### **Institutional Level Interventions**

Cited in Table 3.21 is a list of available interventions at the institutional (or *company*) level concerning organizational measures, practices, and policies that may be implemented for the protection of women worker's reproductive health.

**Table 3.19** Intrapersonal level interventions

Potential Hazard	Intervention Opportunities
<b>Hazardous Chemical Agents</b> (solvents, inhaled vapors, liquid substances)	<ul style="list-style-type: none"> <li>• Education of female employees in potential hazardous effects of chemicals on reproductive health</li> <li>• Education of employees on identification of chemicals, labeling, and proper use of M.S.D.S. (Material Safety Data Sheets)</li> <li>• Provision of definite safety guidelines for handling, storing, mixing and applying chemical substances</li> <li>• Training in proper use of PPE (Personal Protective Equipment)</li> </ul>
<b>Smoking</b> (active & passive)	<ul style="list-style-type: none"> <li>• Education of female employees on the detrimental effects of smoking on female fertility and pregnancy</li> <li>• Implementation of smoking cessation programmes</li> </ul>
<b>Ionizing Radiation</b>	<ul style="list-style-type: none"> <li>• Education of female employees about the hazardous effects of ionizing radiation</li> <li>• Provision of definite safety guidelines for operating equipment which emit radiation</li> <li>• Supply, and training in the use of personal radiation dosimeters</li> <li>• Training in proper use of PPE (Personal Protective Equipment)</li> </ul>
<b>Strenuous Work – Manual Handling</b>	<ul style="list-style-type: none"> <li>• Training of female personnel in stress management techniques and psychological consultation</li> <li>• Education on methods for preventing occupational fatigue (adequate lifestyle and nutritional changes, early recognition of warning symptoms of physical strain, proper clothing)</li> <li>• Personal training in basic principles of ergonomics and safe manual handling techniques</li> </ul>
<b>Infectious Diseases</b>	<ul style="list-style-type: none"> <li>• Education of female employees on hazardous effects of infectious agents on reproductive health and pregnancy</li> <li>• Provision of prevention guidelines for infectious agents (vaccination, transmission pathways)</li> <li>• Training in proper use of PPE (gloves, goggles, safe sexual practices for sexual workers)</li> </ul>

### Community Level Interventions

To implement effective workplace health promotion programs for the protection of female reproductive health, health professionals should not neglect the fact that the female working population in a specific worksite acquires certain characteristics that

**Table 3.20** Interpersonal level interventions

Potential Hazard	Intervention Opportunities
<b>Hazardous Chemical Agents</b>	<ul style="list-style-type: none"> <li>Group sessions on safety procedures for handling chemical substances, to enhance acceptance of safety regulations and team-building</li> </ul>
<b>Smoking</b>	<ul style="list-style-type: none"> <li>Group education on the detrimental effects of tobacco on female reproductive health</li> <li>Smoking cessation groups for employees</li> </ul>
<b>Ionizing Radiation</b>	<ul style="list-style-type: none"> <li>Group training sessions on radioactive material safe handling, and protective measures against ionizing radiation</li> </ul>
<b>Strenuous Work – Manual Handling</b>	<ul style="list-style-type: none"> <li>Group skill-building on stress management techniques, workplace design for the protection of pregnant women employees, safe manual handling methods</li> </ul>
<b>Infectious Diseases</b>	<ul style="list-style-type: none"> <li>Group education on infectious agents hazardous for female reproductive health, their transmission pathways, methods for prevention</li> </ul>
<b>Generic:</b>	
<ul style="list-style-type: none"> <li>Creation of employee’s groups to constitute models of “best practice” and provide a supportive environment for the adoption of safety techniques (or “healthy behaviour”) among women workers</li> <li>Creation of idea-exchanging groups, for identification of specific workplace reproductive hazards and special issues of concern for women workers</li> </ul>	

define a *community*. The main focus of a successful WHP project at this level is to incorporate the issue of reproductive health in the *safety culture* of female workers.

This involves organizing targeted group activities for female workers that addresses the problem of reproductive hazard prevention through the community’s system of “group norms, inner rules and beliefs”(Edlich, Winters, Hudson, Britt & Long 2004), and create a *climate* of awareness on issues related to female employees.

### Policy Level Interventions

At this level, workplace health promotion programs involve contacts with stakeholders (trade union members, employee representatives, company executives) and policymakers to propose measures, policies, and legal provisions for the protection of female workers’ reproductive health, some of which are listed in Table 3.22.

### Communication Strategy

WHP programs may utilize multiple channels of communication to deliver messages related to women’s reproductive health protection. The approach may take various forms (Prevention 2003):



**Table 3.21** Institutional level interventions

Potential Hazard	Intervention Opportunities
<b>Hazardous Chemical Agents</b>	<ul style="list-style-type: none"> <li>• Proposals (by health professionals) for specific changes in the production line – substitution of chemical factors which are detrimental for female reproductive health with “safer” compounds</li> <li>• Proposals for specific design changes in facilities, to isolate chemical procedures</li> <li>• Frequent measurements by health technicians in the workplace to record concentration of chemicals, and identification of high risk population</li> <li>• Training of occupational physicians and nurses in:               <ol style="list-style-type: none"> <li>a) identification of chemical reproductive hazards</li> <li>b) available preventive measures</li> <li>c) early diagnosis of reproductive disorders</li> </ol> </li> <li>• Re-positioning of pregnant employees to reduce potential exposure to chemicals</li> <li>• Provision to all staff members of specific company’s guidelines on occupational safety and reproductive hazards prevention (official forms, leaflets, electronic mail), as well as standard operating procedures for using chemicals</li> <li>• Rotation of workers to reduce potential exposure</li> </ul>
<b>Smoking</b>	<ul style="list-style-type: none"> <li>• Definition of a strict company’s policy on health protection for non-smokers</li> <li>• Placement of warning signs to prohibit smoking in the company</li> <li>• Provision of adequate outdoor spaces, and time-breaks for smokers</li> <li>• Funding of campaigns and incentives on smoking cessation for employees</li> </ul>
<b>Ionizing Radiation</b>	<ul style="list-style-type: none"> <li>• Proposals for specific design changes (e.g. armoring improvement, isolation of radioactive material) to avoid exposure of personnel to radiation</li> <li>• Frequent radiation measurements in the workplace environment to identify potential sources of exposure and high risk employees</li> <li>• Provision (to all staff) of specific directives on safe use of radiation emitting equipment (instruction sheets, official forms, leaflets, electronic mail)</li> <li>• Re-positioning of pregnant employees to reduce potential exposure. Rotation of workers to reduce potential exposure</li> </ul>
<b>Strenuous Work – Manual Handling</b>	<ul style="list-style-type: none"> <li>• Proposals to administration to conduct adequate modifications in ergonomic design and provision of special equipment</li> </ul>

**Table 3.21** (continued)

Potential Hazard	Intervention Opportunities
	<ul style="list-style-type: none"> <li>Proposals to administration for the introduction of specific safety regulations concerning female employees (especially during pregnancy): a) time-schedule modification, b) maximum working hours, c) mandatory time-breaks, d) provision of sick-leave days, e) maximum allowed weight for manual handling, f) re-positioning of pregnant employees, g) zero-tolerance policy on aggressive behavior against employees</li> <li>Providing staff with the organization's safety guidelines for preventing physical strain (instruction sheets, official forms, leaflets, electronic mail). Rotation of workers to reduce physical strain</li> </ul>
<b>Infectious Diseases</b>	<ul style="list-style-type: none"> <li>Provision to all staff of educative material on potential effects of infectious agents to female reproductive health</li> <li>Introduction of collective safety guidelines for all health-care personnel</li> <li>Provision of adequate safety equipment to prevent accidental transmission of infectious agents (safety syringe mechanisms, syringe disposal vessels, goggles, masques, gloves)</li> <li>Extensive vaccination program for child-bearing age personnel (health care workers, teachers, nursery workers)</li> </ul>

## Lectures

Lectures constitute single courses or one-shot education interventions (Prevention 2003) providing general information on the topic of occupational reproductive hazards for women (risk factors, generic preventive measures). Presentations and lectures may be used as well to carry health messages among the staff in an effort to establish general acceptance and support for the company's pertinent safety regulations and policies.

**Table 3.22** Policy level interventions

Intervention Opportunities
<ul style="list-style-type: none"> <li>Prioritization of systematic research on suspected reproductive toxicants</li> <li>Collaboration between experts in industrial toxicology, human reproductive biology, epidemiologists and industry representatives (Lawson et al., 2006)</li> <li>Systematic occupational exposure assessment to identify high risk female employees</li> <li>Proposal for legislative regulation to substitute hazardous agents with "safer" chemical compounds</li> <li>Promotion of scientific research on gender specific reproductive issues for female workers</li> <li>Obligatory reproductive health surveillance of women workers in high risk for reproductive disorders</li> <li>Systematic registry of birth defects according to maternal occupational exposures</li> <li>Production of specifically designed protective equipment for female workers</li> </ul>

## Print Material

This form of communication is able to provide wide-scale access to the population of working women (e.g., access to agricultural workers in distant areas, low-literacy skill employees) through billboards, magazines, and newspapers published by the company, or items of special interest to certain professional sectors, such as leaflets referring to reproductive safety issues. Health professionals may utilize this channel to address generic guidelines for prevention on issues of reproductive health either to female workers themselves or to their coworkers, which may effect women employees through their tasks or behavior (e.g., men employees smoking indoors, safe storage or handling of hazardous chemicals in the workplace).

## Clearinghouse

This form of health promotion is based on establishing an interactive information service for the prevention of occupational reproductive disorders (Prevention 2003). This service should incorporate a telephone center with the ability to provide personal telephone counseling to women employees, as well as a hotline for answering women's questions concerning reproductive health issues. Furthermore, this service should develop an electronic library, accessible through the Internet, for all female workers and the general public, providing official safety guidelines for reproductive hazards and answers to related questions. Finally, it enables continuous sensitization of high-risk female employees through frequent electronic reminders and their activation in safeguarding their reproductive health.

## Media

Media has proven to be one of the most effective communication channels for many health issues and health promotion activities. It can be utilized to address messages on a larger scale, mostly by health professionals who work in workplace health promotion programs on community, national, or European level. It uses public announcements, short messages, and commercials to address reproductive health hazard prevention issues through radio, television, and newspapers. In some cases, this form of health promotion may be useful for approaching female workers who are not easily accessible by other workplace health promotion programs, such as occupations in small enterprises, part-time employment, and female agricultural workers in remote areas.

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