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TRAINING FOR THE HEALTH SECTOR
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PREVENTING REPRODUCTIVE HEALTH PROBLEMS

Training Module 6
Children’s Environmental Health
Public Health and the Environment
World Health Organization
www.who.int/ceh

WHO/HSE/PHE/EPE/11.01.15

<<NOTE TO USER: Please add details of the date, time, place and sponsorship of the meeting for which you are using this presentation in the space indicated.>>

<<NOTE TO USER: This is a large set of slides from which the presenter should select the most relevant ones to use in a specific presentation. These slides cover many facets of the problem. Present only those slides that apply most directly to the local situation in the region or replace them with your own slides and local data.>>

<<NOTE TO USER: This module presents several examples of risk factors that affect reproductive health. You can find more detailed information in other modules of the training package that deal with specific risk factors, such as lead, mercury, pesticides, persistent organic pollutants, endocrine disruptors, occupational exposures; or disease outcomes, such as developmental origins of disease, reproductive effects, neurodevelopmental effects, immune effects, respiratory effects, and others.>>

<<NOTE TO USER: For more information on reproductive health, please visit the website of the Department of Reproductive Health and Research at WHO:
www.who.int/reproductivehealth/en/>>
LEARNING OBJECTIVES

❖ Understanding the importance of preventing environmental exposures to protect reproductive health

❖ Understand various methods of prevention in public health, including in the occupational setting, for the consumer, and in personal matters

Refs:


Preventing Reproductive Health Problems

OUTLINE

❖ The importance of implementing preventive measures

❖ Methods of prevention
  A. Occupational
  B. Consumer / Policies
  C. Personal

❖ Tools available from WHO

Refs:
Environmental issues have been included in the United Nations Millennium Declaration as well as several high level initiatives. However, the importance of preventive methods in various sectors is not always fully appreciated. The following slides will describes preventive methods for different exposure situations.

Refs:

The occupational setting is a prime venue for exposure to environmentally hazardous contaminants, including synthetic chemicals, organic compounds, and metals. Occupational health agencies use field studies, exposure assessments, and laboratory biomonitoring to study prioritized reproductive toxicants that may be present in the workplace. However, it is impossible to assess the toxicity of all occupationally relevant chemicals due to their sheer volume, complex exposure environments in the workplace, and individual susceptibility to effects.

<<NOTE TO USER: For more information regarding occupational exposures to environmental contaminants, please see the educational training module: “Occupational Health and Children’s Risks,” available at: www.who.int/ceh/capacity/occupational.pdf.>>

Refs:
The effect of shift work, and circadian rhythm disruption, on reproductive outcomes is poorly understood, although advances have been made in the development of metrics for measuring disruption of circadian rhythm in working populations. One such metric is the variability of 2-sulfoxymelatonin, the urinary metabolite of melatonin, which has been found to be correlated with travel by female flight attendants through multiple time zones.
Future parents can be exposed at their workplaces to many occupational health risks that can affect their ability to have children or the health of their future children. Both men and women can be affected by reproductive occupational health risks.

Exposures to some chemicals or to stressful conditions may cause both male and female workers to experience a decrease in their desire or ability to have sex. For example, some chemicals may have depressant effects, such as certain solvents, and thus can suppress the libido (sex drive). Occupational exposures can also cause menstrual problems, which may prevent ovulation from taking place. Stress, working on shifts, or exposure to certain organic solvents can disrupt the normal menstrual cycle, which in turn can affect fertility. Another possible effect of exposure to certain occupational hazards is their ability to cause direct damage to the germ cells (sperm and eggs). Radiation and certain chemicals can cause decreased fertility or even sterility.

Occupational risks can reduce the number of sperm to a level below the minimal necessary for fertilization. Certain occupational hazards can cause mutations in genetic material that can be passed on to future generations. Such hazards are called mutagens. Genetic mutations can result in birth defects, stillbirth or miscarriage, depending on the type of damage caused.

Refs:
• International Labour Organization (ILO). Male and female reproductive hazards in the workplace. ILO. Available at actrav.itcilo.org/actrav-english/telelearn/osh/rep/prod.htm – accessed 10 June 2011
A study (Ormond et al.) found that although mothers exposed occupationally to endocrine disruptors faced an increased risk for fetal developmental disorders, folate supplementation during the first three months of pregnancy could significantly decrease the aforementioned risk. In the United States, the “Right to know” is the legal principle that individuals have the right to know the chemicals to which they may be exposed in their daily living. “Right to Know” US can address the community and the workplace “Right to Know”.

Note: PPE is Personal Protective Equipment

Refs:

Hypospadias is one of the most common urogenital congenital anomalies affecting baby boys. Prevalence estimates in Europe range from 4 to 24 per 10,000 births, depending on definition, with higher rates reported from the United States. Relatively little is known about potential risk factors, but a role for endocrine-disrupting chemicals (EDCs) has been proposed. Our goal was to elucidate the risk of hypospadias associated with occupational exposure of the mother to endocrine-disruptor chemicals, use of folate supplementation during pregnancy, and vegetarianism.

We designed a case–control study of 471 hypospadias cases referred to surgeons and 490 randomly selected birth controls, born 1 January 1991–30 September 1994 in southeast England. Telephone interviews of mothers elicited information on folate supplementation during pregnancy and vegetarianism. We used a job exposure matrix to classify occupational exposure. Results: In multiple logistic regression analysis, there were increased risks for self-reported occupational exposure to hair spray [exposed vs. nonexposed, odds ratio (OR) = 2.39; 95% confidence interval (CI), 1.40–4.17] and phthalate exposure obtained by a job exposure matrix (OR = 3.12; 95% CI, 1.04–11.46). There was a significantly reduced risk of hypospadias associated with folate use during the first 3 months of pregnancy (OR = 0.64; 95% CI, 0.44–0.93).

Conclusions: Excess risks of hypospadias associated with occupational exposures to phthalates and hair spray suggest that antiandrogenic EDCs may play a role in hypospadias. Folate supplementation in early pregnancy may be protective.


The setting of occupational exposure limits (OELs) are founded in occupational medicine and the predictive toxicological testing, resulting in exposure–response relationships. For compounds where a No-Observed-Adverse-Effect-Level (NOAEL) can be established, health-based OELs are set by dividing the NOAEL of the critical effect by an overall uncertainty factor. Possibly, the approach may also be used for carcinogens if the mechanism is epigenetic or the genetic effect is secondary to effect from reactions with proteins such as topoisomerase inhibitors, and mitotic and meiotic spindle poisons. Additionally, the NOAEL approach may also be used for compounds with weak genotoxic effect, playing no or only a minor role in the development of tumours. No health-based OEL can be set for direct-acting genotoxic compounds where the lifetime risks may be estimated from the low-dose linear non-threshold extrapolation, allowing a politically based exposure level to be set. OELs are set by several agencies in the US and Europe, but also in-house in major chemical and pharmaceutical companies. The benchmark dose approach may in the future be used where it has advantage over the NOAEL approach. Also, more attention should be devoted to sensitive groups, toxicological mechanisms and interactions as most workplace exposures are mixtures.
Due in part to the ever increasing number of chemicals that are created every year, effective screening methods should be employed to gauge safety before they are used. High cost of screening assays is the prime reason for the gap that exists between existing chemicals and screened chemicals. Because the transition to menopause marks the beginning of a series of important hormonal change, occupational health agencies have suggested using this female endpoint in worker health assessments. A standard definition of the start of the menopausal transition would also allow important comparisons across occupational health studies.

Ref:
RECOMMENDATIONS FOR WORKERS AND EMPLOYERS

- Pregnant women should not work without protection in occupational settings that put them at risk for exposure
  - Mining with mercury
  - Spraying crops with pesticides
- Open dialogue with employers about occupational safety and methods of preventing exposures
- Pay close attention to health status, do not ignore symptoms
EXAMPLE: PREVENTING PESTICIDE EXPOSURE

- Do not use pesticides unnecessarily
- Promote the use of safer pest control methods in agriculture and the protection of agricultural workers
- Do not participate in occupational pesticide application if pregnant or if you plan to be pregnant in near future
- Do not allow children to participate in occupations with pesticide exposure
- If employed in occupations with pesticide exposure, utilize personal protective equipment, if possible
- Change your clothes after occupational exposure to avoid take home exposure risks
- Avoid unnecessary use of pesticides around home environment; when pest control is needed use the safest possible method like bait traps
- Apply pesticides with methods that avoid drift into surrounding communities and contamination of food and drinking water supplies

Ref:
Engineered nanomaterials are uniformly sized materials < 100 nm (1 nanometer = 10^{-9} meter). The potential toxicological hazards associated with the increasing commercial uses of nanotechnology are not well understood.

In terms of multiple exposures and synergistic effects of chemicals, greater research is needed on the specific mechanisms of toxicity of toxicants in order to understand what sort of risk assessment framework can be used. The effects of physical hazards in concert with chemical hazards will be very difficult to assess as exposures increase. Whole-body vibration can affect androgen levels just as chemical toxicants can (Cardinale and Pope 2003).

Ref:


More information:

• International Labour Organization. www.ilo.com
• WHO. Healthy workplaces: a model for action. For employers, workers, policy-makers and practitioners. WHO. 2011.
• WHO Occupational health homepage: www.who.int/occupational_health/healthy_workplaces/en/
B. CONSUMER PROTECTION FROM ENVIRONMENTAL EXPOSURES

Actions can be taken at multiple levels:

- Societal / policies
- Industry/business
- Individual
As a society, there is need for coordinated actions, international agreements, and strengthened domestic laws.

Refs:
Organochlorine pesticides are highly lipophilic organic pollutants that persist in the environment, accumulate in the food chain and are regularly detected in humans. Dichlorodiphenyltrichloroethane (DDT) was banned in the US in the 1970s. Replacement pesticides for DDT are insecticides such as organophosphates. Organophosphate pesticides are the most heavily used pesticide products in US agriculture. Organophosphate pesticides inhibit the acetylcholinesterase in synaptic clefts, which then deregulates the metabolism of acetylcholine. Acetylcholine is a neurotransmitter to critical to skeletal-muscle motor neurons. Continued inhibition causes accumulation of acetylcholine at the neuronal junctions and results in continued stimulation and then suppression of the neurotransmission.

Ref:

Rotterdam Convention - www.pic.int/ - accessed 10 June 2011
National legislation is needed to:

- Track the introduction and presence of chemicals and pesticides in society
- Provide authorities for import and export and obligations under international agreements
- Provide authority for provision of hazard and exposure information, registration and authorization uses of pesticides and industrial chemicals
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**ACTIONS BY INDUSTRY**

❖ **WHY?**
   - Corporate Responsibility!

❖ **Manufacturers**
   - Switch to cleaner technologies
   - Provide clear information about hazards of products and necessary protections by workers and consumers
   - Provide worker protection and education
   - Assure safety of all products intended for use by children

❖ **Retailers**
   - Identify and market products that are safer for consumers
   - Facilitate consumer choice of safer products
   - Provide clear information about safe use of products

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Refs:


C. PERSONAL METHODS OF PREVENTION

❖ Individuals can take specific actions to limit exposure

❖ Education is KEY to limiting personal exposure

❖ WHY?
  – Government policies and regulations may take time
  – Long term persistence even after chemical ban

Refs:

Image: WHO
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LIMITING PERSONAL EXPOSURE VIA FOOD

- Wash fruits and vegetables prior to consumption to reduce pesticide exposure
- If possible, buy organic or plant your own crops and do not use pesticides
- Reduce the amount of animal fat consumed
  - Contaminants may bioaccumulate in animal fats
- Pay special attention to food labels and local dietary warnings and advisories, especially for pregnant women and children

Refs:
FISH CONSUMPTION

- Fish is a health promoting food that contains omega-3 fatty acids beneficial to fetal and child development and prevention of chronic disease

- However, fish bioaccumulate environmental contaminants
  - Polychlorinated biphenyls (PCBs)
  - Metals (mercury)

What you can do:
1. When pregnant or planning pregnancy, consume fish that are lower in risk for contamination – e.g. avoid seafood near the top of the food chain, such as shark
2. Diversify protein diet if possible
3. Pay attention to local advisories if available

Refs:
The advice to families in developing countries, especially those with diets based on fish, is quite different. When possible, limit intake of large fish who eat other fish. Smaller and younger fish are likely to have lower mercury levels. By eating a variety of fish, exposure is also likely to be reduced.

<<READ SLIDE>>

<<READ SLIDE: Please replace with examples of your local advisories>>

Refs:
EXAMPLE: BREATHING EASIER

Prevent airborne exposures to contaminants:

- Do not smoke and encourage others to keep your home smoke free
- Avoid open burning of trash and other materials
- Avoid burning biomass fuel inside your home or dwelling and keep the spaces well ventilated
- Walk or bike when possible, limit use of motor vehicles and motor vehicle idling
- Keep a clean home—indoor pollutants such as dust, mould, and pet dander may trigger asthma symptoms or allergies

Refs:


Image: WHO
Health care providers play a key role in many aspects of the prevention of exposure. These are:

- **Identifying the problem**. What are the main toxic exposures? What are the main causes of acute poisonings? Are there any cases of chronic exposure to environmental pollutants? Is there a high incidence of diseases that may be linked to chemicals in the environment?
- **What are the determinants and characteristics?** Are exposures acute or chronic? Where do they occur? When and how? Are there any predisposing factors? Which populations or groups are affected? Are they predominantly urban or rural?
- **Informing the community** – the workers, the families. A community exposed to chemicals and pollutants in the environment should be informed about the situation in a clear manner (do not hide!...do not scare!). Social workers and communications experts may provide valuable advice on how to communicate risks or potential threats to the community, and how its members may avoid them and protect their own.
- **Educating colleagues and other professionals**. It is especially important to educate those who should recognize and manage the effects of chemicals on health (e.g. nurses, physicians, midwives. primary health care workers). Those who will help in assessing environmental issues should also be educated.
- **Raising the awareness of policy-makers**. Policy-makers should be made aware of the risks communities face – poisonings and potential chronic exposures.
- **Promoting the implementation of the appropriate actions**. The implementation of the appropriate measures should be promoted in consultation with key partners including policy-makers, midwives, doctors, nurses, communities.
- **Evaluating the efficacy of preventive measures**. The efficacy of preventive measures should be evaluated and, again, the community should be informed of the findings!

**Refs:**

Doctors traditionally give advice to pregnant women that includes, among others, taking folic acid supplements, vitamins and getting rubella vaccinations (if not yet vaccinated).

Refs:
Other advice that could consider environmental risk factors could include:

**EXTRA SLIDE**

**NOTE TO USER:** Please adapt the advice to your own context/region.
This is an example of the many tools from WHO available on environment and health. More research is needed in the area of reproductive health and environment. Coordinated collaborative research will yield useful answers. More information: www.who.int/reproductivehealth/en

<<READ SLIDE.>>

Ref:
A Guide to Undertaking a Birth Cohort Study: Purposes, Pitfalls and Practicalities has been developed as a resource for all those who wish to launch a longitudinal study to address the relationship between children’s environments and their developmental and health outcomes. It is the result of four international consultations that brought together a multidisciplinary group of experts, including many cohort directors, from industrialized and developing countries. From these deliberations it was clear that longitudinal cohort studies are both important and feasible, not only in highly industrialized countries but also in low- and middle-income countries.

The Guide provides practical recommendations for setting up birth cohorts, recognizes the challenges involved, and encourages coordination among studies. As it draws from experiences from many cohorts and experts on children’s health from Europe, North and South America, Asia, Australia, and Africa, it will ensure that such studies can be undertaken in all countries. It has been written to be understandable to all who are concerned with child health and the environment and may wish to find out more about the whys and wherefores of setting up and working with a longitudinal birth cohort. It is aimed at people from a wide variety of backgrounds, from parents to politicians, scientists to clinicians, non-governmental organizations (NGOs) to government officials, educationists to economists, psychologists to neuroscientists, obstetricians to pediatricians, and many more.


Ref:
This is an example of the many publications from WHO available on environment in health. These publications look at special vulnerable stages when environmental exposures can have a maximum impact on certain developing organs and systems. For example, as cited in the reproductive health modules, exposure to diethylstilbestrol (DES) in utero can lead to reproductive problems in daughters and sons.

<<NOTE TO USER: For more information, please go to the occupational health training module or to www.who.int/ceh and www.who.int/reproductivehealth/en>>
In order for work to be decent, women workers need to be protected during maternity – protected from losing their jobs and protected from any risks to their health or that of their babies. This guide looks at maternity protection in the workplace, focusing on measures that can be taken to ensure a healthy beginning for both the mother and her child. The material in this guide sets out basic principles and, in an effort to be relevant to a maximum number of settings, provides a wide range of information on reproductive hazards and how to prevent harm. Annexes provide a choice of practical tools which will be helpful in identifying workplace risks and finding solutions.

This publication documents the relationship between gender inequality and health and safety problems. It reviews gender issues in research, policies and programmes on work and health, and highlights some specific issues for women, including the types of jobs they do, as well as their need to reconcile the demands of work and family. Biological differences between women and men also are considered in relation to hazards they face in the workplace. Implications of the findings and recommendations for legislation and policy are discussed. Women will be more and more involved in the global workforce, in both formal and informal work. In ensuring economic survival for themselves and their families they employ a variety of strategies, some of which entail great danger for their health. This review highlights the necessity to strengthen and put in place more and better programmes and practices so as to ensure women’s health and safety at work, while facilitating their access to economic and social equality.

<<NOTE TO USER: For more information, please go to the occupational health training module or to the websites mentioned in the slides.>>
Environmental health units exist in many countries (for instance, there are over 10 in the Republic of Korea) and are reference centres on environmental health. Activities can include the training of health care providers, the ongoing education of the public and other sectors concerned about the protection of communities and families from environmental threats, the management of patients with known or suspected exposure to environmental stressors, and the diagnosis, management, and treatment of patients with illnesses that are derived from environmental stressors.

There are relatively low-cost ways to reduce the high expenditures associated with environmental exposures and environmentally-related diseases. Many interventions, such as teaching community members about safe household water storage and filtration, proper ventilation and cleaning of homes, can generate substantial benefits with relatively little investment. Additionally, these interventions can often be complementary to existing outreach programmes. Other interventions, such as helping a community improve hygiene measures and sanitation systems or assisting a local government with pollution-control policies, require more resources over a long time frame, but can then significantly reduce a community’s future disease burden.

In the Republic of Korea, the Environmental Health Centre Network implemented by the Ministry of Environment has allowed individual centres to focus on research and management of diseases pertinent to the country’s individual health concerns. Cooperating with these centres, the Ministry continuously makes efforts to promote preventive measures through evidence based policies.

<<NOTE TO USER: For more information on environmental centres, please see as guidance the publication on children's environmental health units available at: www.who.int/ceh/publications/childrensunit.pdf>>
Adding simple environmental questions when taking the medical history allows health care providers to incorporate into the clinical records a description of environmental conditions, behaviors and risk factors relevant to a worker's health. For example, the characteristics of the workplace; potential exposure to pesticides; proximity to waste sites, polluting industries or traffic. Eliciting these together with other relevant information improves the capacity to identify, assess and follow up potentially exposed workers at risk and respond with effective measures. The environmental records build the evidence base required for effective interventions and facilitate research. Overall, asking environmental questions provides an opportunity for closer interaction between the health professional, the worker and the community.

Refs:

<<READ SLIDE.>>

<<NOTE TO USER: For more information on environmental questions, please see as guidance the training module: “Pediatric Environmental History,” available at: www.who.int/ceh/capacity/training_modules/en/index.html>>
These are two examples of calls for further action in the prevention of environmental exposures during pregnancy. We can make a difference. We must act now.

<<READ SLIDE.>>
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POINTS FOR DISCUSSION

<<NOTE TO USER: Add points for discussion according to the needs of your audience.>>
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