Chapter 8: Human settlements and urbanization

8.1. Round robin on human settlements and urbanization
8.2. Worksheet questionnaire: health effects of motor vehicle air pollution
8.3. Problem-solving exercise: building a healthy city - the case of Managua, Nicaragua
8.1. Round robin on human settlements and urbanization

⏰ Time: 1 hour

✅ Objectives:
At the end of the exercise, students will be able to:
1. Identify key environmental health hazards associated with housing or urbanization, the health effects caused by these hazards and potential solutions.
2. Review categorization of environmental health hazards.

🗂️ Procedures:
(Note to instructor: The exercise is based on categorizing environmental health hazards in housing or urbanization (as biological, chemical, physical, mechanical or psychosocial) and their health effects, along with a primary or secondary measure for their prevention.)
1. Ask one student to name a biological hazard associated with housing or urbanization and to state the health effects of the hazard.
2. Ask a second student to give two primary or secondary prevention measures for the hazard mentioned by the first student.
3. Ask a third student to name a chemical hazard associated with housing or urbanization and to state the health effects of the hazard. Student four gives a primary or secondary prevention measure for the hazard.
4. Proceed as above for the physical, mechanical and psychosocial hazards. Move along rapidly. If one student does not have an answer, proceed to the next.
5. Summarize key hazards mentioned, their effects and potential solutions.

📖 Materials:
Flip chart (you may want to record hazards and prevention measures as they are mentioned), coloured markers, tape.
8.2 Worksheet questionnaire: health effects of motor vehicle air pollution
Prepared by Ellie Schindelman and David Calkins

❖ Time: 1-2 hours

 ✓ Objectives:
At the end of the exercise, students will be able to:
1. Describe how motor vehicles cause air pollution.
2. List the pollutants and health risks associated with motor vehicle air pollution.
3. Describe who is at risk from motor vehicle air pollution.
4. Describe the main health effects of specific pollutants.

❖ Procedures:
1. Use the attached worksheet to introduce lecture information in a participatory format and as a catalyst for group discussion. During the first 10 minutes of the session, invite students to answer the questions by themselves (or in pairs). Explain that the worksheet is not a test and that no one will see their answers. Encourage participants to guess at the answers if they are not sure of them.
2. The body of the lecture is a review of the questionnaire. Read each potential response and ask students for a show of hands indicating agreement. Encourage students with different responses to justify their answers.
3. Conclude with the correct information and elaborate further, if desired. Then proceed with the next question.

📖 Materials:
Flip chart, coloured markets, tape, worksheet questionnaire (Annex 20).

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Motor Vehicle Air Pollution
Health Effects Worksheet

Instructions: Circle all the correct answers or fill in the blanks.

Note to teacher: This version of the worksheet contains the answers. A copy for use by participants is provided in Annex 20.

Question 1. Motor vehicles become a source of air pollution as a result of:
   (a) refueling losses
   (b) evaporative emissions
   (c) exhaust emissions
   (d) crank case losses
   (e) reckless driving (wrong answer).

Question 2a. What is smog? (not multiple choice)
   Smog is a pollutant primarily made up of ground-level ozone. While ozone in the stratosphere protects human health and the environment, ground-level ozone is the most harmful ingredient in smog. Ozone is not directly emitted - it results from a combination of other pollutants and sunlight.

Question 2b. How is smog produced?
   (a) power generating plants (wrong answer)
   (b) reaction of hydrocarbons and nitrogen oxides with sunlight
   (c) automobile exhausts
   (d) acid rain (wrong answer).

Explanation:
   Acid rain is a combination of pollutants from many sources: smoke stacks, cars, paints, solvents. Wind blows smog-forming pollutants away from their sources; smog-forming reactions take place while pollutants are in the air; pollutants “cook” in the sky, especially if it is sunny and warm. It takes several hours to cook up smog.
Additional information about smog:

What determines where smog goes and how bad it is?
- Weather and topography; temperature inversions.
- When winds are calm, smog can stay in place for days at a time.

How much smog is caused by motor vehicles?
In the United States, motor vehicles:
- are responsible for up to half of smog-forming VOCs (volatile organic compounds) and nitrogen oxides;
- release more than 50% of hazardous air pollutants;
- release up to 90% of the carbon monoxide in the air.

The amount of smog from motor vehicles depends on many factors in the particular area/country.

Question 3. What are the main pollutants from motor vehicles?
(a) carbon monoxide
(b) nitrogen oxides
(c) ozone
(d) particulate matter
(e) lead
(f) benzene
(g) carbon dioxide (wrong answer)
(h) sulfur dioxide (wrong answer)
(i) acid aerosols
(j) halogenated hydrocarbons (wrong answer).

Question 4. What factors affect the composition of motor vehicle exhaust emissions?
(a) fuel type and quality
(b) geographical factors (wrong answer)
(c) maintenance of vehicle
(d) age of vehicle
(e) speed of vehicle (wrong answer)
(f) type and operating condition of engine
(g) use of emission control device.
Question 5. Which population groups may be especially susceptible to adverse health effects from motor vehicle pollution?

(a) children
(b) people who live at high elevations
(c) people who smoke
(d) people with asthma
(e) people with cardiovascular disease
(f) elderly people
(g) people with respiratory disease.

Note: there are no wrong answers.

Question 6. Which groups of people have an increased chance of exposure to motor vehicle air pollution?

(a) traffic police
(b) pedestrians (it depends)
(c) people who live on highly trafficked streets
(d) parking garage attendants
(e) toll-booth workers at bridges or tunnels
(f) subway passengers (wrong answer)
(g) people who drive buses, taxis, trucks
(h) urban roadside street vendors
(i) gasoline station workers
(j) people who work in urban centres.

Question 7. True or false: Fuels in developing countries often have a high lead and sulfur content.  

T ☐    F ☐

True

Additional information
Additional issues related to fuels used around the world are:
- leaded gasoline
- diesel (high sulfur, especially in developing countries)
- ethanol blends (increased volatility)
- butane components added to enhance octane increase volatility
- methanol
- natural gas
- LPG (liquid petroleum gas)
- fuel volatility affects evaporative emissions.

**Question 8.** True or false: All motor vehicles are equally polluting.  **T □  F □**

**Why or why not?**
False. Factors affecting how polluting a vehicle may be:
- age of vehicle
- catalytic converters
- fuel injection and ignition systems
- two-stroke engines (motorcycles/mopeds), HC (hydrocarbons) emitted from lubricating oil
- diesel trucks and buses (sulfur, exhaust odours)
- maintenance.

**Question 9.** Which motor vehicle air pollutants can adversely affect the respiratory tract?

(a) nitrogen oxides
(b) ozone
(c) lead (wrong answer)
(d) sulfur oxides
(e) particulate matter
(f) carbon monoxide (wrong answer).

**Additional information**

**A. Nitrogen dioxide (NO2)**
- An irritant gas absorbed into the mucosa of the respiratory tract. When inhaled, 80-90% of NO2 can be absorbed.
- Health effects vary from a mild inflammatory response to bronchitis and bronchial pneumonia. NO2 is linked with increased susceptibility to respiratory infection, increased airway resistance in asthmatics and decreased lung function.
B. Ozone
- Primary target organ is the lungs. Ozone exposure produces cellular and structural changes, causing a decrease in the lung’s ability to perform normal functions.
- The main ingredient of smog is ozone. Many persons exposed to smog suffer eye irritation, coughs and chest discomfort, headaches, upper respiratory illness and increased frequency and severity of asthma attacks.
- In Los Angeles, air pollution from ozone and particulate matter affects 13 million residents up to 17 days per year. Achieving the U. S. EPA’s National Ambient Air Quality Standards may save 1600 lives per year.

C. Sulfur dioxide and particulate matter
- These are only a minimal part of automotive emissions but they react and may have a synergistic effect with other pollutants from motor vehicles.
- Inhaled sulfur dioxide is absorbed in the nose and upper respiratory tract where it has an irritant effect. It then enters the lungs where it can be absorbed into the blood and body.
- In the United States, 8% of non-smoking cancer risk is due to fine particulate matter from diesel trucks, buses and automobiles.
- Particulate matter is thought to be the main cause of excess mortality observed during the London and New York smog episodes of the 1950s and 1960s (this smog was caused by coal combustion, but effects are expected to be similar from smog caused by motor vehicle emissions).

Question 10. Which substances in motor vehicle emissions can produce toxic systemic effects?
- carbon monoxide
- lead.

A. Carbon monoxide
- Rapidly absorbed in lungs and taken up in blood, carbon monoxide impairs the oxygen-carrying capacity of the blood so that less oxygen gets to the heart, brain or fetus.
- Health effects: low levels can cause headaches, fatigue, slow reflexes.
- People with previous cardiovascular disease (weak hearts) constitute the most sensitive group.
- Large numbers of sensitive people experience adverse health effects at 15ppm (8-hour average).
B. Lead

- Most lead is in fine particles.
- Lead affects many different systems (central nervous system, cardiovascular, endocrine, reproductive).
- Lead is an important problem for young children as it can impair learning ability, behaviour, intelligence and fine motor coordination.

Question 11. Which substances in motor vehicle emissions have a potential carcinogenic effect?

(a) lead (wrong)
(b) sulfur oxides (wrong)
(c) ozone (wrong)
(d) benzene.

Additional information:

- Benzene is a constituent of crude oil.
- In Europe, benzene is present in petrol (5–16%); in the United States, less than 1.5–2%.
- 50% of inhaled benzene is absorbed and distributed to fat–rich tissue such as bone marrow.
- There are toxic effects on the central nervous system, and immunological effects.
- Benzene is a known human carcinogen; there is no safe level for airborne benzene.

Question 12. True or false: Noise pollution can cause physical, physiological and psychological effects. Why or why not? T □ F □

True. Noise can cause physical, physiological and psychological effects.

- Direct effect: sound waves act physically against the ear drums and damage them.
- There is no real potential for damage to hearing from road traffic noise (except possibly young children and people with previous hearing impairment).
- Indirect effects: noise can induce physiological change through nerve impulses to the central nervous system, eventually causing damage.
- Reactions are complex and include sleep disturbance and effects on performance. Blood pressure may be affected.
- Noise can also be a major annoyance, creating stress and anxiety.
Question 13. How is human exposure to motor vehicle air pollution measured?

- by ambient air quality data from fixed stations (gives an overview);
- by personal monitors (self-use in a population sample);
- by technicians using personal monitors to measure concentration in selected micro-environments.

Note to teacher: The following are points to consider for your conclusion:

- Motor vehicles account for half the emissions that cause smog, all the carbon monoxide in city centres, more than 25% of fine particulates, and more than half the toxic air pollutants.

- Motor vehicle emissions are a major source of adverse health effects. Ongoing studies continue to show adverse effects at lower and lower levels.

- Why is air pollution from developing countries particularly important to address?

  1. There is a large proportion of motorcycles and three-wheeled vehicles, especially in Asia.

  2. Some countries have large fleets of two-stroke vehicles (e.g. in eastern Europe).

  3. The high proportion of buses, taxis and trucks is often mixed with tractors and slow-moving non-motorized vehicles. Many countries have large fleets of trucks and buses with poor fuel economy and high emissions of CO (carbon monoxide), HC (hydrocarbons), and NOx (nitrogen oxides).

  4. There is a higher average age of the vehicle fleet and a very low scrappage rate due to moderate climate, the high cost of vehicle ownership, import duties and excise taxes. Older vehicles may have inadequate exhaust controls and may be poorly maintained.

  5. There may be insufficient urban road space and ineffective traffic management, causing slow travel speeds and traffic congestion.

  6. Strict emission control laws and regulations are lacking.
8.3. Problem solving exercise: building a healthy city - the case of Managua, Nicaragua
Prepared by Merri Weinger

⏰ Time: 3 hours

✅ Objectives:
At the end of the exercise, students will be able to:

1. Understand the basic principles of the World Health Organization’s Healthy Cities Programme.

2. Recognize the important impact that physical, social and economic environments have on health status in urban settings.

3. Appreciate the need for intersectoral collaboration and community participation to create physical and social environments that support health.

4. List the key steps in implementing a Healthy Cities project.

📝 Procedures:

1. Introduce the exercise and review its objectives. Divide participants into small groups (4-6 persons). Instruct participants to identify a chairperson and a recorder.

2. Distribute the exercise and review the participants’ tasks. The case scenario is very brief. Instruct students that they can also draw on their knowledge of typical urban problems in health and environment, including those in their own cities.

3. Reconvene the groups and invite a response from one group to the first question. Ask whether other groups have any different responses. Summarize and, if necessary, expand on the participants' responses and proceed to Question 2. Allow a different group to initiate the discussion and continue in this way until all questions have been answered. Possible answers to the questions are provided below. These answers are not all-inclusive. Instructors are encouraged to develop alternative responses and intervention strategies that are appropriate to the local situation.

4. Summarize the results, emphasizing key messages.

📖 Materials:

Problem-solving exercise (Annex 21), flip chart, coloured markers.
Case scenario

Adapted from an article by Francoise Barten and Angel Sanchez

At present, Nicaragua is one of the poorest countries in Latin America. The dislocation caused by the low-intensity war during the last decade led to massive migration from the countryside. The population of the capital, Managua, more than doubled in three years. Today, roughly one-third of the country’s population lives in Managua. This rapid and uncontrolled growth of the city, combined with a lack of urban planning and increased demand on urban services, has contributed to a crisis situation, with increasing social inequalities and the political polarization of society.

Between 1987 and 1994, poverty in Managua increased from 30% to 72.5% and extreme poverty from 15% to 50% - mainly among female-headed households. Unemployment stands at a staggering 62% and malnutrition in children at 68%, while domestic violence and drug abuse among school-aged youth are rapidly rising. The 270 squatter settlements constitute the most unhealthy environments of the city, and more than 300 polluting industries are located in low-income areas. Waste is dumped at 310 illegal sites throughout the city, causing serious health hazards.

Among other health problems, the city faces serious epidemics of malaria and dengue. In spite of declining health status, the public health budget was reduced by 50% in recent years.

Question 1. What are some of the key health, environmental and social problems likely to be faced by the city of Managua?

Students should summarize the problems listed in the exercise and also try to suggest others on the basis of their experience and the information provided. For example: poor housing, overcrowding, unemployment, malnutrition, domestic violence, drug abuse, air and water pollution, potential exposure to hazardous waste, high rates of communicable diseases, high infant mortality rates, shorter life expectancy for adults, poor access to health care, lack of access to effective solid waste management and sanitation, higher crime rates, stress.

Question 2. Your task is to work with an intersectoral group in Managua to develop a municipal action plan to address some of these problems.

a. Who should be part of this working group and how do you propose to establish it?

The working group might include representatives from local government agencies (health, environment, social services, etc.), nongovernmental organizations, community groups, universities and training institutions. This core group of individuals initiates the process, begins to build public support and contacts other groups and individuals who may be interested in participating.

Healthy Cities projects often appoint an advisory group to provide the leadership and legitimacy needed for health advocacy and for the mobilization of people and resources to bring about health improvements. In addition to those mentioned above, potential members may be: city councillors responsible for social services; senior managers of the primary health care system or network of health centres of the city; the mayor; representatives

from business, industry, labour and professional organizations; religious leaders, etc.

A workshop or seminar is an excellent means of initiating a Healthy Cities project and building a core group of activists. In Managua, more than 30 organizations participated in a workshop convened to explain the concept and approach of a Healthy Cities project and to identify current contributions to urban health development which could contribute to the initiative. It soon became clear that many different institutions, municipal agencies, community bodies and nongovernmental organizations were making various separate efforts, often in the same areas of Managua.

b. You would like to ensure that the community is involved in developing the plan. What is your strategy for raising awareness about the project and fostering community participation?

Open meetings, workshops and seminars can be helpful in informing the community about the project. As the project develops, community members can be asked to participate in committees to address particular issues, such as water and sanitation, health conditions in markets, clinic services, etc. A visible and accessible office makes a valuable contribution to the project. Several cities have set up Healthy Cities store-fronts at street level that encourage visitors to drop in. These provide information on environment and health care.

Other strategies for fostering community participation include: gaining the commitment of community leaders, providing training for community participants, publishing stories and reports about the project in local media, organizing public campaigns on specific projects (e.g. vaccination, street cleaning), and inviting the community to participate in gathering information about health problems in their neighbourhoods.

c. Which problem would you make first priority and how would you go about making this decision?

A good first step is to collect and analyse all existing reports on environment and health. In addition, it is often helpful to conduct a survey or study to identify the city’s main environmental health problems as a basis for prioritization. In Managua, the School of Public Health, in collaboration with WHO and the United Nations Development Programme (UNDP) undertook a field study based on direct consultations with the public. The information provided helped to set the agenda for their municipal action plan.

This information is generally presented to the working group and the community. Emphasis is placed on the contribution that problems make to the burden of ill-health. Priority problems can then be identified through group discussion and collective decision-making. It is common for communities to give high priority to access to clean water and sanitation.
d. **What are the objectives of your action plan?**

Objectives will be:

- to create conditions that promote health in settings such as the home, school, neighbourhood, market, workplace and city at large;
- to improve the performance of the municipality both in provision of services and in supporting local community initiatives that promote health;
- to identify health education and other health-related activities which can be incorporated into the agenda of municipal agencies working at community level in water, sanitation, solid waste, housing, education, social services, etc.;
- to facilitate community participation in the health-related activities outlined in the plan.

e. **What are the key components of your municipal action plan?**

Key components will be:

- background information which describes and quantifies the social, economic and environmental health problems and conditions in the city;
- prioritization of problems based on their contribution to the burden of ill-health;
- existing municipal agencies and organizations including NGOs and international agencies that can potentially contribute to solving health problems;
- potential mechanisms for participating partners to work in a more coordinated manner in addressing problems;
- priority actions and programmes, including setting of targets, timetable and evaluation plans.

f. **What kind of activities might be included in the plan?**

Activities might include: health education on nutrition and sanitation; collaboration with the university, water and housing authorities to improve conditions in the squatter communities (e.g. street drainage, tree planting, installation of household water connections, installation of drinking-water and washing stations, community-based management of waste collection, construction of sewerage and stabilization ponds, etc.); improved access to maternal and child health services; youth recreation or job development programmes, etc.
g. On the basis of the activities outlined above, which agencies might take the lead in implementing the plan?

Leadership should reflect intersectoral collaboration and should include community participation.

Selected references


