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AIR POLLUTION AND ENVIRONMENTAL NOISE ON PUBLIC HEALTH

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Air Pollution

- ▣ Major air pollutants
- ▣ “Criteria air pollutants”
- ▣ Particulates (PM) PM₁₀, PM_{2.5}
- ▣ Oxides of nitrogen (NO_x) NO₂
- ▣ Oxides of sulphur (SO_x) SO₂
- ▣ Ozone (O₃)

Air Pollution

- ▣ PM, NO₂ and SO₂ are primary air pollutants - directly produced from burning fossil fuel.
- ▣ Some components of PM are formed from NO₂ and SO₂ by complex chemical reactions
- ▣ Ozone (O₃) is formed from complex chemical reactions involving NO₂ and volatile organic chemicals (VOCs) in the presence of sunlight.

Air Pollution

- ▣ Hence, all 4 "criteria air pollutants" originate from burning fossil fuel.
- ▣ In Hong Kong, the two most important sources are (i) vehicles - in particular diesel vehicles e.g., buses, lorries and trucks, and (ii) power plants, followed by ferries and other boats, and ocean-going ships.
- ▣ Regional transport of air pollutants from the Pearl River Delta is also a major problem contributing to air pollution in Hong Kong.
- ▣ Roadside air pollution is generated from road traffic locally .

Health Impact of Air Pollution

- ▣ While individual air pollutants have different toxicological properties, all of them affect our circulatory (“cardiovascular”) system and respiratory (breathing) system.
- ▣ It is very difficult to isolate the effects of each pollutant on health, because they are from the same source and are present together (in varying proportions) in the atmosphere.

Health Impact of Air Pollution

- ▣ Short-term:
- ▣ Increases the risk of dying from heart and lung diseases;
- ▣ Increases the risk of heart and lung diseases that require hospital admissions;
- ▣ Increases the risk of minor respiratory illnesses and asthmatic attacks;

Health Impact of Air Pollution

- ▣ Long-term:
- ▣ Increases the risk of dying from heart and lung diseases, and from lung cancer;
- ▣ Retards the growth and development of children's lungs;

Health Impact of Air Pollution

- ▣ Other air pollutants: toxic air pollutants (TAPs)
- ▣ A large number of toxic organic compounds that are present in small quantities, for which no standard (or "criteria") for control exists.
- ▣ From various sources: traffic, industrial, etc.
- ▣ Many of these compounds cause cancer.
- ▣ Examples: formaldehyde, acetaldehyde, benzene, toluene, xylene, 1,3-butadiene, acrolein;

Health Care and Other Costs of Air Pollution

- ▣ Direct cost: cost of life, loss live-years lived; Medical cost: hospital beds, doctor consultations, medications and other medical procedures;
- ▣ Indirect cost: Loss of productivity from sickness absence; pain and suffering from illnesses (derived from specific studies);

Noise and hearing

- ▣ Very high levels of noise (>85 dBA, 8-hr TWA) is well-known to impair hearing by damaging the auditory nerve.
- ▣ This high level of noise is usually encountered in the workplace.
- ▣ Environmental noise seldom reaches this level.

Environmental noise

3 major effects:

1. Blood pressure and heart diseases: Growing evidence that environmental noise is associated with heart diseases. Link with heart diseases is complicated by the presence of many other "confounding factors" that are also linked to heart diseases. Link with hypertension has more evidence, but also influenced by "confounding factors" .

Environmental noise

2. Annoyance: A psychological reaction to noise. This is a well-researched response by individuals in the community to environmental noise, such as road traffic noise or aircraft noise.
3. Sleep disturbance: Environmental noise in the night causes sleep disturbance. Both the noise level and the frequency of "noise events" - intermittent noise affects sleep.

Environmental noise

- ▣ For all 3 effects, experts have produced “exposure-response curves” to describe the relationship between the noise level and these effects.
- ▣ However, different socio-cultural settings may have different response to the level of environmental noise.
- ▣ On a long-term time trend, tolerance to environmental noise appears to decrease, i.e., people are getting more annoyed and less tolerant to the same level of noise.
- ▣ There doesn't appear to be any “habituation” to environmental noise (i.e., getting used to it).

Environmental noise

- ▣ Other effects:
- ▣ Some evidence on impairment of learning and “cognitive functions”.
- ▣ Effect on mental illness not established.

Summary Table: Strength of evidence of noise on non-auditory health effects

| Non-auditory Health effects | Strength of evidence | | | |
|------------------------------------------|----------------------|--------|------|-----------|
| | Very strong | Strong | Weak | Very weak |
| Cardiovascular system | | | | |
| Raised BP and HR (acute effects) | √ | | | |
| HT, IHD, ↑serum lipids (chronic effects) | | | √ | |
| Sleep | | | | |
| Quality | √ | | | |
| Symptoms / Disorders | | √ | | |
| Annoyance | √ | | | |
| Mental Health | | | | |
| Mental diseases | | | | √ |
| Symptoms of ill-health | | | √ | |
| Symptoms in noise-sensitive subjects | | √ | | |
| Cognitive performance | | | √ | |
| Stress hormones | | √ | | |

BP = blood pressure; HR = heart rate; HT = hypertension; IHD = ischaemic heart disease;
 ↑ = increased

The End