

**ADVERSE HEALTH EFFECTS OF THE URBAN
HONG KONG ENVIRONMENT**

*Protection of child and adult health from
Noise, Nocturnal Light and Air Pollution*

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1.0 Urban health and healthy cities

The 21st century will witness a massive increase in the size and density of urban populations. By 2050 it is estimated more than 70% of the global population will live in cities. The World Health Organization (WHO) regards the growth of metropolitan areas as a major determinant of population health. The effects of urban development may be both *positive* and *negative*.

2.0 The challenge to sustainability of health in the city

The management of urban environments to underpin health protection must, for example, include the prevention of:

- Infections diseases
Influenza, *pneumonia*, tuberculosis, sexually transmitted diseases
- Non communicable diseases
Chronic respiratory problems; heart disease and stroke; obesity and diabetes
- Violence, trauma, road traffic injuries

In this discussion we are mainly concerned with environmental causes of acute and chronic non-communicable disease. There are many issues to be considered related to infrastructure, land use, building regulations, transportation systems, fuels and energy consumption, mixed residential and industrial areas, and especially vulnerable groups such as those experiencing social deprivation and all areas of environmental safety.

Today we are addressing the potential hazards of noise, excessive nocturnal lighting, fossil fuel emissions and the important interactions between them.

3.0 Obstacles to achieving good quality of life

These three environmental hazards are all confirmed or potential causes of biological stress and therefore obstacles to achieving a calming, breathable, walkable city environment.

In particular they have a negative impact on our hopes for sustainable health protection for children and degrade health related quality of life.

Professor TW Wong has described the impact of noise on sleep and we can note that while the WHO noise limit is 40 decibels average the average exposure in Hong Kong is 70 decibels.

4.0 The problem of bright nights

The Earth is increasingly bright at night in the built environment and satellite images demonstrate that Hong Kong and the Pearl River Delta is one the brightest nocturnal environments in Asia. For health and other environmental reasons we should be addressing the question as whether high levels of nocturnal light are necessary and can be avoided.

5.0 Light pollution disrupts our body clocks

We should be aware that humans evolved with body clocks which are adjusted to light days and dark nights and recent publications, including those endorsed by the US Environmental Protection Agency, the American Medical Association and other authorities, clearly regard nocturnal lighting in the built environment as a public health issue.

Many studies show that the resetting of body clocks and the use of intense blue-white light as opposed to yellow light (from low pressure sodium lamps) may be associated with changes in the function of the brain, heart and endocrine (hormone) glands - and with sleep deprivation, depression, heart disease, and cancer in occupational groups working night shifts. We are not suggesting that all Hong Kong residents are susceptible to these bad outcomes, but we should be fully aware that this area of human biology is under review because such exposures may have long term consequences which are avoidable. Disruption of body clocks (the “circadian clock”) affects the normal physiology of all species. In humans it can affect 10% to 15% of our genes so there is considerable potential for this to cause adverse health effects.

However apart from these possible direct effects of light on health our main point is that excess and inefficient use of lighting is incompatible with energy conservation and contributes to air pollution with emissions from fossil fuel combustion.

6.0 Air pollution amplifies light pollution

The poor air quality resulting from suspended particulates and photo chemical gases actually amplifies ground level light pollution by reflecting light downwards. Pollution increases the intensity and distribution of glare in cities, in contrast to the darker skies of rural areas.

Environmental regulation should ensure that there is zero growth in the flux of light in this environment.

7.0 We need a comprehensive approach to environmental health

We can see that there are important causal associations and interactions between *Noise*, *Nocturnal Light* and *Air Quality*. Along with road traffic, shipping, power generation and aviation the sources of excess *noise* and *nocturnal light* are major contributors to air pollution and may also add in other ways to adverse environmental health effects.

8.0 What is new in the air pollution and health evidence base?

Which brings us to the undoubtedly biggest single threat to sustainable health in the HKSAR population, poor air quality. Probably 100% of the population is exposed, at unacceptable levels, to this environmental hazard. We have spoken on this issue many times in this chamber, so what is new? What additional evidence has emerged from scientific research into the health effects of air pollution which should be of interest to honorable members and their constituents and policy makers?

Here are a few examples of recent studies:

- Measurements of the chronic effects of ambient air pollution on children's lung function by CUHK
- Mathematical statistical analyses show that Hong Kong's new AQO are far too lax to protect our health to the level which we urgently need. Whatever else may work through intervention, it will not be the AQOs.
- Marine emissions, from ships in inshore waters, are a major cause of morbidity and mortality. They directly cause increases in hospital admissions and daily deaths. This is

the clear evidence from analyses based on data from Pearl River Delta together with information on risks from Hong Kong, Taiwan and mainland China regions.

- Finally, recalling one of our previous recent reports, please do not neglect the all too visible evidence that the loss of our horizon through the severe reduction in visibility, can be shown to be directly associated with daily deaths. You can reliably guesstimate the number of daily deaths which will occur by simply looking out of the window.

These are all urgent signals for a new kind of radical evidence based action to protect environmental health in Hong Kong.

9.0 An environmental health index for HKSAR

Our real time website integrates the data feed from EPD monitors with our risk estimates (from CUHK and HKU) for doctor visits, hospital admissions and deaths and provides a monetized value of the lost productivity and health care costs and loss of lives to the whole community (hedleyindex.sph.hku.hk)

Dr LAI Hak Kan will walk us through the index live to observe today's air quality situation and its health impacts since midnight.

In 2012, based on the hedley index monitoring, we estimate that the attributable bad health outcomes and economic loss attributable to air pollution include:

- Deaths: 3,069
- Hospital admissions: 151,300
- Doctor visits: \$7.167 million
- Direct, indirect and intangible costs: \$39.4 billion

10.0 The Inverse Care Law

Although Hong Kong is badly polluted in all areas we know there is considerable variation in different districts. Variation in health outcomes is an important factor in social justice and environmental protection. The Inverse Care Law holds that:

“Those with the greatest needs are least protected by medical and health services and their environment”.

11.0 Environmental injustice: deaths from pollution in lower socioeconomic groups

Hong Kong citizens in lower socioeconomic groups have higher death rates from pollution. This form of inequity has been shown to be true in Hong Kong. Across Tertiary Planning Units those who have high social deprivation scores: i.e. who are unemployed, have lower education attainment and low income, experience higher mortality rates per each 10 microgram increase in pollutants. This finding is consistent for respiratory disease, cardiovascular causes of death and all non-accidental causes of mortality.

This gradient in mortality from pollution exposures, by socioeconomic status, is likely to be reflected across the whole spectrum of health care needs and should be recognized as an urgent priority for environmental protection.

Hong Kong has developed an extensive high quality evidence base of the air pollution impacts on population health. There remain important gaps in this work, especially on maternal and child health, but the current evidence points to the urgent need for radical action and intervention.

12.0 Pathways to prevention

The pathways to prevention must include the following:

- *Recognition* of the large scale external costs to the community which are incurred by lack of action to match the seriousness of the problem. This is particularly emphasized by the threat to child health which may lead to life long disability impaired quality of a life and shortened life expectancy.
- *A resolute precautionary approach*, especially given the primacy of providing protection for child health. The precautionary principle states that, in spite of

uncertainties those most vulnerable should be protected when the evidence points toward the probability of harm from exposures.

- *Achieve an ethical balance between health needs and other vested interests.*
- Hong Kong now needs to put the public health science into environmental policy.

Above all, Hong Kong needs a 21st century system of accountability for environmental management which is based on a public health approach.

13.0 What should we do next in a public health approach?

Pool our scarce resources in a planned collaboration between academics and the administration.

Invest in policy relevant applied research: Those scarce resources need to be boosted. We cannot go on trying to make bricks without straw.

Agree on an agenda of priorities for applied research designed to support environmental decision making and evaluate interventions. This approach should include pooling of resources and collaboration agreement on priorities.

Revise our calculations of risks.

Evaluate new interventions – with emphasis on the community benefits and reduction of external costs.

Above all move visibly forward on several fronts to protect child health.

References:

United States Environmental Protection Agency

American Medical Association

CW So, Department of Physics, The University of Hong Kong. Personal communication

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THE CHALLENGE TO SUSTAINABILITY OF HEALTH IN 21STC CITIES

- World Health Organization regards growth of cities as a major determinant of population health
- The effects may be both *positive* and *negative*
- The priority areas are:
 - * Non-communicable disease
 - * Communicable disease
 - * Trauma: violence; road traffic

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NOISE, Nocturnal LIGHT & AIR POLLUTION

Causes of biological stress

Obstacles to achieving a:

- Calming, breathable, walkable city environment
- Sustainable health protection for children
- Quality of life

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EARTH IS BRIGHT AT NIGHT IN THE BUILT ENVIRONMENT

Light extends the day for work and leisure



Hong Kong is one of the brightest stars in the galaxy

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HUMANS EVOLVED WITH BODY CLOCKS ADJUSTED TO LIGHT DAYS AND DARK NIGHTS

Lighting in the built environment is a public health issue (USEPA)

Disturbing or re-setting the clocks affects

- Brain , Heart and Endocrine glands

Strong associations with:

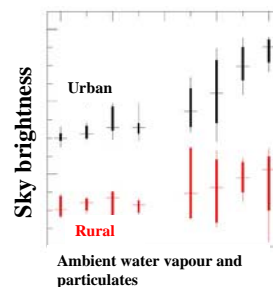
Sleep deprivation , Depression , Heart disease
Cancer

For normal growth and development the evidence shows that infants and children *benefit* from a normal light/dark daily cycle

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HONG KONG POLLUTION MAKES THE NIGHT BRIGHTER

- Particles suspended in the air such as water vapour and pollutants increase the sky luminance in cities
- City lights are amplified by air pollution

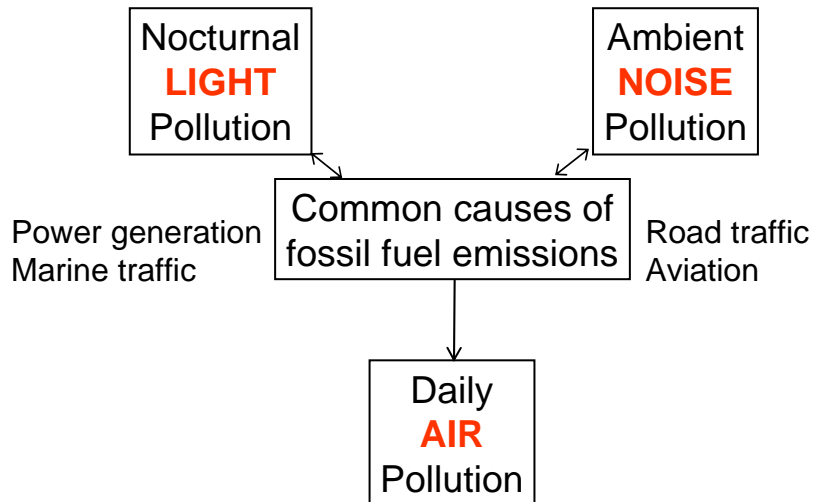


Kyba et al. Cloud coverage acts as an amplifier for ecological light pollution in urban ecosystems. Plos One. 2011;6:e17307

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URBAN ENVIRONMENTAL CAUSES OF STRESS

Psychological & Biomedical



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UPDATE ON HEALTH EFFECTS OF POOR AIR QUALITY IN HONG KONG & SOUTH CHINA

- *Chronic effects of ambient air pollution on children's lung function (CUHK)*
- *Hong Kong's new low key AQO will not work to protect health (HKU)*
- *Marine fossil fuel emissions cause increased hospital admissions and deaths in Pearl River Delta using the excess risk (HKU)*
- *Hong Kong's daily low visibility is a direct indicator of daily deaths attributable to pollution (HKU)*

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In 2012, we estimate that the bad health outcomes and dollar values attributable to air pollution include:

- Deaths: 3,069
- Hospital bed-days: 151.3 thousands
- Doctor visits: 7.167 Million
- Economic loss: \$39.4 Billion

THE INVERSE CARE LAW

An issue for social justice in environmental protection

The Inverse Care Law holds that:

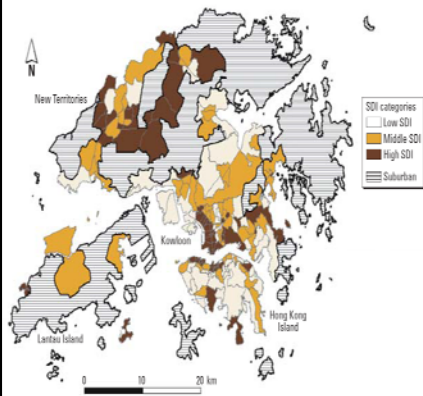
Those with greatest needs are least protected by medical and health services and their environment.

最需要的人，就是最欠缺
醫療保健服務及環境保障的人。

Social deprivation index (SDI):

Unemployment, low income, lower education attainment

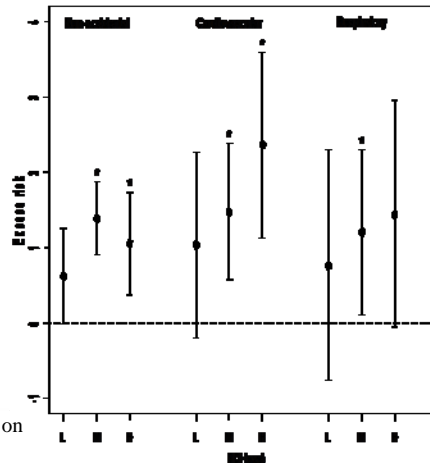
People with high SDI are more likely to die from air pollution



SDI in three levels for Hong Kong, 2001, excluding suburban areas.

Source: Wong CM et al. The effects of air pollution on mortality in socially deprived urban areas in Hong Kong, China. *Environmental Health Perspectives* 2008;116:1189-94

Mortality risk associated with NO₂



PATHWAYS TO PREVENTION

- **RECOGNIZE** the external costs; eg damage to child health
- **TAKE** a precautionary approach
- **ACHIEVE** an ethical balance between health needs & other vested interests
- **GET THE SCIENCE INTO POLICY**

ABOVE ALL

HKSAR needs a 21st century system of accountability for environmental management based on a public health approach

WHAT SHOULD WE DO NEXT IN A *PUBLIC HEALTH* APPROACH?

- **POOL** resources & collaborate
- **INVEST:** in applied research to support policy
- **AGREE** on an agenda of priorities for applied research to support environmental policy decision making
- **CALCULATE:** Exposure by person, place & time
Health risks (Death, illness, quality of life)
- **EVALUATE:** the community benefits and reduction in external costs from intervention
- **MOVE FORWARD** urgently on several fronts
to protect child health

香港市區環境的不良健康影響

從噪音，光污染及空氣污染中
保護兒童和成人的健康

賀達理
黎克勤
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衛生的可持續發展 – 21世紀城市所面臨的挑戰

- 世界衛生組織(WHO) 視城市的發展為人口健康的主要決定因素
- 可以是正面和負面的影響
- 優先領域包括:
 - *非傳染性疾病
 - *傳染性疾病
 - *創傷：暴力；交通

噪音，光污染及空氣污染 生理壓力的原因

阻礙了下列的實現：

- 寧靜、空氣清新、適宜步行的城市環境
- 對兒童健康的持續保護
- 生活質素

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在人造的建築環境下，地球在晚上是明亮的
燈光延長了我們一天的生活



香港仿似是在銀河系中最亮的星之一

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人類的生物時鐘進化了一-- 適應白日 與黑夜

建築環境的光是公共健康問題 (USEPA)

干擾或重設生物時鐘的影響:

- 大腦，心臟，內分泌腺

與下列的健康問題有很大的關聯:

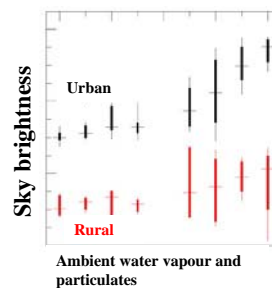
失眠，抑鬱症，心臟病，癌症

每天正常的光/暗週期，對於嬰兒和兒童的正常成長和發展，明顯地十分重要。

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香港的空氣污染令晚間更亮

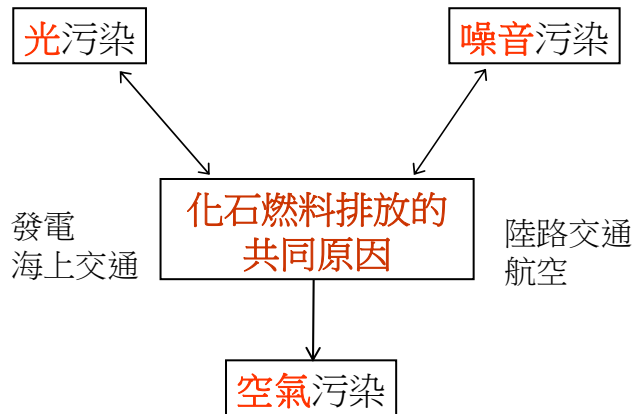
- 空氣中的懸浮粒子，例如水蒸氣和污染物，令城市天空的亮度增加
- 空氣污染增強了城市的光



Kyba et al. Cloud coverage acts as an amplifier for ecological light pollution in urban ecosystems. Plos One. 2011;6:e17307

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城市環境產生心理和生理的壓力



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學術更新: 在香港及南中國, 空氣質素欠佳對健康的影響

- 空氣污染對兒童肺功能有長期影響 (香港中文大學)
- 香港新的低調空氣質素指標，不能真正保護健康(香港大學)
- 在珠江三角洲，船隻廢氣排放導致更多的住院和死亡率 (香港大學)
- 香港每天由污染引起的低能見度，是死亡率的直接指標 (香港大學)

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在2012, 我們估計了因空氣污染造成的不良健康影響及經濟損失, 包括:

- 死亡人數: 3,069人
- 住院床位日數: 15.1萬
- 診症次數: 7.167 百萬人次
- 經濟損失: \$394 億

逆向照顧法則

環境保護中關於社會公義的議題

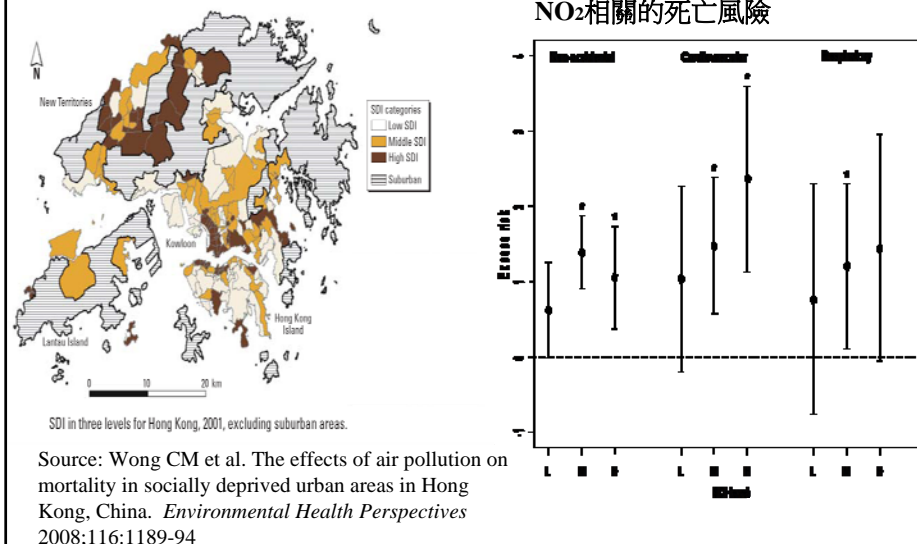
逆向照顧法則認為：

最有需要的人，就是最欠缺
醫療保健服務及環境保障的人。

***Those with greatest needs are least
protected by medical and
health services and their environment.***

社會匱乏指數 (SDI): 失業，低收入，未受教育

高 SDI 的人更有可能死於空氣污染



預防的途徑

- 識別 外在的成本，如損害兒童健康
- 採取 審慎態度
- 實現 健康需求和其他利益之間的道德平衡
- **讓科學納入政策**

上述所有

香港需要以21世紀的問責制度，從公共衛生的角度去進行環境管理

從公共衛生的角度出發, 下一步應該怎樣做?

- 集中資源與合作
- 投資: 應用研究來支持政策
- 同意一個議程來進行研究, 以支持環境政策的實施
- 推算: 曝露於污染中的人群, 地點和時間
健康風險 (死亡, 疾病, 生活質素)
- 評估: 推出措施後社會的得益和成本的減少
- 前進 從多方面**保護兒童健康**