Air pollution and dementia; how it hinders sustainability in Hong Kong

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It is common knowledge that air pollution can take years off our lives and causes lung and heart disease. However, it can also cause dementia. As a densely urbanised city with high rates of air pollution and an ageing population, Hong Kong is uniquely affected by this. In 2009, 103,000 people aged 60 and above suffered from dementia. This will rise to an estimated 333,000 by 2039 (Legislative Council of the Hong Kong Special Administrative Region, 2017).

According to WHO, dementia is one of the major causes of disability among elderly dependants, placing a considerable burden on caregivers, families and societies. Dementia cannot be cured and affects the ability to carry out daily activities. (Legislative Council of the Hong Kong Special Administrative Region, 2017) Beyond personal health, it will lead to an economic and social loss.

Extensive research shows the connection between air pollution and dementia. For instance, a negative correlation was found between the distance from roadways and the rate of dementia. Researchers tracking all adults in Ontario, Canada from the ages of 20 to 85 from 2001 to 2012 found that more than 243,000 developed dementia. Those who resided within 50 meters of busy roads had 7% higher risk, from 50-100 meters the risk was 5% greater and from 101-200 meters the elevated risk was 2%. There was no increase in risk for those living more than 200 meters away. (National Post, 2017) Considering that Hong Kong’s air pollution is worse than Canada’s – Hong Kong has on average 26 higher AQI in terms of Particulate Matter (PM) 2.5 pollution than Canada (World Air Quality Index, 2019) – people in Hong Kong are likely to be at an even greater risk of developing dementia due to the effects of air pollution.

We can apply this to Central in Hong Kong. Central is the city’s Central Business District (CBD). It is the main hub with numerous developed roads coupled with congested traffic. Central’s AQI exceeds the World Health Organisation’s standards more than 280 days per year (South China Morning Post, 2015). I have compared the average AQI of two of the most urbanised areas in Ontario and Hong Kong: Toronto and Central. Using the Past 30 days detailed AQI table of real-time air quality index, on the 40th week of 2019, I have calculated that Toronto had 30.4 AQI on average while Central had 105.87 AQI. (World Air Quality Index, 2019) As Central had 3.48 times higher AQI, we can deduce that Central will have a similarly higher risk of dementia from roadside air pollution.

Then how do air pollutants reach the brain and cause dementia? Magnetic nano-particles like sulphur dioxide, nitrogen dioxide and particulates smaller than 10
micrometres in diameter travel deep into the lungs and bloodstream to permeate the blood-brain barrier (NewScientist, 2019). Research at the University of Edinburgh detected that nano-particles reach the bloodstream within 24 hours and reside even after 3 months, which is enough time for particles to reach the brain cells. (National Institutes of Health, 2017) Derrick Ho, from the Hong Kong Polytechnic University, associates air pollution with oxidative stress, neuroinflammation and neurodegeneration of humans. (The Guardian, 2018) Inflammation in the brain causes a stress response like an increase in heart rate, breathing and glucose released.

Air pollution also causes a decrease in cognitive intelligence and ultimately leads to dementia following the theory of cognitive epidemiology, a theory that cognitive intelligence affects psychiatry. The Study from Peking University and Yale University has tested people in both sexes from 10 years old and above between 2010 and 2014 with standardized math tests and 34 world recognition questions. The report found a direct link between air pollution and a loss in cognitive intelligence, reducing a person’s level of education by fully one year. (The Guardians, 2018) Magnetic nano-particles permeate into the 2 main kinds of brain tissues: grey matter and white matter, each of which is related to verbal ability and mathematical ability respectively. Accordingly, there was a decrease in both abilities. The trend was more severe for those over 64 years of age, males and less educated groups of people. The logical reasoning behind this is that less-educated males usually get involved in laborious outdoor jobs. Together, the research shows that those exposed to high levels of pollution are at a significantly higher risk of reduced cognitive intelligence and dementia. (Xin Zhang, Xi Chen, and Xiaobo Zhang, 2018)

Consequently, the working-class neighbourhood of Sham Shui Po is at risk. Air pollution in Sham Shui Po is in an ‘unsafe’ state. Residents in over half of Sham Shui Po breathe in more pollutants than the WHO standards. (South China Morning Post, 2014) In support of this fact, I interviewed a 67 years old lady in Sham Shui Po and she has said “I feel like suffocating and I am struggling to sleep well. I cannot open the window.” In addition to this, Sham Shui Po is the area with one of the highest ageing populations and highest poverty rates: 24.6 % of its residents are living below the poverty line. (South China Morning Post, 2017) Combining all of these factors, we can infer that Sham Shui Po will likely suffer striking figures of lowered cognitive intelligence and dementia. Cognitive intelligence is more influential to elderlies as they have to make significant financial decisions in their life: retirement, pension schemes, etc. From air pollution, Sham Shui Po residents are more likely to have detrimental health conditions, lowering their financial independence and labour productivity, worsening poverty and vulnerability to air pollution, and eventually side effects of health issues, constituting a cyclic effect of poverty and health and spoiling the sustainability of Hong Kong. The low awareness of the mental health effects of air pollution is part of the problem. The resident I interviewed replied, “I’ve never heard air pollution would
cause dementia." Without public awareness of the risks, there is likely to be few attempts to treat dementia in relation to air pollution.

The danger of brain dysfunction has often been overlooked, despite much (warranted) attention given heart and lung diseases. However, its long term and indirect effects are potentially staggering. The study linking air pollution and neuroscience can open up a new future and solutions for psychiatry – if air pollution causes dementia, cleaning the air can conversely help resolve dementia. Therefore, clean air is a key element to sustainable health in Hong Kong.

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