

Air Quality and Physical Activity in Hong Kong Schoolchildren

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1. Introduction

Measuring health can be subjective and reliant on many contributing factors, making it difficult to measure, especially over short periods of time. Because physical activity is a thoroughly-researched health promoter, studying factors which impede physical activity can provide insight on the effects of the studied factors. Identifying health obstacles is especially important among school children who are at an age for establishing patterns of healthy or unhealthy habits and are developmentally susceptible for development of certain chronic disorders.

Hong Kong, a global center of technological advancement, has quickly become a highly industrialized city with levels of pollution that have been shown to negatively

affect cardiopulmonary function.¹ Such respiratory problems can further impair a person's ability to engage in physical activity, leaving them at higher risk for other chronic health problems.² Hong Kong's children are speculated to be one of the least active in the world.^{3 4} Attitudes regarding physical activity can be explored by looking at the different factors that influence physical activity levels. For example, investigating whether or not there is a link between pollutant levels and physical activity among schoolchildren can lend some insight into the effects pollution levels may have on physical activity and potential for health. Especially for schoolchildren who are not only a susceptible population, but also a population with limited control over their own actions, exploring influential factors that determine their actions regarding physical activity is important. For example, parents and schools play large roles in determining whether or not a child is allowed to go out and play. In addition to taking school and parental roles into account, preventative health programs serve as factors that determine students' access to knowledge regarding benefits of physical activity.⁵

¹ Van der Zee, S., G. Hoek, H. M. Boezen, J. P. Schouten, J. H. van Wijnen, and B. Brunekreef. "Acute Effects of Urban Air Pollution on Respiratory Health of Children with and without Chronic Respiratory Symptoms." *Occupational and Environmental Medicine* 56, no. 12 (December 1999): 802-12. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1757690/>.

² Schwela, D. "Air Pollution and Health in Urban Areas." *Reviews on Environmental Health* 15, no. 1-2 (January-June 2000): 13-42.

³ Hui, S. "Health And Physical Activity in Hong Kong: A Review." *Hong Kong Sports Development Board* 19-22. Accessed July 23, 2015. <http://www.hksi.org.hk/hksdb/html/pdf/research/r2.pdf>.

⁴ Macfarlane, DJ. "Some disturbing trends in the level of habitual physical activity in Hong Kong primary school children: preliminary findings." *HKJ Sp Med Sp Sci* 1997;5:42-6.

⁵ "Exercise and Health-New Imperatives for Public Health Policy in Hong Kong." Accessed July 5, 2015. <http://www.hkmj.org/abstracts/v4n4/389.htm>.

2. Literature Review

Many previous studies have already identified a link between air quality and respiratory health. Studies have even gone so far as to determine how levels of physical activity decline in children with asthma and other respiratory disorders. However, not much research has been done on the effects of air pollutant levels on the physical activity of schoolchildren, regardless of whether or not students have been diagnosed with asthma or any other respiratory problem.

Because both components of study-air quality and physical activity-are rarely linked in the literature, studies that compare levels of pollution between parts of Hong Kong, and studies that measure physical activity will have to be combined to develop a useful data collection method.

The first part of the research involves figuring out a way to measure levels of particulate matter throughout various microenvironments in Hong Kong. Several studies have conducted relevant research experiments regarding the link between air quality and health, mostly focusing on asthma and respiratory problems, because of the obvious link between air pollutants and airways. For example, a study done in Hong Kong compared the adverse respiratory effects on children living in high exposure to pollutants and children living in low exposure levels.⁶ The comparative study between different parts of Hong Kong serves as a good model for a study comparing differences in physical activity between different regions in Hong Kong. A similar study also took a look at the effect of particulate matter on schoolchildren throughout different parts of

⁶ Gao, Yang, Emily YY Chan, Liping Li, Patrick WC Lau, and Tze Wai Wong. "Chronic Effects of Ambient Air Pollution on Respiratory Morbidities among Chinese Children: A Cross-Sectional Study in Hong Kong." *BMC Public Health* 14 (February 3, 2014): 105. doi:[10.1186/1471-2458-14-105](https://doi.org/10.1186/1471-2458-14-105).

Hong Kong. This study went further by linking the varying levels of particulate matter throughout different seasons⁷, which can be useful for identifying changing patterns of physical activity as the AQI changes throughout the seasons. Another study, which assessed the Air Pollution Index Reporting System, serves as a useful statistical model for looking at the distribution of different pollutants on different days. Although the study did not assess a possible link between physical activity and air quality, the study correlated the days when pollutant levels exceeded WHO standards which can be useful in follow-up studies that look at overall health effects of low air quality.⁸

While studies that focus on the effects of pollutants on schoolchildren serve as good methodological models, looking at studies that measure physical activity is essential. One study in Hong Kong took a thorough look at demographic characteristics and the role they play in children's exposure to particulate matter and overall health. The researchers collected their data by distributing diaries, which may be more accurate than questionnaires that rely on information recall.⁹ A public health research team attempting to implement physical activity programme in Hong Kong claims that Hong Kong's schoolchildren are one of the most inactive in the world.¹⁰¹¹ The article points out that physical education is not a core value in most of the studied population. Taking into

⁷ Che, W. W., H. Christopher Frey, and Alexis K. H. Lau. "Comparison of Sources of Variability in School Age Children Exposure to Ambient PM_{2.5}." *Environmental Science & Technology* 49, no. 3 (February 3, 2015): 1511–20. doi:[10.1021/es506275c](https://doi.org/10.1021/es506275c).

⁸ Wong, T. W. "A Study of the Air Pollution Index Reporting System." Accessed June 22, 2015. http://www.aqhi.gov.hk/pdf/related_websites/APIreview_report.pdf.

⁹ Che, W. W., H. Christopher Frey, and Alexis K. H. Lau. "Assessment of the Effect of Population and Diary Sampling Methods on Estimation of School-Age Children Exposure to Fine Particles." *Risk Analysis* 34, no. 12 (December 1, 2014): 2066–79. doi:[10.1111/risa.12238](https://doi.org/10.1111/risa.12238).

¹⁰ "Exercise and Health-New Imperatives for Public Health Policy in Hong Kong." Accessed July 1, 2015. <http://www.hkmj.org/abstracts/v4n4/389.htm>.

¹¹ . Macfarlane DJ. "Some disturbing trends in the level of habitual physical activity in Hong Kong primary school children: preliminary findings." *HKJ Sp Med Sp Sci* 1997;5:42-6.

account values that are prioritized and other reasons for decreased physical activity can lead to a thorough understanding of factors that affect schoolchildren physical activity levels and overall health. For example, finding out what children are doing when they are not engaged in physical activity may lend some insight into that are valued over physical activity.

Although many studies have identified the relationship between air quality and respiratory health, there is light to be shed on the effects of low air quality on other health factors. Physical activity is oftentimes a promoter of health and wellness, especially among schoolchildren who are at an age most susceptible to chronic development. Air quality can determine whether or not a child is able to go out and play, or if a child's cardiopulmonary system is able to handle rigorous physical activity. However, many other factors, like access to parks and having time to take a child to a park, along with cultural values can also contribute to lower levels of physical activity. These external factors, along with air quality should be studied in order to gain a sense of the many different elements that can contribute to decreased levels of physical activity among schoolchildren, thus determining their potential for overall wellness.

3. Methodology

In order to figure out how the varying levels of air pollutants throughout the microenvironments in Hong Kong affect the amount of physical activity among schoolchildren, several factors must be addressed. Because children are somewhat limited in their decision-making sovereignty, parents' and schools' decision-making will be taken into account.

To begin, a distribution study will be carried out to assess the distribution of the susceptible population, children (age below 15), and the AQHI levels by district.








Air Quality Health Index (AQHI) levels are taken hourly at monitoring sites throughout 15 Hong Kong regions.¹² In Hong Kong, each report is a culmination of Particulate Matter (2.5 & 10), Ozone, Sulfur Dioxide and Nitrogen Dioxide levels with “risk” levels based on WHO standards (Figure 1).¹³ The AQHI report is accompanied by a suggested practice for limited exposure to high risk levels of pollutants. The following table, taken from the AQHI page, describes the ranking criteria for low risk, moderate risk, high risk and higher pollutant levels with relevant suggestions.¹⁴

¹² “Live: Hong Kong Air Quality Levels.” *Greenpeace East Asia*. Accessed July 2, 2015. <http://www.greenpeace.org/eastasia/campaigns/air-pollution/work/air-pollution-truth-index/>.

¹³ “GovHK: Air Quality Health Index.” *GovHK*. Accessed July 5, 2015. <http://www.gov.hk/en/residents/environment/air/aqhi.htm>.

¹⁴ “Health Advice: Which Action Should I Take?”. *Air Quality Health Index*. Accessed July 2, 2015. <http://www.aqhi.gov.hk/en/health-advice/sub-health-advice.html>

Figure 1. The figure to the right, taken from Hong Kong's Air Quality Health Index site, outlines precautionary suggestions for populations more susceptible to pollutant damage.

| Health Risk Category | AQHI | People who are sensitive to Air Pollution | |
|--|--------------|--|--|
| | |  People with existing heart or respiratory illnesses * |  Children and the Elderly |
|  LOW | 1 - 3 | No response action is required. | No response action is required. |
|  MODERATE | 4 - 6 | No response action is normally required. Individuals who are experiencing symptoms are advised to consider reducing outdoor physical exertion. | No response action is required. |
|  HIGH | 7 | People with existing heart or respiratory illnesses are advised to reduce outdoor physical exertion, and to reduce the time of their stay outdoors, especially in areas with heavy traffic. They should also seek advice from a medical doctor before participating in sport activities and take more breaks during physical activities. | Children and the elderly are advised to reduce outdoor physical exertion, and to reduce the time of their stay outdoors, especially in areas with heavy traffic. |
|  VERY HIGH | 8-10 | People with existing heart or respiratory illnesses are advised to reduce to the minimum outdoor physical exertion, and to reduce to the minimum the time of their stay outdoors, especially in areas with heavy traffic. | Children and the elderly are advised to reduce to the minimum outdoor physical exertion, and to reduce to the minimum the time of their stay outdoors, especially in areas with heavy traffic. |
|  SERIOUS | 10+ | People with existing heart or respiratory illnesses are advised to avoid outdoor physical exertion, and to avoid staying outdoors, especially in areas with heavy traffic. | Children and the elderly are advised to avoid outdoor physical exertion, and to avoid staying outdoors, especially in areas with heavy traffic. |

During days with an AQHI of 7 or higher, children are advised to reduce their physical activity outdoors, especially in areas with heavy traffic (Figure 1). There are 15 air quality monitoring sites throughout Hong Kong that measure hourly pollutant levels and provide publically accessible AQHI levels.¹⁵ Because students are on summer break while research is conducted, student questionnaires on personal deterrence from physical activity is difficult to

¹⁵ "Live: Hong Kong Air Quality Levels." *Greenpeace East Asia*. Accessed July 2, 2015. <http://www.greenpeace.org/eastasia/campaigns/air-pollution/work/air-pollution-truth-index/>.

carry out. Additionally, children tend to have limited authority over their own actions, so authoritative figures, like schools and parents, will be assessed, along with corresponding action or inaction.

The school assessment entails selecting primary schools in different regions of Hong Kong in order to then assess number of school days when the schools should have taken precautionary steps. The chosen schools are whole-day, government primary schools, with the aim of creating a set of schools with standard holidays and similar rules regarding student health. School selection is also based on proximity to AQI monitoring stations, which take measurements of pollutants that are then displayed on Greenpeace.org's website every hour.

AQHI hourly data is recorded for the 2014-2015 school year. Hong Kong's Environmental Protection Department allows users to download previous hourly AQHI measurements from each monitoring station.¹⁶ After taking the daily average by school hours, and omitting weekends and holidays, the number of "high risk" days can be quantified and used to determine expected missed hours of potential physical activity, depending on the school's AQHI protocol.¹⁷ Selected schools have accessible emails and phone numbers on their websites, to allow verification of recess time and AQHI protocol.

¹⁶ "GovHK: Inquire and Download Air Quality Monitoring Data." *Environmental Protection Department*. Accessed July 5, 2015. <http://epic.epd.gov.hk/EPICDI/air/station/?lang=en>.

¹⁷ "Hong Kong Academy 2014-2015 Master Calendar." *Hong Kong Academy*. Accessed July 12, 2015. http://www.hkacademy.edu.hk/uploaded/PDF_downloads/Calendar/2014-15_Calendar_v1.pdf.

The following are the chosen monitoring sites and nearby schools:

Figure 2. The Table below indicates the chosen AQHI monitoring sites, the site addresses, and the primary schools chosen based on proximity to the monitoring sites. **Green highlight** indicates roadside stations, unlike the majority of the stations which are elevated.

| | Station | Address | School(s) |
|---|-----------------|---|--|
| 1 | Tai Po | Tai Po Government Offices Building, 1 Ting Kok Road | Tai Po Government Primary School |
| 2 | Causeway Bay | 1 Yee Wo Street | Sir Ellis Kadoorie (Sookunpo) Primary School |
| 3 | Sha Tin | Sha Tin Government Secondary School, 11-17 Man Lai Road | Shatin Government Primary School |
| 4 | Kwun Tong | Yue Wah Mansion, 407-431 Kwun Tong Road, Kwun Tong, Kowloon | 1. Kwun Tong Government Primary School (Sau Ming Road) 2. Kwun Tong Government Primary School |
| 5 | Central/Western | Sai Ying Pun Community Complex, 2 High Street | 1. Li Sing Primary School 2. Bonham Road Government Primary School |
| 6 | Sham Shui Po | Sham Shui Po Police Station, 37A Yen Chow Street | 1. Fuk Wing Street Government Primary School 2. Li Cheng Uk Government Primary School |

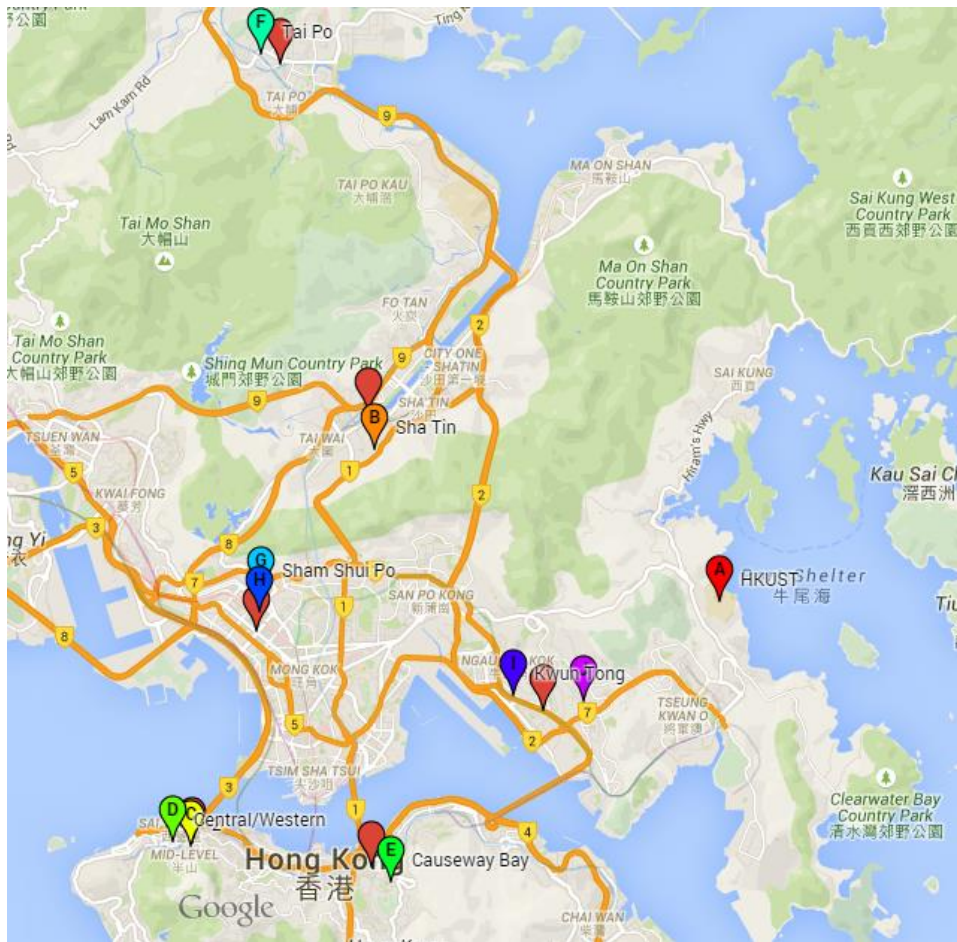


Figure 3.
The map to the left shows the distribution of monitoring sites and corresponding primary schools.

Schools are divided into categories by type of land use. The following chart (Figure 4), modeled after categorization by the Air Quality Health Index¹⁸, describes the type of land and the Hong Kong regions that fall within the category.

¹⁸ "Pollutant Long-Term Trends (1990-2013)." *Air Quality Health Index*. Accessed July 22, 2015. http://www.aqhi.gov.hk/api_history/english/report/files/aqt13e.pdf.

Figure 4. The chart below categorizes regions in Hong Kong under different land use types and characteristics of each land type. The three regions highlighted in green indicate regions that will be studied further.

| Type of Land | | Regions in Hong Kong Classified |
|--------------|---|---|
| New Town | mainly residential | Sha Tin, Tai Po, and Yuen Long Tung Chung |
| Roadside | urban roadside in mixed residential. commercial area with heavy traffic and many tall buildings | Causeway Bay, Central and Mong Kok |
| Urban | densely populated residential areas and some commercial and industrial areas. | Central/Western, Eastern, Kwai Chung, Kwun Tong, Sham Shui Po and Tsuen Wan |
| Rural | | Tap Mun |

In order to assess the distribution of schoolchildren in the monitored areas, three stations, one from New Town, one from Urban, and one from Roadside, were taken for compilation of schoolchildren distribution and analysis of missed school days. The chosen stations are Sha Tin (New Town), Sham Shui Po (Urban), and Causeway Bay (Roadside).

To understand school influence on children’s levels of physical activity, the following questionnaire aims to investigate AQHI protocol surveyance.

How long is recess for the students?
 What kinds of activities do the students engage in when they are on the playground?
 Is the playground indoors or outdoors?
 Does your school check the AQHI levels when sending the students outdoors?
 If you check, do you prevent students from going outside if the AQHI levels are high?
 At what AQHI level do you prevent the students from going outside?
 If recess is cancelled, what do the students do instead?

The following questionnaire aims to get a sense of parental influence on schoolchildren's physical activity when it comes to high AQHI levels:

1. How old is your child? Boy or Girl?

您的孩子年齡多大？男孩還是女孩？

2. About how many hours of physical activity per week does your child get?

您的孩子每周運動多長時間（小時）？

3. What kind of physical activity? Please specify the time length of each if more than one.

您的孩子做何種運動？如果多於一種，請列出每種運動的時長。

4. Is it indoors or outdoors? Please specify if more than one.

您孩子的運動類型是室內還是室外？如果多於一種，請列出每種運動的類型。

5. Do you check air quality levels?

你會關注/檢查空氣質量嗎？

6. On days of bad air quality, do you prevent your child from going outside?

當空氣質量糟糕的時候，你會阻止您的孩子去室外麼？

7. If they do not go outside, what do they do instead?

如果他/她不去室外活動，會做什麼來代替？

8. What district do you live in?

你們住在哪個區？

During the school-year, when questionnaires can be carried out in school, it would be interesting to study how often children are deterred from going out, due to personal decisions, rather than a rule implemented by their school, or decisions carried out by their parents.

4. Results & Discussion

School Surveys

Out of the 9 schools that were selected for the survey, the following participated in the survey:

| School | Region | Recess Time | AQI Protocol |
|--------------------|-----------------|-------------|-------------------------------|
| Sir Ellis Kadoorie | Causeway Bay | 20 minutes | do not check AQI |
| Sha Tin | Sha Tin | 30 minutes | do not check AQI |
| Kwun Tong Sau Ming | Kwun Tong | 40 minutes | indoor playground |
| Li Sing | Central/Western | 15 minutes | did not want to finish survey |
| Fuk Wing Street | Sham Shui Po | 15 minutes | do not check AQI |
| Li Cheng UK | Sham Shui Po | 15 minutes | do not check AQI |

The school surveys revealed that although the Hong Kong Education Bureau indicates that Hong Kong's government primary schools have 40 minute recess breaks, surveyed schools did not meet the 40 minute recess time.¹⁹ Recess at most surveyed schools was as short as 15 minutes long. This may be beneficial in reducing outdoor pollutant exposure time, at the cost of adequate physical activity time.

Despite AQHI data being publically accessible on multiple sites, Hong Kong's tools to educate the public on the dangers of pollutants are underutilized. The school surveys revealed a lack of action on the local level in response to AQHI recommendations. Schools that were contacted revealed that they do not check the AQHI levels when determining whether or not to let their students out for recess. However, one school indicated that the students had their physical activities in an indoor playground. Although there is no filter that prevents air

¹⁹ "Whole-Day Primary Schooling." *Education Bureau: The Government of the Hong Kong Special Administrative Region*. Accessed June 28, 2015. <http://www.edb.gov.hk/en/edu-system/primary-secondary/applicable-to-primary/whole-day-schooling/index.html>.

conditioners from circulating pollutants indoors, the recorded AQHI levels outdoors would probably differ from the ones indoors.

Out of the surveyed schools, three primary schools were chosen to further comparisons between school day AQHI depending on the type of region (New Town, Urban, and Roadside). Sha Tin School in Sha Tin, Li Cheng UK School in Sham Shui Po, and Sir Ellis Kadoorie School in Causeway Bay.

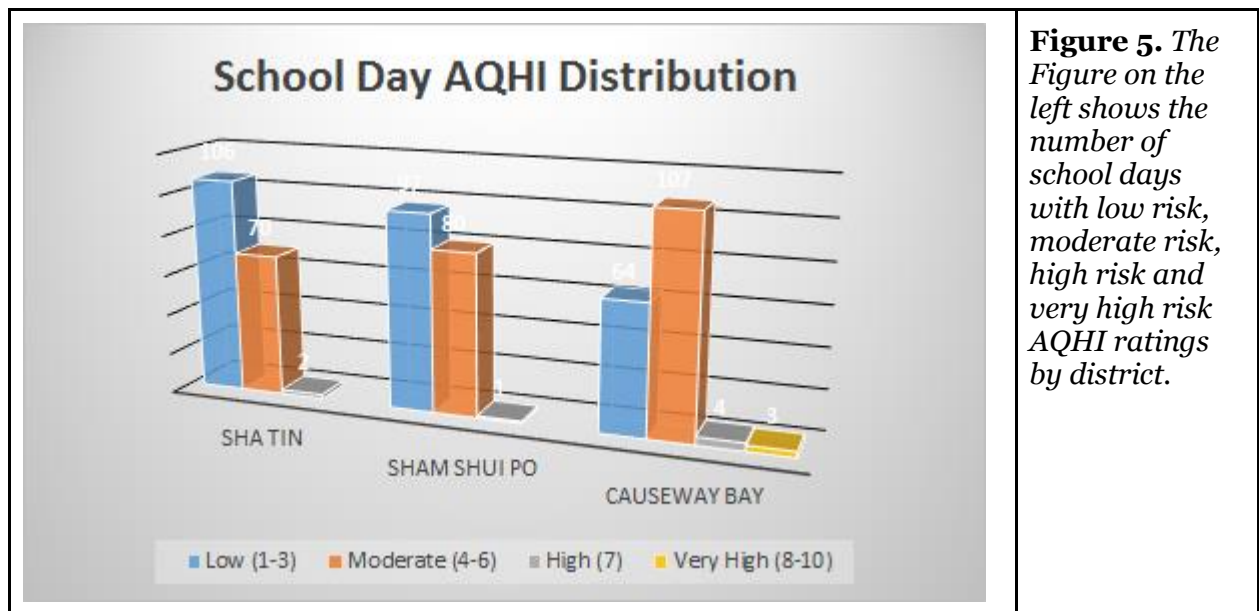


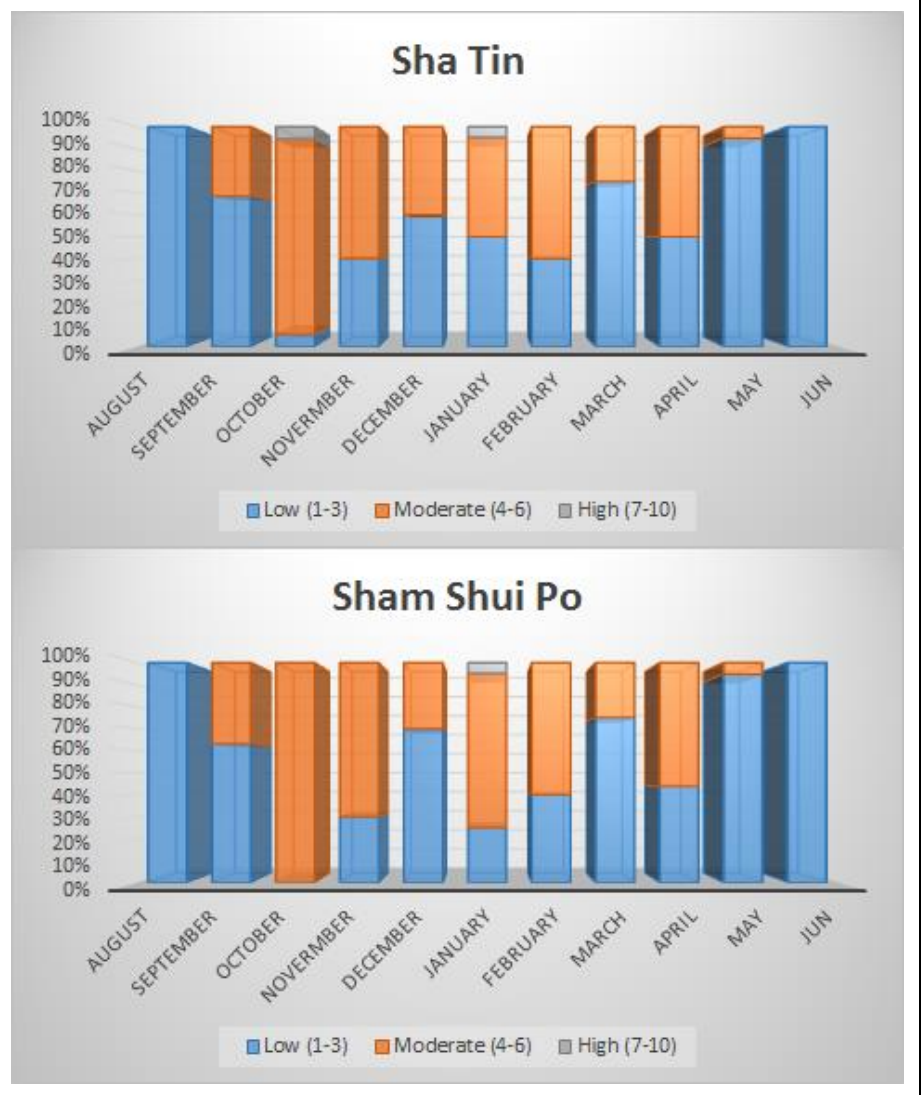
Figure 5. The Figure on the left shows the number of school days with low risk, moderate risk, high risk and very high risk AQHI ratings by district.

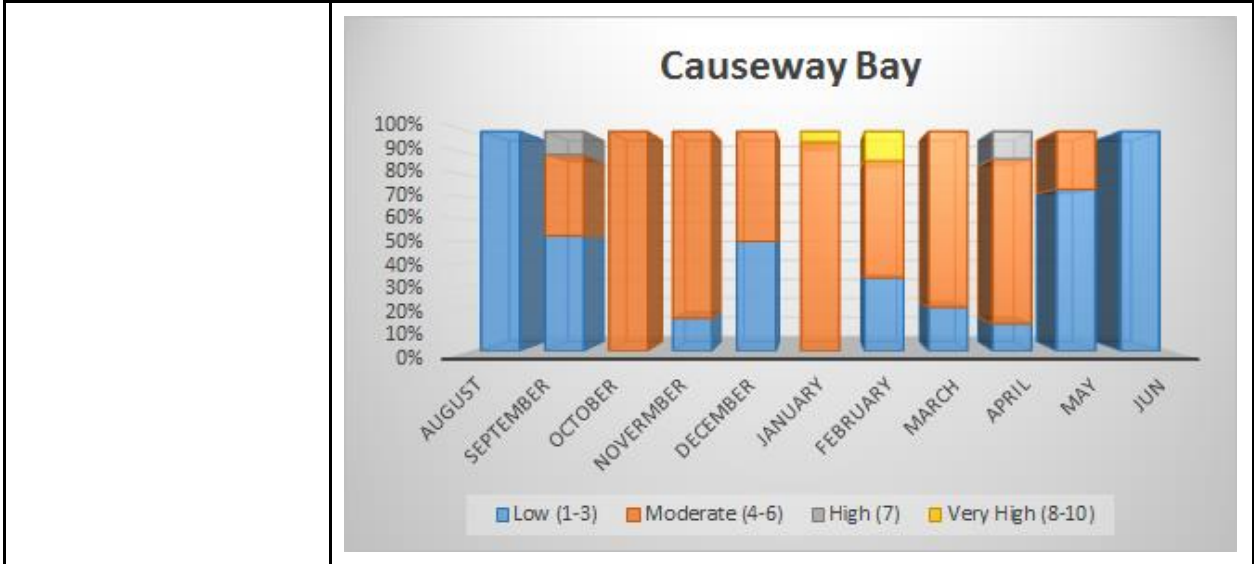
Causeway Bay, a Roadside region, had the most school days with moderate risk (107 days), high risk (4 days) and very high risk (3 days) readings out of the three studied regions. Sha Tin, in a New Town region, had the lowest amount of Moderate Risk school days (70 days), but just one more High Risk day when compared to Sham Shui Po, an Urban region with 89 Moderate Risk days.

Using the AQHI data by district, the minutes of outdoor exposure during recess time were calculated, using the times for recess indicated in the school surveys. Sir Ellis Kadoorie in Causeway Bay would have had the highest amount of missed or reduces minutes of physical activity, with roughly just over two hours over the entire school year. However, the studied schools do not check AQHI, so the children went outside anyway.

AQHI data for the three different regions is compared below.

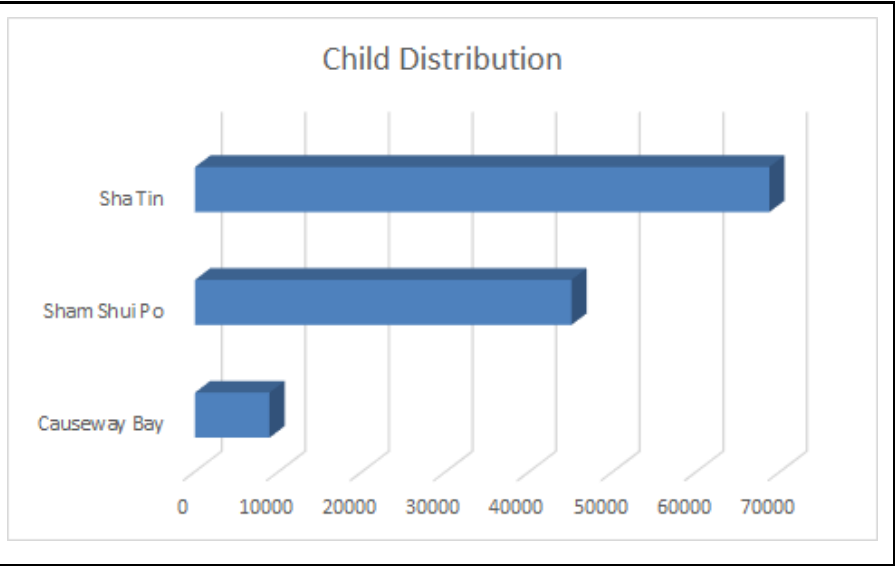
Figure 6. The charts to the right show the percentage of Low Risk, Moderate Risk, High Risk and Very High Risk AQHI ratings on school days per month. Percentage was taken to account for varying school days per month. None of the stations exceeded a Very High Risk AQHI rating. Causeway Bay, a Roadside region, had the highest amount of days and percentage by month in which the AQHI reached High Risk and Very High Risk levels.



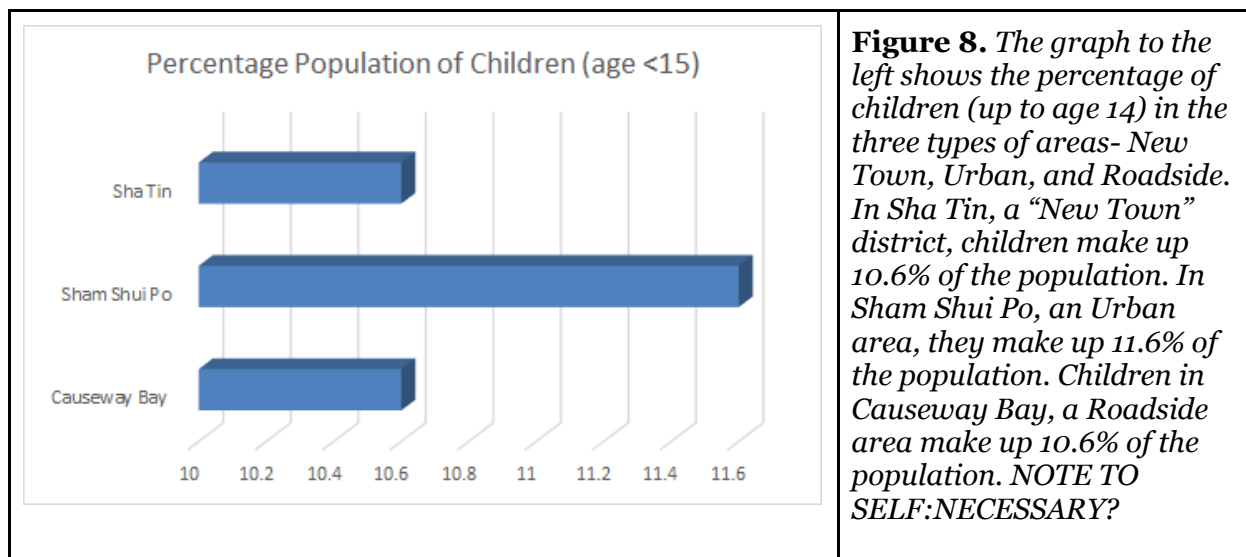


The AQHI data reveals that children experience higher risk levels in a Roadside area like Causeway Bay, when compared to an Urban or New Town area. However, further analysis of child demographics, taken from Hong Kong Census 2014, lends some insight into how many children are really affected on high or very high risk days.²⁰

Figure 7. The graph on the right shows the number of children by region. Sha Tin’s under 15 population is the highest, reaching 68,709. Sham Shui Po’s population reaches 45,042, while Causeway Bay’s falls at only 8,914. Calculations were made using percentages of children and total net population, provided by the Hong Kong Census of 2014.



²⁰ “The Profile of Hong Kong Population Analysed by District Council District, 2014.” Census and Statistics Department, Hong Kong Special Administrative Region. Accessed July 18, 2015. Accessed July 18, 2015. <http://www.statistics.gov.hk/pub/B71506FB2015XXXXB0100.pdf>.



Schoolchildren demographics revealed that children (below age 15) make up a lower percentage of the population in Roadside or more industrial areas, like the regions found on Hong Kong Island. Higher percentages of children make up populations in inland areas like the New Territories and Kowloon, which in general are less industrial, though they are dense in population. For example, regions in Hong Kong Island may be more industrial and more likely to have higher levels of pollutants, but most of Hong Kong’s population resides outside of Hong Kong Island, with 52% living in the New Territories and 30% living in Kowloon. Figure 7 reveals that out of the three studied regions, most children live in Sha Tin, a New Town area with lower levels of risky AQHI ratings during the 2104-2015 school-year.

Parent Surveys

Although most parents who took the survey indicated that their child got more than 5 hours of physical activity per week, most parents did not check AQHI levels. Additionally, the physical activity tended to be what the parents thought the children engaged in at school, indicating a lack of initiative to get children physically active outside of school. If the child was not engaged

in physical activity, the child would be preoccupied with schoolwork or interacting with technology.

5. Conclusion

Although the study aimed to link high AQHI levels to lower levels of physical activity among Hong Kong schoolchildren, lower levels of physical activity were not necessarily due to concern over pulmonary health that may be compromised by going outdoors, but more so due to a lack of esteem for AQHI levels. The same lack of concern over health was observed when surveying schools' nonexistent protocol for following AQHI guidelines on days of severe AQHI levels.

Even though there is a push by Hong Kong air quality organizations to make AQHI data widely accessible, along with recommendations for action, a gap exists between knowledge distributed by organizations and action at a personal level. Finding out whether the gap exists out of lack of health literacy or out of apathy is important. For example, even though residents may fully understand the AQHI reporting system, they are apathetic because they feel as though checking will make no difference in their health since they cannot change the AQHI levels.²¹ Because AQHI levels are not checked by the general public, they cannot influence people's decision-making process when it comes to engaging or not engaging in physical activity. Although apathy towards AQHI levels prevents AQHI levels from having a deterrent effect on physical activity, more influential factors on physical activity should be explored.

In terms of physical activity, preventative health initiatives are not uncommon in Hong Kong, but are not as heavily monetized and updated as secondary or tertiary health care

²¹ "Tell Us What We Don't Know: Hongkongers Sceptical of New AQHI." *South China Morning Post*. Accessed August 8, 2015. <http://www.scmp.com/news/hong-kong/article/1393101/tell-us-what-we-dont-know-hongkongers-sceptical-new-aqhi?page=all>.

practices.^{22 23} Unlike primary health care programs which aim to prevent disease, secondary and tertiary health care involves treatment after a patient has already contracted or developed a disease, and is expected to make up a third of GDP spending in Hong Kong by the end of the century.²⁴ Research on proposals and preventative care measures in Hong Kong revealed that although the Food and Health Bureau created a Health Care and Promotion Fund to address the lack of preventative programs, the Fund was created in 1995 with an initial fund of \$80 million, which is little compared to the 101,985 million HKD spent on care in health facilities.^{25 26} There have been many initiatives promoting health in public spaces-prohibition of cigarette smoking, “cover your cough” ads, and more. However, proposals involving primary care initiatives for physical education are dated before 2008, indicating slow progress.

Given, there are significantly more accessible public awareness campaigns regarding AQHI levels than there are for physical activity. Despite public health measures to raise awareness on both these issues, there exists a knowledge-action gap when looking at responses to AQHI levels and engagement in physical activity. The lack of action regarding AQHI levels seems to be largely driven by apathy towards a long-term goal that has no clear short-term and personal benefits. When it comes to physical activity, even if people, specifically school-age students, understand the benefits of physical activity and have a positive attitude, it may be hard to act upon the desire to engage in physical activity. Children under the age of 15 would probably

²² Tse, KY. “A Study of the Healthcare Policy in Hong Kong.” *The University of Hong Kong*. Accessed August 1, 2015. <http://hub.hku.hk/bitstream/10722/52433/3/FullText.pdf>.

²³ Chan, ACM. “Action Plan to Promote Healthy Diet and Physical Activity Participation in Hong Kong.” *Department of Health*. Accessed July 15, 2015. http://www.change4health.gov.hk/filemanager/common/image/strategic_framework/action_plan/action_plan_e.pdf.

²⁴ “Health Care Could Account for Almost a Third of Hong Kong GDP by End of Century.” *South China Morning Post*. Accessed August 1, 2015. <http://www.scmp.com/comment/insight-opinion/article/1580799/health-care-could-account-almost-third-hk-gdp-end-century>.

²⁵ “Health Facts of Hong Kong: 2015 Edition.” *HK GOV*. Accessed August 1, 2015. http://www.dh.gov.hk/english/statistics/statistics_hs/files/Health_Statistics_pamphlet_E.pdf.

²⁶ “Health Care and Promotion Fund.” *Food and Health Bureau: Research Fund Secretariat*. Accessed August 2, 2015. http://rfs2.fhb.gov.hk/english/funds/funds_hcpf/funds_hcpf_abt/funds_hcpf_abt.html.

need parental guidance to the nearest park, and in a high-efficiency culture where working days of 11 hours or more are not uncommon, parents have limited time to set aside for physical activity.²⁷ An interview with a Hong Kong family revealed that once the parents get home from work, they eat dinner and go to sleep. Additionally, studies that assess Hong Kong's culture of efficiency reveal that younger generations are less likely to commit time to physical activity. There is a generational difference in the way physical activity viewed as a health enhancer by older generations, and as almost unnecessary by younger generations. Although the elderly in Hong Kong tend to view physical activity as a good way to enhance health, the younger populations in Hong Kong see no need to carry out "healthy" practices if they are not sick, so they devote time to other activities that are valued more.

There is no shortage of recreational space in Hong Kong-the city is even known for its great hiking spots. However, when comparing the visitor density to other public centers like malls, parks are sparsely populated. For certain areas in Hong Kong, going to a park entails MTR and bus time. Perhaps Hong Kong's high-efficiency culture combined with a generation brought up in a technological world contributes to Hong Kong's disinterest in physical activity, an unnecessary time-consuming burden.²⁸ The climate, which is humid and unsuitable for prolonged outdoor activity, can also influence people's deterrence from going outdoors, more than AQHI levels do, especially given the public's apathy towards AQHI levels. This theory would entail further study into indoor facilities, with or without air filters, and frequency of facility use. The study can be based on distribution of public surveys, throughout an entire year to account for seasonal changes.

²⁷ "Law on Working Hours in Hong Kong Long Overdue." *South China Morning Post*. Accessed August 1, 2015. <http://www.scmp.com/comment/insight-opinion/article/1744896/law-working-hours-hong-kong-long-overdue>.

²⁸ "Public Opinion Survey on Physical Exercise Participation in Hong Kong Executive Summary." *Centre for Social Policy Studies Department of Applied Social Sciences The Hong Kong Polytechnic University*. Accessed August 1, 2015. http://www.lcsd.gov.hk/en/cscommittee/common/form/paper_csc_0806_20061122_annex_e.pdf.

Although AQHI does not seem to affect physical activity levels, many factors that influence people's responses towards AQHI levels also influence physical activity levels. For example, both are affected by a passive outlook. Additionally, although there is general widespread knowledge on AQHI levels, there are less public awareness campaigns that relay the benefits of physical activity. Thus, the amount of information that gets taken up and put to use by the general public is limited.

Even with an increase in widespread health campaigns focusing on physical activity, the public may approach physical activity with a fatalistic attitude they display when it comes to AQHI levels. No matter how many AQHI public awareness campaigns people encounter on a daily basis, inaction persists. If people do not feel a cause benefits them enough to take action, the benefits of public awareness campaigns are cut short. However, physical activity can yield more short-term changes in one's personal health, so that may increase motivation to act on a piece of public health knowledge. For both of these issues, it's important to stimulate desire for action at a personal level. Instead of solely delivering health information, focusing on individual effects of physical activity and AQHI levels may help increase a sense of motivation and willingness to act. Additionally, incorporating visual methods that track improvement may help transform an issue that seems like a large mountain to tackle into shorter hills.

Even though AQHI levels do not seem to affect physical activity levels due to lack of interest over AQHI levels, many other factors seem to play a role in levels of physical activity among Hong Kong schoolchildren. Whether it's out of apathy or lack of knowledge, there is disconnect between the governmental organizations that compile public health information and local or personal action.

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