Healthy Exercise for All Campaign – Physical Fitness Test for the Community

Final Summary Report

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【 Summary of Findings 】

1. Background

1.1 The Physical Fitness Test for the Community (the Study) was one of the events under the Healthy Exercise for All Campaign. The Study was steered by the Community Sports Committee of Hong Kong, and organized by the Leisure and Cultural Services Department (LCSD). It included a series of standardized physical fitness tests and questionnaire survey on the basis of "國民體質監測工作方案" done by the General Administration of Sport, China (國家體育總局).

1.2 Targeted Participants were Hong Kong citizens aged 3–69. There were five age groups, infants aged 3–6, children aged 7–12, adolescents aged 13–19, adults aged 20–59, and elderly aged 60–69.

1.3 The Study sampled over 13,000 participants through Stratified and random sampling method in 18 districts, ended up with 8,178 valid samples.

1.4 The LCSD as the organizer of the Study appointed the Department of Sports Science and Physical Education (SSPE) at The Chinese University of Hong Kong, the Physical Fitness Association of Hong Kong, China (HKFPA), and MVA Hong Kong Limited (MVA) to conduct a territory-wide community fitness survey from April 2011 to January 2012. The SSPE research team was to assist the Government Representative in monitoring the performance and provide consultation and professional advice on the work of other involved parties in the Project, and oversee the sampling method. Recommendation was made on fitness test and survey questionnaire design, including suggestions and modifications on testing protocols and questionnaire items, together with the format of data collection process. The SSPE was also responsible for data processing, statistical analysis, and the results report write-up. The HKPFA was responsible for testers training, conducting the fitness tests for all age groups, preparing and collecting questionnaire data from school-age groups, providing operational supporting services including safety screening and professional advice provision. MVA was responsible for enumerators training, conducting household interviews and inviting eligible citizens to the sports centres nearby for physical fitness tests.

1.5 There was a phased data collection process according to age groups. For infants and adolescents, the working group randomly selected one kindergarten and one secondary school in 18 districts respectively. For children, 18 primary schools were randomly selected from four regions (H.K. Island, Kowloon, New Territories East, and New Territories West) according to their modus operandi (direct subsidy scheme, aided school, and private independent school) with assistance from the Education Bureau (EDB). HKPFA was responsible for the data collection of the three student groups. For adults and elderly, MVA and HKPFA were to conduct household survey and follow up the fitness measurements respectively.

2. Project Objectives

2.1 The objectives of the Study were to (1) enable the individuals participants to have a general understanding of their physical fitness condition; (2) continue building up a physical fitness database of Hong Kong people; (3) identify the relationship between physical exercise pattern and physical fitness of Hong Kong people; and (4) identify priority areas for improvement to enhance the overall physical fitness of the public.

2.2 Fitness measurements were executed by qualified HKPFA testers. The fitness data was used to generate normative tables by gender and age group, so that people could compare their fitness performance with the overall profile on their own.

2.3 The information about the patterns and the level of physical activity (P.A.) participation, lifestyle, demographic information as well as attitude towards in P.A. participation and self-perception of health-related issues were collected via questionnaire.

2.4 According to the findings, suggestions concerning education and related supporting policies were provided so as to raise Hong Kong people's P.A. level and general fitness profile.

3. Data Analysis

3.1 After collecting the data from questionnaire surveys and physical fitness tests, the research team carried out statistical analyses, including descriptive statistics, sampling distribution, comparisons, and correlation analysis. The relationships between participants' fitness levels and their exercise patterns as well as lifestyle habits and so on were investigated.

3.2 In the Study report, participants were being categorized into four groups (obese, overweight, underweight, and normal) according to their body mass index (BMI). The classification of adults and the elderly was based on the BMI criteria for Asian established by the World Health Organization (WHO) in 2000 while infants, children, and adolescents were classified with reference to age and gender specific BMI criteria recommendation by the International Obesity Task Force (IOTF) in 2000 and 2007.

3.3 On the other hand, the Study grouped the participants aged 7 years or above in terms of their P.A. level. Two reference criteria were adopted, namely "2008 Physical Activity Guidelines for Americans" ("American Indicator")[remarks 1] and "Physical Activity Baseline Indicator" ("Baseline Indicator")[remarks 2] which was promoted locally and by some other countries/ regions, including China, England, and Taiwan. Participants were evaluated whether or not they met the recommendations under the two criteria. Although there was a difference in P.A. recommendations, research team still believed that it was necessary to conduct the classification analysis based on both criteria. The reasons included (1) "American Indicator" which was widely admitted and used in the field of physical education, medicine, and public health was founded on an enormous number of scientific evidences. It was quoted by WHO (2010) as well. The classification using a globally-recognized reference made helped the Study report more comparable; (2) "Baseline Indicator" which was less demanding than "American Indicator" and easily accepted by busy Hong Kong people was promoted locally in recent years. Therefore, research team summarized that each reference criterion had its advantages, especially in a fast-moving place like Hong Kong. People were encouraged to take a first step to meet "Baseline Indicator". After enriching cognitive level as well as physical fitness level, they were suggested to take reference from "American Indicator" and gradually increase their P.A. level.

Remarks 1 "American Indictor": "Active" children were those who accumulated at least 60 minutes moderate-or-above intensity P.A. every day in a week. "Active" adolescents were those who accumulated at least 60 minutes moderate-or-above intensity P.A. every day in a week in which any three days involved with vigorous intensity P.A. "Active" adults and elderly were those who accumulated at least 150 minutes moderate-or-above intensity P.A. in a week (or 75minutes vigorous intensity P.A. or other combinations of different intensities, e.g. accumulation of 90 minutes and 30 minutes moderate- and vigorous- intensity P.A. respectively).

Remarks 2 "Baseline Indicator": The Indicator was applied to all age groups. "Active" people were those who participated in moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day.

3.4 The P.A. level of Hong Kong people was also used to compare with the one released in the "Report for the Consultancy Study on Sports for All – Participation Patterns of Hong Kong People in Physical Activities" in 2009 ("Sports for All Study 2009"). The purpose of making such comparison was to understand the change of P.A. level across the past few years. The main reason why "Sports for All Study 2009" was chosen for comparison was that both studies adopted similar research methodology: (1) random sampling; (2) same age groups of participants; (3) similar assessment methods of P.A. level.

3.5 The percentages of different parameters presented in the report were calculated from the true value before rounding. Therefore, add-ups of figures in the tables may not be equal to the sub-total or total.

4. Infants

4.1 Participants

4.1.1 One kindergarten was selected from 18 districts respectively through stratified randomly sampling. Each school assisted in picking one class from three grades respectively. Infants aged 3–6 were invited to participate in the Study.

4.1.2 There were 707 randomly selected samples of which 584 were valid (82.6%).

4.1.3 The research team compared the sample sizes of four sub-groups (boys/ girls aged 3–4; boys/ girls aged 5–6) with the "Mid-2011 Provisional Population Figures" published by the C&SD so as to allow necessary weighting calculations.

4.2 Physical Fitness Level

4.2.1 The mean values of body composition and fitness parameters were shown in the table below.

Age	3–4		5–6	
Parameters / Gender	Boys	Girls	Boys	Girls
Height (*cm*)	104.37	103.30	114.55	113.27
Weight (*kg*)	17.28	16.40	21.00	20.22
BMI (kg/m^2)	15.83	15.33	15.91	15.66
Seated height (*cm*)	58.92	58.15	63.47	62.79
Total Skinfold (Upper Arm + Calf) (*mm*)	16.01	17.16	16.88	18.92
Chest circumference (*cm*)	54.73	53.94	58.30	57.35
Resting HR (*bpm*)	99.14	97.52	93.91	94.85
Sit-and-reach (*cm*)	5.35	7.52	4.42	6.39
Walking on a balance beam (*s*)	17.58	18.18	8.02	8.52
Continuous jump with both feet (*s*)	11.42	11.35	7.58	7.69
Standing long jump (*cm*)	67.00	62.93	90.98	81.89
10m × 2 shuttle run (*s*)	8.15	8.46	6.88	7.04
Throwing a Tennis Ball (*m*)	3.42	2.80	5.01	4.38

4.2.2 According to the criteria suggested by International Obesity Task Force (IOTF), 12.9% of boys and 14.1% of girls were classified as overweight or obese (see the table below). In addition, about 20% of infants (boys: 19.3%; girls: 19.5%) were categorized as underweight. To sum up, the prevalence of overweight and obese infants was a bit high. Close attention should be paid to the issue.

Age	Underweight		Overweight		Obese	
	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
3–4	20.1	22.2	6.7	9.0	3.4	0.7
5–6	18.4	16.5	8.2	13.5	7.6	5.3
Sub-total	19.3	19.5	7.5	11.2	5.5	2.9
Total	19.4		9.3		4.2	

4.2.3 Infants' physique (height, weight, seated height, and chest circumference) and skinfold thickness significantly increased with age.

4.2.4 Resting HR and sit-and-reach performance (flexibility) decreased significantly with age.

4.2.5 The performances of walking on a balance beam, continuous jump with both feet, standing long jump, 10m × 2 shuttle run, and throwing a tennis ball significantly got improved with age.

4.2.6 Girls had thicker skinfold and greater flexibility while boys performed better in standing long jump and throwing a tennis ball. The results mentioned reached significant difference.

4.2.7 Age and gender specific normative tables in quintiles and percentile ranks were generated.

4.3 Inter-correlation between Fitness Variables

4.3.1 In both genders, moderate-to-high correlations (r = 0.608–0.830) existed among infants' BMI, skinfold thickness, and chest circumference.

4.3.2 There was a moderate correlation ($0.400 \leq r < 0.700$) between the performances of continuous jump with both feet and 10m × 2 shuttle run in boys only. Other correlations are very small ($r < 0.400$).

4.4 Physical Activity Participation Pattern

4.4.1 The three most favourite physical activities of boys were "playing in the playground" (80.4%), "swimming" (49.7%), and "ball games" (44.4%). The three most favourite physical activities of girls were "playing in the playground" (80.4%), "dance" (50.7%), and "swimming" (40.6%).

4.4.2 More than 30% of infants received exercise training (learning class) on "cycling" (33.5%) or "swimming" (32.0%) in the past year.

4.4.3 Less than 20% of infants (17.7%) in Hong Kong performed an hour or more of outdoor activities on average each day. The time spent on outdoor activities could be an indicator for measuring the amount of P.A. participation. Hong Kong infants thus were not physically active enough.

4.4.4 Only 48.5% of infants participated in P.A. with their family members at least once per week in weekends or holidays. 31.8% of infants had P.A. participation with family for 1 to 2 times per month. As high as 13.6% of infants only took part in P.A. with family once several months. Even 6.1% had none in the past year. These statistics drew our attention in the society that parents may not be aware of the importance of having P.A. with their children and sacrificed the time for heavy daily workload.

4.5 Further Analysis

Relationship between Physical Fitness and Screen Time in Infants

4.5.1 In age group of 5–6, screen time was significantly correlated with resting HR, standing long jump performance, and 10m x 2 shuttle run performance ($p<0.05$).

4.5.2 Infants who accumulated two hours or more of screen time in a day had faster resting HR, weaker leg muscular strength, lower running speed, and longer reaction time than those who accumulated less than two hours a day.

Relationship between the Frequency of Family Physical Activity and the Duration of Outdoor Activity in Infants

4.5.3 The duration of outdoor activity significantly increased with the frequency of family P.A. (boys: $p < 0.05$, girls: $p < 0.05$).

Relationship between Physical Fitness and the Duration of Outdoor Activity in Infants

4.5.4 The BMI of infants aged 3–4 who accumulated one hour or more of outdoor activities each day was higher than those who accumulated less than one hour at $p<0.05$.

4.6 Discussion & Recommendations

4.6.1 Parents and preschool organizations were recommended to perform physical fitness assessments regularly in order to understand the change of fitness level. Referral for children in need to appropriate professionals could be made as soon as possible. Fitness measurements should be comprehensive instead of only focusing on one or two items. Various fitness parameters were suggested to be evaluated separately as they were mainly independent against each other

4.6.2 According to the criteria recommended by the International Obesity Taskforce (IOTF), as much as 19.4% and 13.5% of infants were underweight and overweight or obese respectively. It reflected that undernourishment and over-nutrition were both common in infants. It was necessary to deliver the information about balanced diet to parents.

4.6.3 One of the innate characteristics of infants is that they love to move around all day long. P.A. is a major component in their daily life. The National Association for Sports and Physical Education (NASPE) of the United States suggested that children aged 2 years or above should accumulate at least 60 minutes of physical activities every day. In Hong Kong, less than 20% of infants (boys: 18.0%, girls: 17.4%) met the recommendation in terms of outdoor activities, reflecting insufficient P.A. Moreover, more than half of infants could not have P.A. participation with family at least once per week. The situation drew our attention. In fact, it is crucial to nurture children to have active lifestyle starting from early childhood. It was suggested that preschool organizations and parents should share the responsibilities in modifying health behaviours of infants. For example, kindergartens may incorporate minimum 20-minute physical games into their curriculum every day while parents arranged not less than 40-minute P.A. in before-school or after-school periods. Formal training should be provided to kindergarten teachers on how to teach physical movement of their students. In addition, government and related stakeholders may think about offering more workshops and fun days so as to encourage and educate parents to arrange more family-based P.A.

4.6.4 "Playing in playgrounds", "swimming", and "ball games" were the most favourite physical activities of infants. Related stakeholders should continue to sustain the resources in these activities, so as to increase the opportunities for infants' participation.

5. Children

5.1 Participants

5.1.1 Primary schools were selected through stratified randomly sampling according to their locations and modus operandi. Children aged 7–12 were invited to participate in the Study.

5.1.2 A total of 18 primary schools were participated, 4 from H.K. Island, 5 from Kowloon, 5 from New Territories West, and 4 from New Territories East. There were 2,803 randomly selected samples of which 2,723 were valid (97.1%).

5.1.3 The research team compared the sample sizes of four sub-groups (boys/ girls aged 7–9; boys/ girls aged 10–12) with the "Mid-2011 Provisional Population Figures" published by the C&SD so as to allow necessary weighting calculations.

5.2 Physical Fitness Level

5.2.1 The mean values of body composition and fitness parameters were shown in the table below.

Age	7–9		10–12	
Parameters \ Gender	Boys	Girls	Boys	Girls
Height (*cm*)	130.68	130.05	144.71	146.18
Weight (*kg*)	30.11	28.71	40.48	39.70
BMI (kg/m^2)	17.41	16.80	19.11	18.39
Seated height (*cm*)	70.26	69.88	75.79	77.25
Total Skinfold (Upper Arm + Calf) (*mm*)	23.50	24.45	27.10	27.55
Chest circumference (*cm*)	66.48	65.09	73.36	73.66
Resting Systolic BP (SBP, *mmHg*)	104.62	103.91	108.88	109.72
Resting Diastolic BP (DBP, *mmHg*)	63.97	64.20	66.51	67.36
Resting HR (*bpm*)	87.53	90.34	81.56	86.28
Sit-and-reach (*cm*)	1.13	3.84	-1.15	4.76
Hand Grip (*kg*)	23.21	21.30	32.88	32.80
1-min Sit-ups (*rep*)	17.07	16.02	22.09	21.53
Standing Long Jump (*cm*)	116.24	105.16	133.62	120.72
15m PACER (*turns*)	13.20	12.31	19.97	17.57

5.2.2 According to the criteria suggested by International Obesity Task Force (IOTF), 30.6% of boys and 22.8% of girls were classified as overweight or obese (see the table below). In addition, 7.8 % of boys and 9.9% of girls were categorized as underweight.

Age	Underweight		Overweight		Obese	
	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
7–9	8.0	10.1	18.2	16.6	10.0	6.2
10–12	7.6	9.8	22.4	19.7	10.2	3.2
Sub-total	7.8	9.9	20.5	18.3	10.1	4.5
Total	8.8		19.5		7.4	

5.2.3 From the table below, 4.1% of primary school students were identified with the risk of hypertension [remarks 3]. Although the percentage is low, caution should be raised as healthy children at young age should not have such chronic disease.

High Blood Pressure Symptom	SBP ≥140*mmHg* **or / and** DBP ≥ 90*mmHg*		
Age	Boys (%)	Girls (%)	Total (%)
7–9	4.2	4.5	4.3
10–12	4.1	3.7	3.9
Total	4.2	4.1	4.1

5.2.4 Children's height, weight, BMI, seated height, skinfold thickness, chest circumference, as well as resting SBP and DBP significantly increased with age.

5.2.5 Resting HR decreased significantly with age.

5.2.6 The performances of 1-min sit-ups, standing long jump, and 15m PACER significantly got improved with age.

5.2.7 Girls had higher resting HR and flexibility but smaller percent body fat while boys performed better in standing long jump, and 15m PACER. The results mentioned reached significant difference.

Remarks 3 Such classification was conducted according to resting SBP ≥140 *mmHg* **or**/**and** DBP ≥ 90 *mmHg*. In fact, BP was correlated with students' age, height, and gender. Research team also took the age-, height-, and gender-adjusted criteria recommended by National High Blood Pressure Education Program (NHBPEP) Working Group and Bureau of Health Promotion, Department of Health (Taiwan) as well as Taiwan Society of Internal Medicine into account. Children with BP ≥ 95 percentile values were regarded as having high BP symptom (see the table below).

Age	Meet at least 1 of the following conditions		High Blood Pressure Symptom		
	Resting SBP (*mmHg*)	Resting DBP (*mmHg*)	Boys (%)	Girls (%)	Total (%)
7–9	≥ 122	≥ 78	19.1	17.5	18.3
10–12	≥ 126	≥ 82	16.9	19.0	17.9
Total			17.8	18.3	18.1

5.3 Inter-correlation between Fitness Variables

5.3.1 In both genders, high correlations ($r \geq 0.700$) existed among children's BMI, skinfold thickness, and chest circumference.

5.3.2 In boys, a negative moderate correlation existed between skinfold thickness and 15m PACER (r = -0.430), reflecting that fat children may have smaller leg muscular strength and cardiovascular fitness. On the other hand, there were moderate correlations (r = 0.404–0.479) among 15m PACER, 1-min sit-ups, and standing long jump. Other correlations were very small ($r < 0.400$).

5.3.3 In girls, a moderate correlation existed between chest circumference and handgrip strength (r = 0.451), reflecting children with large chest cavity may have greater strength at upper limbs. In addition, there was a moderate correlation between standing long jump and 15m PACER (r = 0.415). Other correlations were very small ($r < 0.400$).

5.3.4 Age and gender specific normative tables in quintiles and percentile ranks were generated.

5.4 Health-related Lifestyle

5.4.1 About 80% of children (81.1%) indicated that they had sufficient or very sufficient P.A.

5.4.2 According to the "American Indicator", children who accumulated at least 60 minutes moderate-or-above intensity P.A. every day in a week were classified as physically active. To facilitate the further analysis, the original categories "active" and "inactive" were subdivided into "active", "some active", and "sedentary" (see the table below). Only 9.5% of boys and 7.0% of girls in the study met the recommendation based on the amount of P.A. they reported. There was substantial discrepancy between children's self-evaluation and the reality. Therefore it is suggested that school-aged children may not be aware of the minimal requirement of P.A. during childhood. Education should be reinforced to alert students about the related requirement so as to promote active lifestyle in younger ages.

Category (with modification)		Number of days accumulated at least 60 minutes moderate-or-above intensity physical activity in a week	Boys (%)	Girls (%)	Total (%)
III	Active	7 days	9.5	7.0	8.3
II	Some active	1–6 days	69.9	72.2	71.0
I	Sedentary	<1 day	20.5	20.9	20.7

5.4.3 Furthermore, a classification according to the "Baseline Indicator" was shown in the table below. Children who participated in moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day were classified as physically active. About half of children (51.8%) did pass the mark. Boys had larger proportion of being "active" than girls (54.7% vs. 48.7%). The use of different standard made no difference to the discrepancy between what the children assessed for themselves and the real situation.

Category		Accumulation of moderate-or-above intensity physical activity in a week	Boys (%)	Girls (%)	Total (%)
III	Active	≥ 90 minutes	54.7	48.7	51.8
II	Some active	30–89 minutes	35.7	44.6	40.0
I	Sedentary	< 30 minutes	9.6	6.7	8.2

5.4.4 In the past year, approximately 80% of children had taken part in sports training as extra-curricular activities with "ball games" being the most favourite sports (68.1%), followed by "swimming" (48.8%) and "track and field" (42.0%).

5.4.5 It was found that about 40% of children spent more than 5 hours on sedentary activities (including study and recreation) after school.

5.4.6 17.9% of children slept less than 7 hours per day while the percentage of those slept for 9 hours or more per day was 32.0%.

5.4.7 Over 80% of children (83.5%) had an intake of at least a bowl of vegetables everyday. Also, a similar proportion of children (84.8%) had an intake of at least one fruit daily. 64.8% of children drank at least a cup of milk beverage everyday. It was found that most of the children met the recommendations on the food pyramid made by the Department of Health. However, the perception of the importance of consuming vegetables, fruits, and milk products was not studied in this study. Children may be able to meet the requirements only because their menus were set by their schools which provided lunch box or other care takers.

5.4.8 Around a quarter of children took high calorie food 3 times or more in a week, such as "chocolates or candies" (27.0%), "soft drinks, paper-packed drinks or canned drinks" (24.8%), and "cup noodles or instant noodles (23.5%)" (see the table below).

Foods/ Drinks	Boys (%)	Girls (%)	Total (%)
Chocolates or candies	26.0	28.1	27.0
Soft drinks, paper-packed drinks or canned drinks	27.5	21.9	24.8
Cup noodles or instant noodles	27.7	19.0	23.5
Deep fried foods (e.g. fried chicken, pork chop cutlet)	22.4	14.8	18.7
Street snacks (e.g. fish balls, siu mai)	19.6	14.2	17.0
Potato chips	15.4	11.6	13.6
Yogurts	12.5	12.6	12.5
Ice-creams	11.5	11.4	11.5
Pizzas	10.7	6.8	8.8

5.5 Attitudes and Feelings toward Physical Activity

5.5.1 The three major reasons adduced by the children for poor physical health were "inadequate sleep" (62.9%), "imbalance diet" (47.2%), and "too much homework" (38.8%). "Inadequate physical activity" was accounted for 38.0%。

5.5.2 On a scale of 1 to 4, the three most important benefits associated with P.A. participation were "P.A. helps maintain physical health" (mean rank: 3.57), "P.A. develops various physical skills" (mean rank: 3.45), and "P.A. helps control body-weight" (mean rank: 3.42).

5.5.3 On a scale of 1 to 4, the three attitude statements with highest level of agreement were "I like P.A." (mean rank: 3.61), "P.A. is very interesting" (mean rank: 3.53), and "P.A. participation makes me feel happy" (mean rank: 3.52). The results reflected that interesting physical activities which brought children happiness and aroused their emotional state could increase their participation.

5.5.4 On a scale of 1 to 3, the three major barriers cited to participation of P.A. were "inclement weather" (mean rank: 2.01), "too much homework" (mean rank: 1.99), and "being tired" (mean rank: 1.86).

5.5.5 Among those 59.5% of children who had the experience in playing electronic motion-sensing games, 81.5% of them agreed that those games has induced a greater interest in sports participation, while about half of them (50.9%) spent an hour or more per day in playing electronic motion-sensing games in the past week.

5.6 Further Analysis

Relationship between Physical Fitness and Physical Activity Level ("American Indicator") in Children

5.6.1 An increase in P.A. participation was highly associated with better muscular strength and cardiovascular fitness at significant level. Related test items included handgrip, 1-min sit-ups, standing long jump, and 15m PACER.

5.6.2 "Active" boys demonstrated 8.4% and 19.8% better performance in standing long jump and 15m PACER respectively than "sedentary" boys who also demonstrated 9.0% and 14.7% lower performance in handgrip and 1-min sit-up than "some-active" boys.

5.6.3 In girls, major difference mainly existed between "some-active" children and "sedentary" children.

Relationship between Screen Time and Physical Activity Level ("American Indicator") in Children

5.6.4 When children's screen time (watching TV/ movies, playing electronic games, using computer or web-surfing) increased, their P.A. level significantly dropped.

5.6.5 In boys, there were a higher proportion of children who spent more than 3 hours on screen activities during school days classified as "sedentary" than those with 3-hour-or-less screen time (32.0% vs. 18.1%).

5.6.6 In girls, there were fewer children who spent an hour or above on screen activities classified as "active" than those with less than an hour screen time (5.3% vs. 9.7%).

Relationship between Screen Time and Body Mass Index in Children

5.6.7 When children's screen time increased, their BMI significantly rose.

5.6.8 Boys who spent 2 hours or above on screen activities during school days had greater BMI than those without screen time.

5.6.9 Girls who spent more than 3 hours on screen activities had greater BMI than those with less than 1 hour or no screen time.

Relationship between Physical Fitness and Sleeping Time in Children

5.6.10 There was a significant difference in fitness level between groups of children having different sleep times.

5.6.11 Children who slept for 7 to 8 hours daily performed better in standing long jump and 15m PACER than those who slept less or more.

5.6.12 In 1-min sit-ups test, boys with 7 to 8 sleeping hours daily also had better performance whereas girls with 9 sleeping hours or more showed worse performance than those who slept less.

5.6.13 In handgrip test, children who slept 9 hours or more demonstrated smaller forearm strength.

Relationship between Parent's Exercise Frequency and Children's Physical Activity Level ("American Indicator")

5.6.14 There were significant differences in children's P.A. levels between groups of parents with various exercise frequencies per week. Children tended to be more physically active if their fathers or mothers were more physically active.

5.6.15 When fathers did exercise at least 6 times per week, 24.1% of their sons and 16.2% of daughters were "active". The proportions were higher than those whose fathers had no exercise in a week (boys: 7.5%, girls: 4.9%).

5.6.16 When mothers' exercise frequency reached 6 times per week, 23.6% of their sons and 15.0% of daughters were "active". The proportions were also higher than those whose mothers had no exercise in a week (boys: 6.5%, girls: 5.4%).

5.6.17 In fact, there were 34.9% of fathers and 37.2% of mothers who did not participate in any form of exercise. Moreover, as much as 62.9% of family did not manage to have regular family activities in sports during weekends or holidays (at least once a week) in the past year.

Comparison of Physical Activity Level across Years

5.6.18 The results from the table below showed the comparison of P.A. level based on the "Baseline Indicator" between "Sports for All Study 2009" and the current study. There was no significant difference in P.A. level between the two years.

Study	P.A. Level		Chi-square Test *p*-value
	Some active, Sedentary (%)	Active (%)	
2009	50.8	49.2	0.147
2011	47.7	52.3	

5.6.19 The P.A. level based on "American Indicator" proposed by USDHHS was also compared between "Sports for All Study 2009" and the current study (see the table below). More children (9.0%) met the guidelines requirement in the current study, higher than the proportion reported in Sports for All Survey (5.7%). The difference reached statistically significance. Such results were mainly attributed to a significant increasing percentage of girls being classified as "active" from 3.7% to 7.7%.

Study	P.A. Level		Chi-square Test *p*-value
	Some active, Sedentary (%)	Active (%)	
2009	94.3	5.7	0.006 [@]
2011	91.0	9.0	

[@] Significant difference at $p \leq 0.05$

5.7 Discussion & Recommendations

5.7.1 To allow children to have full understanding of how much P.A. is recommended for their age, corresponding frequency, duration, and intensity under the two P.A. indictors should be explained clearly to them.

5.7.2 According to the criteria suggested by the International Obesity Taskforce (IOTF), 19.5% and 7.4% of children were overweight and obese respectively. Other than insufficient P.A. participation, children may suffer from over-nutrition. Related stakeholders are advised to publicize the impact of eating junk food (generally referring to fast food and low nutritional value food) on health.

5.7.3 To alleviate the main constraint "inclement weather" to P.A. participation, it is suggested that related stakeholders establish more highly-accessible indoor activity facilities and play rooms suitable for children aged 7 to 12.

5.7.4 To awaken children's interests in do exercise and raise their P.A. levels, schools and families are recommended to arrange diversified exercise games in groups so as to provide children with interesting and delighted experiences.

5.7.5 Parents' and children's P.A. levels were found to be highly associated. Parents' positive attitude toward P.A. participation had great influence on children. It is suggested to let parents obtain more information about the benefits of developing regular exercise habit and encourage them to organize family-based P.A. functions.

5.7.6 Electronic screen-based motion-sensing games become more popular nowadays. They involve intensive body movements that simulate biomechanics of various sport activities in reality. Electronic motion-sensing games are thought to be one of the innovative and attractive means which could be supplementary to traditional mode of exercise promotion. Certainly, more evidences should be explored to evaluate their effectiveness. Do playing electronic motion-sensing games increase overall fitness level? Are cognitive and psychosocial effects brought by playing electronic motion-sensing games identical to those of actual P.A. or sports participation? Are any safety measures such warm-up and cool-down activity incorporated in electronic motion-sensing games?

6. Adolescents

6.1 Participants

6.1.1 One secondary school was selected from 18 districts respectively through stratified randomly sampling. Adolescents aged 13–19 were invited to participate in the Study.

6.1.2 There were 2,805 randomly selected samples of which 2,517 were valid (89.7%).

6.1.3 The research team compared the sample sizes of four sub-groups (boys/ girls aged 13–15; boys/ girls aged 16–19) with the "Mid-2011 Provisional Population Figures" published by the C&SD so as to allow necessary weighting calculations.

6.2 Physical Fitness Level

6.2.1 The mean values of body composition and fitness parameters were shown in the table below.

Age	13–15		16–19	
Parameters / Gender	Boys	Girls	Boys	Girls
Height (*cm*)	165.46	157.26	170.99	158.90
Weight (*kg*)	55.83	49.56	62.30	51.06
BMI (kg/m^2)	20.32	20.02	21.27	20.19
Seated height (*cm*)	86.75	83.98	90.76	85.12
Chest circumference (*cm*)	82.05	80.63	86.08	81.88
Total Skinfold (Upper Arm + Calf) (*mm*)	21.88	28.95	19.18	28.97
Percent Body Fat	18.23	24.08	14.40	22.93
Resting Systolic BP (SBP, *mmHg*)	115.46	107.20	122.48	107.28
Resting Diastolic BP (DBP, *mmHg*)	69.11	66.70	73.56	66.70
Resting HR (*bpm*)	81.24	84.91	76.15	83.07
Sit-and-reach (*cm*)	-0.43	6.84	2.48	7.81
Hand Grip (*kg*)	58.37	40.65	71.97	42.43
1-min Sit-ups (*rep*)	28.61	22.03	30.62	22.58
Push-ups (*rep*)	9.51	6.19	15.06	6.68
Standing Long Jump (*cm*)	169.44	131.31	187.75	134.93
15m PACER (*turns*)	38.05	21.77	43.50	22.23

6.2.2 According to the criteria suggested by International Obesity Task Force (IOTF), 18.5% of boys and 9.4% of girls were classified as overweight or obese (see the table below). In addition, 15.5 % of boys and 21.0% of girls were categorized as underweight.

Age	Underweight		Overweight		Obese	
	Boys (%)	Girls (%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
13–15	12.8	13.4	15.0	9.5	7.1	2.4
16–19	17.3	26.3	11.9	5.8	4.0	1.8
Sub-total	15.5	21.0	13.2	7.4	5.3	2.1
Total	18.2		10.3		3.7	

6.2.3 According to SBP ≥ 140*mmHg* or / and DBP ≥ 90*mmHg*, 7.5% of boys and 1.2% of girls were identified with the risk of hypertension [remarks 4] (see the table below).

High Blood Pressure Symptom	SBP ≥140*mmHg* **or / and** DBP ≥ 90*mmHg*		
Age	Boys (%)	Girls (%)	Total (%)
13–15	3.4	1.4	2.4
16–19	10.3	1.1	5.8
Total	7.5	1.2	4.4

6.2.4 The exercise performances of handgrip, 1-min sit-ups, push-ups, standing long jump, and 15m PACER significantly got improved as age advanced.

6.2.5 Boys had greater height, weight, seated height, chest circumference, and resting SBP and DBP than girls while girls possessed higher skinfold thickness, percent body fat, and resting HR than boys. The results mentioned reached significant difference.

Remarks 4 Such classification was conducted according to resting SBP ≥140 *mmHg* **or**/**and** DBP ≥ 90 *mmHg*. In fact, BP was correlated with students' age, height, and gender. Research team also took the age-, height-, and gender-adjusted criteria recommended by National High Blood Pressure Education Program (NHBPEP) Working Group and Bureau of Health Promotion, Department of Health (Taiwan) as well as Taiwan Society of Internal Medicine into account. Adolescents with BP ≥ 95 percentile values were regarded as having high BP symptom (see the table below).

Age		Meet at least 1 of the following conditions		High Blood Pressure Symptom		
		Resting SBP (*mmHg*)	Resting DBP (*mmHg*)	Boys (%)	Girls (%)	Total (%)
13–15		≥ 136	≥ 86	8.3	2.4	5.4
16–19	16–18	≥ 142	≥ 92	7.5	0.6	4.1
	19	≥ 140	≥ 90			
Total				7.8	1.3	4.6

6.3 Inter-correlation between Fitness Variables

6.3.1 In both genders, moderate-to-high correlations (r = 0.625–0.897) existed among adolescents' BMI, skinfold thickness, and chest circumference. There were also moderate correlations between resting SBP and BMI (boys: r = 0.478, girls: r = 0.423) and chest circumference (boys: r = 0.467, girls: r = 0.386).

6.3.2 In boys, moderate correlations were found between body compositions and exercise performances (chest and handgrip: r = 0.402, skinfold thickness and 15m PACER: r = -0.408, and skinfold thickness and standing long jump: r = -0.422). Other correlations are very small (r < 0.400).

6.3.3 On the other hand, the exercise performances of 1-min sit-ups, push-ups, 15m PACER, and standing long jump in boys were moderately inter-correlated ($0.400 \leq r < 0.700$) except for the associations between 1-min sit-ups and 15m PACER (r = 0.341) and standing long jump (r = 0.398). In girls, a moderate correlation was shown only between 15m PACER and standing long jump (r = 0.471). No other moderate-or-above inter-correlations were found.

6.3.4 Age and gender specific normative tables in quintiles and percentile ranks were generated.

6.4 Health-related Lifestyle

6.4.1 According to the "American Indicator", adolescents who accumulated at least 60 minutes moderate-or-above intensity P.A. every day in a week in which any three days involved with vigorous intensity P.A. were classified as physically active. To facilitate the further analysis, the original categories "active" and "inactive" were subdivided into "active", "some active", and "sedentary" (see the table below). Only 12.8% of boys and 4.2% of girls in the study met the recommendation based on the amount of P.A. they reported.

Category (with modification)		P.A. Level	Boys (%)	Girls (%)	Total (%)
III	Active	Accumulation of at least 60 minutes moderate-or-above intensity P.A. everyday in a week in which any three days involved with vigorous intensity P.A.	12.8	4.2	8.4
II	Some active	Accumulation of at least 10 minutes but less than 60 minutes moderate-or-above intensity P.A. everyday in a week	47.6	41.9	44.7
I	Sedentary	Accumulation of less than 10 minutes moderate-or-above intensity P.A. everyday in a week	39.6	53.9	46.9

6.4.2 On the other hand, a classification according to the "Baseline Indicator" was shown in the table below. Adolescents who participated in moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day were classified as physically active. 42.3% of adolescents were "active" whereas 28.9% of adolescents were "sedentary", 20.7 percent points higher than the prevalence in children (8.2%). 50.1% of boys were "active", 15.9 percent points higher than the prevalence in girls.

Category		Accumulation of moderate-or-above intensity physical activity in a week	Boys (%)	Girls (%)	Total (%)
III	Active	≥ 90 minutes	50.1	34.2	42.3
II	Some active	30–89 minutes	25.3	32.5	28.8
I	Sedentary	< 30 minutes	24.6	33.4	28.9

6.4.3 The three major extra-curricular activities during weekend were "friends gathering" (61.5%), "sports" (40.5%), and "visual/ audio entertainment" (35.0%). In girls, the top three activities were "friends gathering" (64.0%), "shopping" (48.1%), and "visual/ audio entertainment" (44.6%).

6.4.4 A majority of adolescents (boys: 62.6%, girls: 60.4%) felt that homework and studying was generally acceptable. Almost one-third of adolescents (boys: 30.3%, girls: 36.7%) felt very hard.

6.4.5 During school days, a majority of adolescents (boys: 81.0%, girls: 80.2%) slept at least 6 but less than 9 hours. 8.8% of boys and 14.4% of girls slept less than 6 hours whereas 10.2% of boys and 5.4% of girls slept over 9 hours.

6.4.6 Senior secondary students (boys: 7.12 *hours*, girls: 6.74 *hours*) slept less than junior secondary students (boys: 7.64 *hours*, girls: 7.32 *hours*), which may reflect academic pressure in senior secondary classes. On the other hand, girls slept less than boys during school days but slept more than boys during non-school days

6.4.7 25.7% of adolescents spent 3 hours or more on screen activities (including watching TV, using cell phone and computer, or playing video games) for an average day.

6.5 Physical Activity Habits and Altitude & Preferences towards Physical Activities

6.5.1 The three most popular sports activities were "ball games" (75.1%), "ice skating or roller skating" (24.8%), and "swimming" (24.7%).

6.5.2 The three major reasons adolescents adduced for poor physical conditions were "insufficient sleep" (75.5%), "insufficient sports training" (55.8%), and "stress" (34.2%).

6.5.3 There were 56.9% of boys and 28.3% of girls who really liked to attend P.E. lessons. Only 5.0% and 10.9% of boys and girls respectively disliked the lessons. The rest of them included "fairly liked" and "no comment".

6.5.4 68.3% of adolescents said that they would participate or actively participate in sports activities.

6.5.5 The three major reasons for participating in sports activities were "raising ability on sports" (55.3%), "health strengthening/ prevention or cure of sickness" (51.3%), and "releasing pressure and emotions" (38.7%). "Keeping fit" was the fourth popular reason (36.3%) in girls, 15.4 percent points higher than boys.

6.5.6 The three major barriers to sports activities participation were "not interested" (52.3%), "lazy" (45.2%), and "lack of spare time" (44.3%).

6.5.7 The three major reasons for participating in distance run training were "raising ability on sports" (55.8%), "health strengthening/ prevention or cure of sickness" (47.3%), and "releasing pressure and emotions" (27.0%). The distribution was similar to the reasons for participating in sports activities.

6.5.8 The three major barriers to distance run training participation were "tired" (58.8%), "not interested" (55.0%), and "lazy" (35.7%).

6.5.9 The three major reasons for participating in strength training were "raising ability on sports" (53.1%), "keeping fit" (48.3%), and "health strengthening/ preventing or cure of sickness" (47.3%).

6.5.10 The three major reasons for not participating in strength training were "not interested" (52.4%), "tired" (46.2%), and "lazy" (35.3%). The reasons were the same as not participating in distance run.

6.5.11 40.8% of boys' parents and 30.6% of girls' parents always or sometimes recommended their children to reduce sport activities for studies.

6.6 Further Analysis

Main Effects and Interaction Effect of Gender and Age-Groups on Physical Fitness

6.6.1 In 2-way ANOVA, significant main effects (age-groups and gender) and interaction effect (gender × age-groups) were found on physical fitness. For exercise measurements, boys performed better in handgrip, 1-min sit-ups, push-ups, standing long jump, and 15m PACER than girls except for the sit-and-reach test.

6.6.2 The overall fitness level significantly increased with age in both genders with boys showing a greater improvement than girls.

Relationship between Physical Fitness and Physical Activity Level ("American Indicator") in Adolescents

6.6.3 Various P.A. levels were not significantly associated with the changes in BMI, percent body fat, and chest circumference in both genders. It may reflect large variations of growth factors between individuals at puberty stage.

6.6.4 Nevertheless, there were significant relations between advancing P.A. levels and decreasing resting HR as well as enhancing other exercise performances (sit-and-reach, 1-min sit-ups, push-ups, handgrip, standing long jump, and 15m PACER). Similar findings were found for both boys and girls.

Influence of Parental Education Level on Fitness Parameters in Adolescents

6.6.5 In fathers with tertiary education attainment, their sons had smaller chest circumference and forearm strength but lower BMI and greater cardiovascular fitness in terms of better performance in 15m PACER test. Girls whose fathers attained tertiary education level possessed higher abdominal endurance and cardiovascular fitness.

6.6.6 In mothers with primary-or-below education attainment, their sons had greater flexibility, forearm strength, and muscular endurance at shoulders, upper back and pectorals. There was no significant difference found in fitness parameters among various mother's education levels in girls.

Relationship between Parents' and Adolescents' Physical Activity Levels

6.6.7 Significant differences were found between adolescents' and fathers' P.A. levels. The P.A. levels of boys and girls with active father (frequency of exercise training ≥ 3 per week) would have respectively about 38% and 96% higher in terms of MET-minute than those with sedentary father (frequency of exercise training < 1). Active mothers were found to be associated with more physical activities in girls.

6.6.8 In other words, adolescents tended to be more active if the parents were more active. However, 47.5% of fathers and 52.1% of mothers did not take part in exercise training in the past year. Moreover, as high as 77.0% of adolescents did not participate in P.A. with their families regularly (at least once per month).

Relationship between Screen Time and Physical Fitness in Adolescents

6.6.9 Adolescents were grouped according to the amount of screen time. Boys who spent 3 hours or more on screen activities had poorer flexibility and cardiovascular fitness than those having less than 3-hour screen activity. Furthermore, they also were found to have lower muscular endurance (abdomen, shoulders, upper back, and pectorals) and strength at lower limbs than those with less than 2 hours on screen activities. There was no significant difference in fitness parameters among various amount of screen time in girls.

Comparison of Physical Activity Level across Years

6.6.10 The results from the table below showed the comparison of P.A. level based on the "Baseline Indicator" between "Sports for All Study 2009" and the current study. The proportion of "active" adolescents dropped significantly from 48.6% to 42.1% in these two years. Such results were mainly attributed to a significant decreasing percentage of boys being classified as physically active from 57.5% to 50.1%.

Study	P.A. Level		Chi-square Test *p*-value
	Some active, Sedentary (%)	Active (%)	
2009	51.4	48.6	0.001 @
2011	57.9	42.1	

@ Significant difference at $p \leq 0.05$

6.6.11 The comparison analysis of P.A. levels based on the "American Indicator" was not available as the data collected from the two studies could not be matched.

Preliminary Study on the "Sport For All Day"

6.6.12 Close to half of adolescents (45.2%) adolescent heard about the "Sport for All Day" organized by the LCSD to provide Hong Kong people with a series of free recreation and sports programmes in the past two years (2010, 2011). No significant difference was observed between genders as shown in the table below.

Heard about the "Sport For All Day" Before	Boys (%)	Girls (%)	Total (%)	Chi-square Test *p*-value
Yes	44.7	45.7	45.2	0.607
No/ Not sure	55.3	54.3	54.8	

6.6.13 32.3% of the respondents who were aware of the "Sport for All Day" participated in the event. There was a significant difference between genders that more boys took part in the event, 7.2 percent points higher than girls as shown in the table below.

Participation in the "Sport For All Day"	Boys (%)	Girls (%)	Total (%)	Chi-square Test *p*-value
Yes	35.8	28.6	32.3	0.009 @
No/ Not sure	64.2	71.4	67.7	

@ significant difference at $p \leq 0.05$

6.6.14 As much as 67.4% of "Sport for All Day" participants thought that their interests in sports and P.A. could be raised through the participation. A significant difference was found between genders as shown in the table below. More boys (71.8%) had such thought than girls (61.9%).

Increase Interests in Sports and P.A.	Boys (%)	Girls (%)	Total (%)	Chi-square Test *p*-value
Yes	71.8	61.9	67.4	0.042 @
No	28.2	38.1	32.6	

@ significant difference at $p \leq 0.05$

6.7 Discussion & Recommendations

6.7.1 In the current study, a majority of the physical fitness parameters showed significant difference between age groups of 13–15 and 16–19. Gender difference was also found in both age groups. This reflected the growth spurt in physical development during puberty. Physical education curriculums (e.g. exercise intensity, equipment disposal, and safety measures) in schools are recommended to cater for the growth needs. Schools were also suggested to take reference from "Physical Education Key Learning Area Curriculum Guide (2002)" published by the HK Curriculum Development Council so as to provide adolescents with diversified learning experiences through a series of physical activities.

6.7.2 According to the criteria suggested by the International Obesity Taskforce (IOTF), 18.5% of boys and 9.4% of girls were overweight or obese. On the other extreme, 15.5% of boys and 21.0% of girls were underweight. Boys tended to encounter overweight problem while girls tended to have underweight problem. One possible reason was the promotion of "Thinness is beauty" in girls by mass media. It was suggested that related stakeholders proactively publicize the correct concepts of achieving a healthy body weight as well as how to gain/ lose weight in a proper way. Adolescents were encouraged to keep track on their own weight and percent body fat.

6.7.3 Findings revealed that more than 30% of parents (35.8%) frequently or occasionally recommended their children to reduce sport activities for studies. It is believed that adolescents may treat studies as a higher priority so as to satisfy the traditional expectations of parents and social norms. The stress from studying was not that little in adolescents. An increase in study stress may be one of the reasons for the decrease in P.A. participation. Therefore related stakeholders should work together to find solutions in order to mitigate the problems and promote healthier lifestyle other than academic pursuit alone. The benefits of engaging in P.A. should not only be promoted to students, but should also be emphasized to their parents who would be the role model to show more active lifestyle to their children. Family activities in sports and exercises were encouraged.

6.7.4 With reference to the key barrier "not interested" to sports activities participation, great variety of sports content, such as cycling, sailing, canoeing, and bowling, etc., should be introduced to adolescents. "Ball games", "ice skating or roller skating", and "swimming" may also be continuously promoted with corresponding input of resources as they were reported to be the most popular sports.

6.7.5 As can be seen from the survey results, 62.8% of adolescents chose "friends gathering" as their major extra-curricular activities during weekend. "No company" was the fifth place of the reasons for not performing sports activities. Close to 20% of adolescents (19.7%) regarded it as a key factor. It is possible that if the norms of peer group prefer sedentary activities, active adolescents are likely to conform to these peer norms and become less active, vice versa. Peer group intervention is therefore suggested to be one of the effective strategies to promote P.A. in adolescents.

7. Adults & the Elderly

7.1 Participants

7.1.1 After a try-out test for Hong Kong residents aged 20 to 69 was implemented, a Territory-wide Physical Fitness Test for the same target group was conducted in 18 districts, from April 2011 to January 2012. To begin with, Hong Kong residents were stratified randomly selected for a face-to-face interview, then respondents were invited to attend fitness assessments in a sports centre near their home by appointment. To complete all the field fitness testing, fifty-seven different sports centres provided by the LCSD and 270 testing sessions were utilized.

7.1.2 7,591 households accepted the interview which involved 15,013 household members. There were 2,354 sets of valid data (15.7%) who completed both questionnaire survey and physical fitness tests.

7.1.3 Although the sampling percentages of middle-aged adults (age: 40–59) and the elderly (age: 60–69) were close to the actual population distribution ratio, young adults (age: 20–39) contributed a relatively small portion for both genders and diverged from the sampling requirement. The research team compared the sample sizes of sub-groups with the "Mid-2011 Provisional Population Figures" published by the C&SD so as to allow necessary weighting calculations.

7.2 Physical Fitness Level

7.2.1 The mean values of body composition and fitness parameters were shown in the table below.

Age		20–39		40–59		60–69	
Parameters \ Gender		Men	Women	Men	Women	Men	Women
Body Height (*cm*)		171.32	158.25	167.91	156.10	165.46	153.81
Body Weight (*kg*)		69.74	53.70	68.91	56.92	65.24	57.78
BMI (kg/m^2)		23.72	21.44	24.41	23.35	23.81	24.43
Chest Circumference (*cm*)		91.85	83.32	92.98	87.31	91.37	89.12
Waist Circumference (*cm*)		82.97	71.18	86.36	77.33	86.83	82.18
Hip Circumference (*cm*)		95.15	91.52	94.64	94.09	93.05	95.72
Skinfold Thickness	Upper Arm (*mm*)	11.35	16.43	9.95	17.68	9.45	17.65
	Subscapular (*mm*)	16.79	16.71	18.40	20.47	17.13	20.34
	Abdomen (*mm*)	21.31	20.08	22.18	22.89	20.53	24.29
	Chest (*mm*)	11.77	------	13.58	------	13.29	------
	Suprailiac (*mm*)	------	16.03	------	18.85	------	19.54
	Thigh (*mm*)	13.28	23.20	12.01	23.82	10.95	21.38
Resting HR (*bpm*)		74.85	75.63	74.29	74.68	73.75	72.51
Resting Systolic BP (*mmHg*)		124.31	110.54	129.16	123.08	135.02	132.63
Resting Diastolic BP (*mmHg*)		78.05	70.06	81.89	75.40	80.37	75.49
3-min Step Test (Post Exercise HR)		143.85	145.91	132.93	144.07	------	------
3-min Step Test (Recovery HR)		122.13	121.77	113.96	119.54	------	------
Sit-and-reach (*cm*)		-3.01	2.81	-2.58	3.22	-4.80	1.81
Hand Grip (*kg*)		77.94	45.56	74.47	43.46	66.15	38.77
1-min Sit-up (*rep*)		25.00	17.99	------	------	------	------
Push-up (*rep*)		17.07	9.17	------	------	------	------
Vertical Jump (*cm*)		36.16	22.74	------	------	------	------
Closed Eyes Balance Stand (*s*)		39.31	32.23	15.53	14.42	9.80	8.76
Reaction Time (*s*)		0.4076	0.4623	0.4504	0.5033	0.5134	0.5543

7.2.2 According to BMI classification laid down by WHO, 14.0% of young women were regarded as underweight (see the table below). The proportions of overweight and obese individuals increased in the middle-aged. The prevalence of women experienced the obesity problem kept on rising. 40.3% of middle-aged men and 40.8% of elderly women were obese.

Age	Underweight (%)		Normal (%)		Overweight (%)		Obese (%)	
	BMI < 18.5		18.5 ≤ BMI< 23		23 ≤ BMI < 25		BMI ≥ 25	
	Men	Women	Men	Women	Men	Women	Men	Women
20–39	6.8	14.0	39.1	60.1	19.3	13.3	34.8	12.6
40–59	2.1	3.5	31.4	48.1	26.2	21.7	40.3	26.7
60–69	5.4	3.0	31.7	37.1	28.7	19.1	34.2	40.8
Sub-total	4.3	7.9	34.4	52.0	23.9	17.8	37.3	22.3
Total	6.3		44.0		20.6		29.1	

7.2.3 Men and women with waist circumference greater than 90*cm* and 80*cm* respectively were classified as having central obesity. Over a quarter of adults and the elderly (men: 28.1%, women: 25.9%) encountered related issue as shown in the table below.

	Central Obesity (%)		
Waist Circumference	> 90cm	> 80cm	Total
Age	Men	Women	
20–39	22.2	10.8	15.7
40–59	31.4	32.7	32.1
60–69	33.1	55.1	44.0
All	28.1	25.9	26.9

7.2.4 There was a significant increase in prevalence of hypertensive response from young to old adulthood as shown in the table below. 16.4% and 6.3% of young men and women suffered from the risks of hypertension. The percentage of elderly men with high blood pressure symptom was approximately 2.4 times the young men. A 5.6-time expansion even existed in women.

Age	High Blood Pressure Symptom (%)		
	Men	Women	Total
20–39	16.4	6.3	10.6
40–59	29.0	19.4	23.9
60–69	40.0	35.1	37.6
All	25.7	15.6	20.2

7.3 Inter-correlation between Fitness Variables

7.3.1 Among 14 fitness parameters, high correlations ($r \geq 0.700$) existed between BMI and skinfold thickness (except for elderly women), resting SBP and DBP (except for the elderly), and step test post-exercise HR and recovery HR (except for young women). Moderate correlations ($0.400 \leq r < 0.700$) were only found among a few parameters. Other correlations are very small ($r < 0.400$) or close to zero.

7.3.2 The overall result suggests that most fitness parameters are quite unique and independent to each other. Hence, when evaluating physical fitness, various aspects have to be included for a completed fitness evaluation.

7.3.3 Age and gender specific normative tables in quintiles and percentile ranks were generated.

7.4 Health-related Lifestyle

7.4.1 The research team took reference from the International Physical Activity Questionnaire (IPAQ) to help transform the time spent on moderate-or-above intensity P.A. into MET-minutes. According to the "American Indicator", adults and the elderly who accumulated at least 150 minutes moderate-or-above intensity P.A. in a week (or 75minutes vigorous intensity P.A. or other combinations of different intensities, e.g. accumulation of 90 minutes and 30 minutes moderate- and vigorous-intensity P.A. respectively) were classified as physically active. To facilitate the further analysis, the original categories "active" and "inactive" were subdivided into "highly active", "active", "some active", and "sedentary" (see the table below). Less than 30% of adults and the elderly were categorized as having sufficient P.A. (highly active and active levels) in each age group. For almost every two adults, one of them was found sedentary.

Category (with modification)		Accumulation of moderate-or-above intensity physical activity in a week	Age (%)			Total (%)
			20–39	40–59	60–69	
IV	Highly active	≥ 300 minutes	14.7	16.3	16.7	15.7
III	Active	150–299 minutes	13.8	12.2	12.6	12.9
II	Some active	31–149 minutes	26.4	20.5	18.6	22.7
I	Sedentary	≤ 30 minutes	45.1	51.0	52.1	48.7

7.4.2 On the other hand, a classification according to the "Baseline Indicator" was shown in the table below. Adults and the elderly who participated in moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day were classified as physically active. 37.1% of adults and the elderly were "active". 41.3% of men were "active", 7.7 percent points higher than the prevalence in women.

Category		Accumulation of moderate-or-above intensity physical activity in a week	Boys (%)	Girls (%)	Total (%)
III	Active	≥ 90 minutes	41.3	33.6	37.1
II	Some active	30–89 minutes	16.8	19.6	18.3
I	Sedentary	< 30 minutes	41.9	46.8	44.6

7.4.3 The majority of adults and the elderly (71.1%) slept 7 hours or more but less than 9 hours per day on working or school days. There were 5.5% sleeping less than 6 hours per day. People slept about 7.46 hours on average.

7.4.4 The four major activities engaged in leisure time were "audio/ video entertainment" (63.0%), "shopping" (45.2%), "browsing on the internet" (40.2%), and "sports/ physical exercise" (27.6%).

7.4.5 In adults and the elderly, the average walking time per day was 84.90 minutes. More than 60% of them (62.0%) walked less than 120 minutes. On the other hand, the average sitting time per day was 7.01 hours.

7.4.6 More than 50% of samples (52.3%) took part in sports activities for "health strengthening/ prevention or cure of sickness". As high as a quarter of young adults (27.5%) did not have any involvement in sports activities. The prevalence of other two age groups got even higher (middle-aged: 35.7%, elderly: 32.5%). The situation raised awareness. More and more people lost interests in playing sports as getting older. The percentage of unsuitability to participate for health concern also increased with age.

7.4.7 The three major barriers to sports activities participation were "lack of spare time" (62.9%), "tired"(37.9%), and "lazy" (33.5%). 71.5% of young adults expressed that they did not have spare time to take part in sports activities. This barrier contributed a relatively smaller proportion to other age groups (middle-aged: 61.2%, elderly: 40.8%).

7.4.8 The most frequently participated sports activities were "ball games" (40.4%) and "running/ jogging" (36.9%) in young adults. "Walking" become more popular and got the first place in the elderly (51.4%). As age increased, physically demanding activities or those involving body-contact lost popularity. Walking was more preferable for the elderly.

7.5 Further Analysis

Main Effects and Interaction Effect of Gender and Age-Groups on Physical Fitness

7.5.1 In 2-way ANOVA, significant main effects (age-groups and gender) and interaction effect (gender × age-groups) were found on physical fitness. For exercise measurements, men performed better in handgrip, 1-min sit-ups, push-ups, vertical jump, closed eyes balance stand, reaction time, and 3-min step test than women except for the sit-and-reach test. The overall fitness level significantly decreased with age in both genders.

7.5.2 These results suggest that women decline in fitness parameters (including resting SBP and DBP, BMI, waist circumference, hip circumference, percent body fat, handgrip, estimated VO_2 max, and step test recovery HR in 3-min step test) much quicker than men from young adult to middle aged and carry over to older adult years. More attention was suggested to promote health-related fitness of women.

Relationship between Physical Fitness and Physical Activity Level ("American Indicator") in Adults & the Elderly

7.5.3 Significant differences in many physical fitness parameters were found amongst the three P.A. levels in both genders. Men with "sufficient P.A." (active and highly active) possessed lower resting HR and waist-to-hip ratio, higher cardiovascular fitness, flexibility, forearm strength and abdominal endurance, and shorter reaction time, but larger BMI. In addition, men having "sufficient" or "some P.A." (some active) both had greater leg strength and muscular endurance at shoulders, upper back, and pectorals.

7.5.4 Sedentary group generally possessed lower physical fitness level.

7.5.5 Women had similar findings as men.

Relationship between Family Income and Physical Activity Level ("American Indicator")

7.5.6 Family income was found to be highly correlated with the P.A. level. 40.0% of men whose family income was higher than the median income were "active". Such prevalence was higher than those below the median income (28.7%). In other words, more physically active men were found in family with higher income.

7.5.7 On the contrary, family income did not indicate a significant relationship with the P.A level of women.

Relationship between Smoking Status and Physical Fitness

7.5.8 Significant differences were found in several physical fitness parameters between smokers and non-smokers in men. The sampling error may be high as the number of female smoking participants was so small. Therefore significant difference in fitness profiles could not be easily defined between female smokers and non-smokers.

7.5.9 In men, non-smokers possessed smaller waist-to-hip ratio, larger leg strength, better balance-controlling ability, and shorter reaction time.

Relationship between Occupations and Physical Activity Level ("American Indicator")

7.5.10 Types of occupations were highly correlated with employee's P.A. level.

7.5.11 The occupation with highest proportion of "active" level was professionals (47.9%) in men and managers or administrators (34.8%) in women.

Relationship between Physical Fitness and Educational Attainment

7.5.12 Significant differences were found in many physical fitness parameters among various groups of educational attainment in both genders. Women with tertiary education level had thinner skinfold, better cardio-respiratory fitness (in terms of estimated VO_2 max), and larger abdominal endurance and leg strength. Moreover, women with higher levels of education had smaller BMI, percent body fat, chest circumference, waist circumference, hip circumference, and waist-to-hip ratio, lower resting SBP and DBP, greater handgrip strength and balance-controlling ability, and shorter reaction time. More desirable fitness level may be attributed to their consciousness of health and fitness.

7.5.13 Men had similar findings but not such obviously among different education levels existed in women. Significant differences were involved in some fitness parameters mainly between secondary level and tertiary level of education. That is, men with tertiary education attainment were found to better fitness level (including lower BMI, percent body fat, and resting DBP, as well as greater muscular endurance at abdomen and strength at lower limbs) than those having secondary level of education.

Comparison of Physical Activity Level across Years

7.5.14 The results from the table below showed the comparison of P.A. level based on the "Baseline Indicator" between "Sports for All Study 2009" and the current study. The proportion of "active" adults and elderly dropped significantly from 43.5% to 37.0% in these two years. Such results were attributed to a significant decrease in the prevalence by 8.7 percent points in men and 4.2 percent points in women being classified as physically active.

Study	P.A. Level		Chi-square Test *p*-value
	Some active, Sedentary (%)	Active (%)	
2009	56.5	43.5	0.000 [@]
2011	63.0	37.0	

[@] Significant difference at $p \leq 0.05$

7.5.15 On the other hand, the P.A. level based on "American Indicator" classification was compared between "Sports for All Study 2009" and the current study (see the table below). There was no significant difference in P.A. level between them. The prevalence of being "active" stayed within 28% and 30%.

Study	P.A. Level		Chi-square Test *p*-value
	Some active, Sedentary (%)	Active (%)	
2009	70.7	29.3	0.471
2011	71.6	28.4	

Preliminary Study on the "Sport For All Day"

7.5.16 Close to half of the respondents (46.4%) heard about the arrangement of the "Sport for All Day". Significant difference was observed among different age groups that 53.7% of young adults heard about the event, 22.9 percent points higher than the elderly as shown in the table below.

Heard about the "Sport For All Day" Before	Age (%)			Total (%)	Chi-square Test *p*-value
	20–39	40–59	60–69		
Yes	53.7	44.1	30.8	46.4	0.000 @
No/ Not sure	46.3	55.9	69.2	53.6	

@ significant difference at $p \leq 0.05$

7.5.17 12.2% of the respondents who were aware of the "Sport for All Day" participated in the event. No significant difference was observed among different age groups as shown in the table below.

Participation in the "Sport For All Day"	Age (%)			Total (%)	Chi-square Test *p*-value
	20–39	40–59	60–69		
Yes	13.7	10.8	10.5	12.2	0.513
No/ Not sure	86.3	89.2	89.5	87.8	

7.5.18 As much as 60.4% of "Sport for All Day" participants thought that their interests in sports and P.A. could be raised through the participation. No significant difference was found among different age groups as shown in the table below.

Increase Interests in Sports and P.A.	Age (%)			Total (%)	Chi-square Test *p*-value
	20–39	40–59	60–69		
Yes	57.3	60.8	81.4	60.4	0.403
No	42.7	39.2	18.6	39.6	

7.6 Discussion & Recommendations

7.6.1 It is important to provide not only all-around education on the relationship between physical activity and health to schoolchildren, but also a regular delivery of related messages, including simple concepts of exercise training, health risks associated with inactivity, etc. For example, it is necessary for all ages to learn how to use BMI for overweight and obese classification, in addition to the idea of central obesity. It can be a breakthrough point to alleviate the rapid expansion of obesity. Another example is regular checking of blood pressure. In this Study, results showed that the prevalence of hypertensive response kept on increasing throughout the adulthood. A sharp rise in having hypertension was also observed in women. However, "*Population Health Survey 2003/2004*" found that less than two-thirds of people (62.9%) had their blood pressure checked by health professionals from year 1999 to 2004. In those who had the blood pressure checking, 21.2% performed it once for more than 12 months. Making people more self-conscious about the universal and comparable standards as well as helping them take the initiative to develop an active lifestyle are always the most effective strategies.

7.6.2 In the current study, 81.9% of men and 58.1% of women were currently engaged in employment, including full-time and part-time job. They spent 47.75 hours on average per week. 11.0% of them worked even 60 hours or above. 28.3% of adults and the elderly had not retired yet. The workplace nowadays is no doubt a second home for many people. It is suggested that employers provide their employees with simple physical activities in the workplace or arrange regular recreation sports activities to them and their family members. It can help raise employees' P.A. level as well as promoting their sense of belonging to the company.

7.6.3 Results showed that at least one person was classified as either of overweight or obese for every two men. Even as high as 40.8% of elderly women experienced the problem of obesity. According to "American Indicator", 71.6% of adults and the elderly did not have sufficient P.A. to sustain healthy body. Enormous economic and medical costs will be incurred if no further actions are taken. Related stakeholders can encourage sedentary people to have moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day. In other words, sedentary people are advised to take a first step to meet "Baseline Indicator". For those who have already met the basic requirement, they were suggested to gradually increase their P.A. level and ultimately achieve 150 minutes moderate-or-above intensity P.A. On the other hand, related stakeholders were also recommended to install the concepts of energy balancing in the public at various levels, including the implementation of food labelling policy, standardized recommendations for daily intake by authority such as universities and professional dieticians, and exercise training principles instructed by qualified fitness instructors.

7.6.4 As much as 66.5% and 48.4% of middle-aged men and women respectively encountered overweight or obesity. The situation raised awareness in the society. It is common that the middle-aged are busy at work and find difficulty in sparing time to take part in P.A., which involves with standardized requirements on the number of participants, time, and venue, etc. Related stakeholders may consider organizing some kind of activities, which only require simple equipment and are not restricted by time, say jogging and walking. Other possible activities suitable for middle-aged people include gateball, lawn bowls, hydro-fitness, and stretching exercise. The middle-aged can alleviate pressure from work and daily life via making full of the opportunities to engage in more physical activities. On the other hand, it is suggested that business companies design some fitness areas for exercise so as to help employees incorporate a regular exercise habit into workplace.

7.6.5 In adults and the elderly, "walking", "running/ jogging", "ball games", "swimming", and "hiking" were the top five popular sports activities. Exercise promotion programs such as walking fun days and family ball games carnivals can be organized periodically at the venues managed by related stakeholders.

7.6.6 Evidence showed that the general fitness level of women declined much faster than men across their adulthood in the current study. It is necessary to promote healthy and active lifestyle to women. Related stakeholders may consider organizing more exercise and recreational programs that are appealing to women, such as dancing, hydro-fitness, Tai Chi, fit ball, Thera-band exercise …etc.

8 Conclusion

8.1 The fact that weight problem straddles various age groups is a matter of concern.. According to "Global Strategy on Diet, Physical Activity and Health" released by WHO in 2004, regular P.A. and balanced diet had substantial influence on human health. They both helped control the calories intake and retrieve the problem of obesity.

8.2 Educators were suggested to take reference from the guidelines prepared by EDB and the Department of Health to improve the inactivity in children. A Physical Education curriculum covering a great variety of physical activities through different learning experiences was needed to provide students with more options. Moreover, it was recommended that related stakeholders offer education to parents who had the responsibility to encourage and support their children to participate in P.A. Community resources could also be further utilized so as to enrich the opportunities of non-school based physical activities for children.

8.3 Men generally fared better than women in all age groups in terms of physical fitness level. After reaching adulthood, both genders registered significant drop in fitness level and increase in exposure to various health risks (obesity, high BP, and low cardiovascular fitness) as age increased. Meanwhile, women's fitness was also found to have diminished much faster than men's. Related stakeholders were suggested to strengthen education and publicity in order to enhance people's cognition in physical fitness as well as their alertness against health risks.

8.4 Fitness level and P.A. participation were also found to have a different degree of correlation with the living habits such as sleeping time, screen time, parents' rate of participation in P.A., and education attainment. It follows that personal lifestyle, if carefully adjusted, could raise people's fitness level and P.A. level. The proposed adjustments include sufficient time for sleeping (neither too many nor too few), reduction in sedentary activities, increase in family-oriented P.A., start of keeping a balanced diet as young as possible, and regular updating of fitness-related information, etc.

8.5 Results showed that high correlations only existed between limited numbers of fitness parameters. In other words, every parameter had its unique characteristics and measurement value. It was recommended to include as more test items as possible so as to project a realistic fitness profile.

8.6 Hong Kong people were encouraged to gradually develop an active lifestyle starting from "Baseline Indicator" which emphasized the participation in moderate-or-above intensity P.A. at least three days a week with accumulation of 30 minutes or above per day. Research team also pointed out a dose-effect relationship between P.A. levels and health benefits. Everyone should therefore avoid inactivity. Having limited physical activities were stills said to be better than nothing done. Participation in any P.A. would always bring you some health benefits. The long-term goal was to achieve recommendations stated in "American Indicator". That is, for children, to accumulate at least 60 minutes moderate-or-above intensity P.A. every day in a week; for adolescents, to accumulate at least 60 minutes moderate-or-above intensity P.A. every day in a week in which any three days involved with vigorous intensity P.A.; for adults and the elderly, to accumulate at least 150 minutes moderate-or-above intensity P.A. in a week (or 75minutes vigorous intensity P.A. or other combinations of different intensities and durations). People who had not taken part in P.A. for some time, and those with chronic diseases or being at high risks for these problems should consult their doctors before embarking on an exercise training programme.

8.7 To conclude, findings indicate no significant rise but a slight drop in the overall P.A. level of Hong Kong people (except for girls aged 7 to 12) in the past two years according to "Baseline Indicator" and "American Indicator". One of the reasons may be the occurrence of major sports events. The data collection period of "Sports for All Study 2009" was mainly in year 2008 in which Beijing hosted Olympic Games and Hong Kong co-organized the equestrian competition. At the same time, Hong Kong also actively prepared for the first regional multi-sport event "2009 East Asian Games". The government devoted resources to popularize the event with the support of the mass media. The passionate atmosphere for physical activities was developed as a result. People may easily get in touch with the exercise and sports as well as yielding interests in participation, raising the P.A. level. Since the Games were all over, the atmosphere cooled down and the P.A. level may decrease eventually.

8.8 Since 1995, the Government of the People's Republic of China announced the National policy "全民健身計劃綱要" and has determined "Fitness for All" as their national health objective. Since then significant education and researches are actively implemented throughout the country. The United States has established a government funded and independent agency called the "National Coalition for Promoting Physical Activity (NCPPA)" as a result of the release of the Surgeon General Report on Physical Activity and Health (1996). Increasing the P.A. level became the top priority of their national health goal, followed by obesity reduction and smoking cessation. Professional bodies like the American College of Sports Medicine, American Heart Association, and President Challenge for Physical Fitness Council jointed the NCPPA for implementing nationwide P.A. promotion to emphasize the importance of regular P.A. To learn from these experiences, we may set citywide health objectives in Hong Kong and put increasing the P.A. level as one of our top priority. The Study is the first scientific-based survey which aimed to investigate Hong Kong people's fitness level and P.A. participation pattern using random sampling. It provided an enormous database to help define the directions and strategies. Once objectives are established, evaluation can be easily made in future to see whether our existing resources are effective to achieve the health objectives.

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