Healthy Routes To School (HRTS) For Overweight and Obesity Children

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Abstract

The trend of overweight and obesity cases in developing countries in recent years have been particularly alarming as the cases are consistently on the rise. Improving the economy rate has resulted to the increasing number of overweight and obesity cases among adults and children in a family. Overweight and obesity have commonly been known to associate with eating habits and this belief is assimilated into the people for many years. However, recent studies suggest that the factors to the issue are extended to the convenience and comfort that modern technologies have provided which affects our lifestyle due to passive mobility. Therefore, it is important that the awareness of practicing healthy lifestyle is incorporated in young children. Although there are efforts towards this campaign such as organizing physical activities in school as a part of the curriculum, it is insufficient to burn enough calories. Thus, Healthy Routes to School (HTRS) concept is introduced as a strategy to cope with this issue by encouraging childhood walking so its positive effects on health can be benefited. The use of Geographic Information System (GIS) in this research is to monitor the distance and BMI classification, and to calculate the appropriate time taken for each mobility mode. The results were classified into four categories which are walking, public transport, parent vehicle, and cycling. Children that use parent vehicle and public transport contributed to 82.35% of overweight and obesity class while 17.65% were normal and underweight. In order to promote the HRTS concept, the distance and time taken were calculated to determine the most suitable and comfortable distance for walking and cycling to school.

Keywords : Obesity, Healthy, Route to School, GIS

I. Introduction

Malaysia has been rated as the highest overweight and obesity percentage in Asian country. According to a study by the British Medical Journal, Malaysia is rated overweight at 45.3%, followed by South Korea (33.2%), Pakistan (30.7), and China (28.3%). In 2015, the rate of obesity among Malaysian recorded an increase of overweight and obesity cases that made up half of the total population (Subramaniam, 2015). This alarming issue has sent the electronic media in Malaysia to raise the awareness among the people by publishing the effects of being overweight and obese to general health. It is known that Malaysia has been experiencing rapid economic growth in the last few decades, but the same experience may also contribute to the changes of lifestyle among Malaysian. Eating habit remains to be the possible main factor for many obesity cases as people prefer to eat fast food which then lead to the blooming of food processing industries. However, there are many other factors that influence obesity such as genetics, smoking, home factors, school factors, soft drink consumption, pregnancy, longer duration of watching television, and environmental factors. Physical environments are significantly become the contribution factors to children's inactive lifestyles (Xingyou, 2006). In the case of obesity cases among children, passive mobility mode to school could be considered as another factor to obesity. Walking and cycling to school are seems to be unfavourable daily transportation as the percentage showed drastically declined since 1990s (Robert, 2009). There are two hypotheses of being obese among the children, which are those who are not using active mobility (i.e. walking or cycling), and those who prefer to use motorized-vehicle either being sent by parents or riding the school bus. Second hypothesis is made because the distance between the school and home is too far for walking or cycling. The objectives of this research are firstly, to study the relationships among the distance, mobility mode to school, Body Mass Index (BMI), and secondly, to asses walking routes and time taken from home to school that can contribute to the design of healthy routes to school.

Global Trend of Overweight and Obesity Childhood

Childhood obesity trend illustrates a gradual increase in many developing countries. In 2000, the International Obesity Task Force (IOTF) estimated that one in five children in Europe is overweight, an additional of 400,000 children each year are becoming overweight, adding to the 14 million-plus who are already overweight, including at least 3 million of obese children. The increase rate of childhood overweight and obesity in Brazil and Chile is greater than in the USA or Europe. In Chile, two extensive surveys conducted on 6 years old children shows a remarkable increase of childhood overweight and obesity between 1987 and 2000, with 12 percent to 26 percent among boys and 14 percent to 27 percent among girls. In Malaysia, obesity is also reported to increase from 1 percent in 1990 to 6 percent in 1997 among children of 13 to 17 years old (Segal, 2001). Previous research has also demonstrated the increasing obesity rate with 6.6 percent among the 7 years old, rising to 13.8 percent among the 10 years old. Obesity rate is higher among boys (12.5 per cent) compared to the girls (5 percent). On the other hand, ethnic differences show that 16.8 percent of Malays are obese as compared to approximately 11 percent of Chinese and Indians (Ismail, 1998). In another study, prevalence of

childhood obesity is reported to be higher in urban area than rural areas (Bong et. al, 1996). Research by University Kebangsaan Malaysia (UKM) in 2008 reported that the prevalence of obesity among children age 6 to 12 years old group has significant increase by 30 percent of obesity (Razalee Sidek, et. al, 2010). The Ministry of Health actively urged the schools in Malaysia to control these children from being obese by monitoring their weight through physical activities.

Trends in School Travel

The possibility of children to become overweight and obesity can be associated with the trend of mobility mode to school. A study by the National Household Travel Survey in 2008 reported that in 2001, 16 percent of students between the ages of 5 and 15 walked or rode bicycle to and from school, while 42 percent of students walked or bicycled to school in 1969. The decrease of 26 percent is apparent between those years. Recent years, the number of children walking or riding bicycle to school becomes even lesser and it is difficult to see children within 500 meters. Most of parents choose to send their children with motorized vehicle such as school bus or parent's vehicle, hence causes the traffic congestion near the school.

In Malaysia, physical activity is a part of the curriculum at school such as physical education that allocates 30 minutes for children to participate in active outdoor games. This weekly activity is insufficient for the children to achieve ideal BMI. Walking or cycling to school is beneficial as it gives children the time for physical activity while teaching them the sense of responsibility. Independently walking or cycling to school allows them to enjoy being outside and provides them the opportunity to socialize with their friends and to explore their neighborhood. Additionally, there would be less traffic congestion and the air quality would improve as a result of fewer vehicles on the road.

The Role of GIS in Monitoring Obesity

The Geographical Information System (GIS) provides a relatively fast analysis and visualization of obesity trend among primary school children and capable of producing a mobility map as well. Network analysis is commonly used for the analysis of moving resources from one location to another through a set of interconnected features. Another analysis tool is using the shortest path identified by the system as the best route for children to walk or cycle to school. It is reported that the furthest trip between the school and the home of the children by walking or cycling is within a mile or approximately 1.3 kilometers (Mc Millan, 2002). The study hypothesized that this is the maximum distance where the children will be inclined to walk or cycle and the distance also acceptable for the children to walk or cycle to their school. Although the children will go to school using the shortest path, it is more important that the children can get a proper amount of exercise or physical activity in daily basis.

II. Research Methodology

The method of analysis based on statistical and spatial analysis. Statistical analysis explains more about relationship pairs of variables. The cross tabulation explains about qualitative types of variables which is relationship of mobility mode and BMI classification and the distance to school. The second part of analysis is the proximity analysis showing buffer coverage area with several distance ranges set up at each selected school. Buffer coverage area would be shown based on 400m, 800m, 1000m and 1300m distance range from each school. Third part of analysis is the network analysis consisted of shortest path and new service area. The shortest path is used to identify the shortest route from one location to target location; school selected. Hence, new service area is showing the polygon of coverage area from the input features; school selected based on different distance range set up. After that, the shortest path is used to solve the shortest path in this coverage of buffer and service area of schools selected. The result from all these analyses will be used in determining the truth of mobility mode to school in affecting primary school students' health. Thus, mobility map with providing some safety features is proposed at every school selected in encouraging primary school children to walk and bicycle to school.

Study Area

The study is conducted in Shah Alam which is in the district of Petaling, Selangor, Malaysia. Four primary schools were selected which are SK S9, SK S13, SK S16 and SK S18. Fig.1 shows the map of Shah Alam which is located at 3˚05'36.07" latitude and 101˚31'46.55" longitude. This study area has a total of 46 primary schools.

Fig. 1. Map of Shah Alam
Source:Google Map, 2010

III. Research Findings

Respondent's Background

i. Gender

Table 1 shows the number of respondents participated in the questionnaire process. The frequencies of respondent based on gender are balanced between boys

and girls. The total of respondents from four different schools is ranged from 45 to 72 children.

Table 1. Total Respondent based on Gender

Location	Gender of Respondent					
	Female			Male		
	Count	Row %	Column %	Count	Row %	Column %
SK S9	29	52.7	23.2	26	47.3	20.5
SK S18	31	50.8	24.8	30	49.2	23.6
SK S13	25	39.1	20.0	39	60.9	30.7
SK S16	40	55.6	32.0	32	44.4	25.2
Total	125	49.6	100	127	50.4	100

ii. Total Respondent based on Mobility to School

The total number of respondents based on mobility mode to school is shown in Fig. 2. The highest preferred mobility mode from each school are parent's vehicle with 151 respondents which brings 59.9 percent from the total number of 252 respondents. The second preferred mobility mode is walking with 51 respondents, followed by public transport and cycling with a total of 40 and 10 respondents respectively.

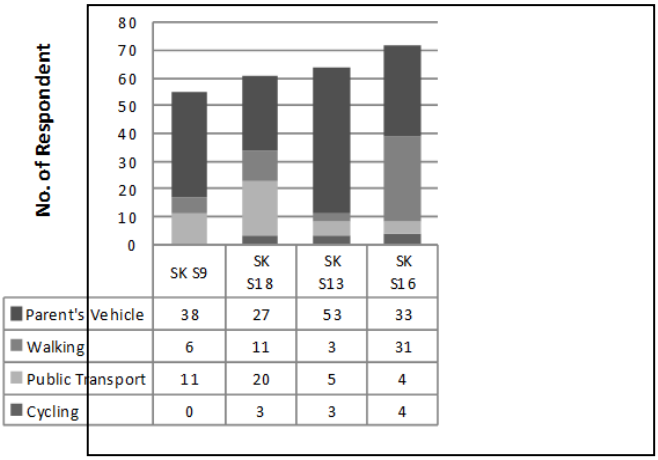
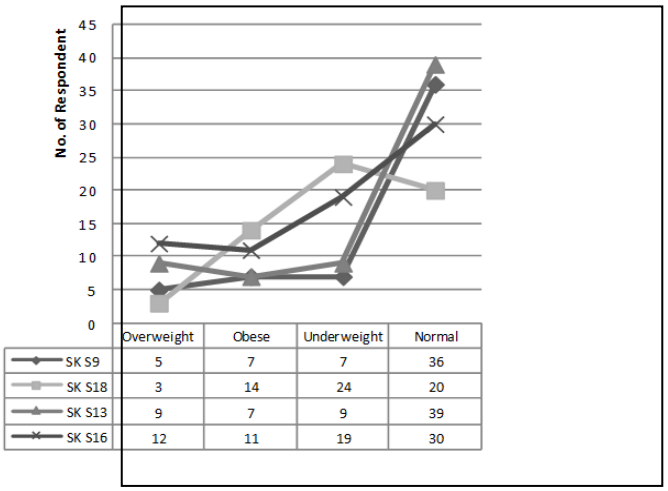


Fig. 2. Total Respondent based on Mobility Mode

iii. Respondent and BMI Classes

Fig. 3 shows the BMI Classes of respondents in each school. From the analysis, most of the respondents are in the normal BMI class with the total of 125 respondents. 59 respondents were classified as underweight, while 68 respondents were classified as overweight and obese. The high number of respondents in the high BMI class indicates that one third of the respondents are inclined to health problem.



	Overweight	Obese	Underweight	Normal
SK S9	5	7	7	36
SK S18	3	14	24	20
SK S13	9	7	9	39
SK S16	12	11	19	30

Fig.3. Respondent's BMI Classes

Spatial Analyses

i. Proximity Analysis

The distances selected for the proximity analysis are 400 meters, 800 meters, 1000 meters, and 1300 meters. The distance range is determined according to the specifications of the Public Works Department, Malaysia. The buffering distance is extended to 1300 meters as this is explained by Mc Millan (2002) as an essential distance for children to walk or cycle. The intention of this analysis is to see the school coverage area and the location of the children's home based on the distance in the buffering range. This is an earlier stage to understand the overall route from school to the home location and later it will be used to propose a proper walking and cycling route. Fig.4 shows buffer mapping based on different ranges for each selected school.

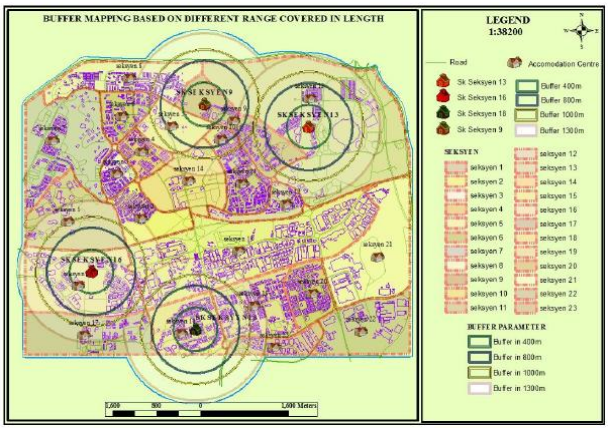


Fig.4. Buffering based on Distance Range for Each School.

ii. Distance and Time Taken to School
(Buffer and Service Area Tool as Parameters)

Distance and time taken per trip are the key criteria in the effort to encourage the primary school children to walk and cycle to school. After buffer and new service area are executed, the proposed safe route to school map with safety features and suitable distance and time taken is planned as well. To achieve this aim, shortest path analysis was used as a guide to show the route with the shortest path from home to school with total length and duration of time need to be shown and fit together. Shortest path analysis is tested on both coverages of buffer and school service area as well. Both buffering and school service area are tested to investigate the difference between the total length and duration of time needed for primary school children to walk or cycle to school for each selected school.

Fig. 5 shows the route with the shortest path generated in the buffer coverage of 500 meters and school service area which utilized proximity and network analysis

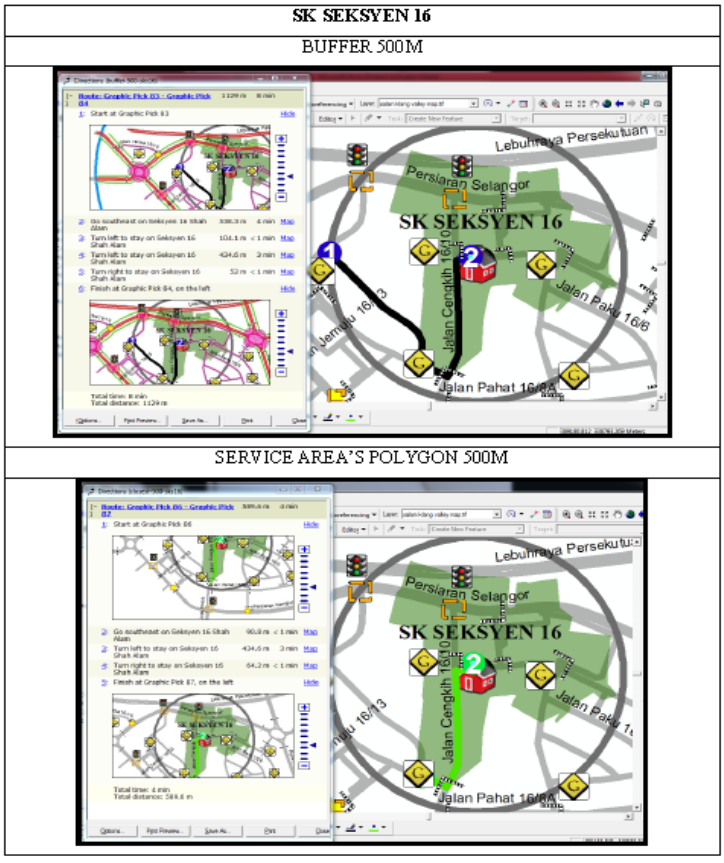


Fig. 5. Shortest Path in the Coverage 500m of Buffer and School Service Area

respectively. Sample of analysis is from SK S16. The map shows the route with the shortest path on the coverage of buffer and school service area. The figure is attached with summary window showing the direction of shortest path from one selected location to SK S16. At the summary window, every road access provides

approximate distance and time spent. One selected location is chosen at the approximate end of the coverage of both buffer and school service area. From the figure, point 1 is the selected location for both tools while point 2 is a school which is the location that provides the service area. The route with the shortest path in coverage area is shown in dark color, while light line color shows the coverage in school service area. The summary window provides the approximate total distance and duration of time needed along the routes generated. For the coverage under buffer, the total distance and duration of time needed is 570.2 and 3 minutes respectively. Meanwhile, for coverage under school service area, the total distance and duration of time needed is 412.7m and 2 minutes respectively.

The Relationship of Mobility Mode and Obesity

Table 2 shows the relationship between mobility modes and BMI class. Students who walk to school with underweight and normal BMI make up the 22.3% or 41 respondents, while 14.7% or 10 respondents are overweight and obese. Students who use public transport make up 15.2% or 28 respondents with normal and underweight BMI, while 17.6% or 12 respondents are overweight and obese. Next, students who are sent to school by their parents have the highest percentage of the total respondents, with 58.2% or 107 respondents which are normal and underweight, while 64.7% or 44 respondents are overweight and obese. Lastly, students who ride bicycle to school covers another 4.3% or 8 respondents with normal and underweight BMI, while 2.9% or 2 respondents are overweight and obese.

The table also shows that the largest contributor to overweight and obese amount among primary school children comes from students that chose parent vehicle as a mobility mode to school. The proportion of overweight and obese children with the mobility mode counts at 44 respondents or 64.7% which takes more than half of the total population. Additionally, the second largest contributor to overweight and obese is primary school children who chose public transport as a mobility mode to school with 12 respondents or 17.6%. The second lowest contributor to overweight and obese amount is walking which is 10 respondents or 14.7%. Lastly, the lowest contributor to the amount of overweight and obese is from students that choose cycling as a mobility mode to school. The amount of respondents is only 2 which contributes to 2.9% out of the total population. Through this pattern and trend, it is clear that the mobility mode to school affects the health of the primary school students.

Table 2. Relationship between Mobility Mode and BMI

		Your BMI class		Total
		Normal and Underweight	Overweight and Obese	
Walking	Count % within BMI class	41 22.3%	10 14.7%	51 20.2%
Public Transport	Count % within BMI class	28 15.2%	12 17.6%	40 159%
Parent Vehicle	Count % within BMI class	107 58.2%	44 64.7%	151 59.9%
Cycling	Count % within BMI class	8 4.3%	2 2.9%	10 40%
Total	Count % within BMI class	184 100%	68 100%	252 100%

Mobility and Distance as a New Factor to Obesity

SK S16 has a number of students in normal, overweight, and obese classes, who walks to school in every range of distances defined in this study. Through the analysis, the pattern and role of distance is shown as predicted contribution towards obesity among primary school children. Figure 6 shows the relationship between walking and obesity. There is a positive relationship where the rate of obesity is reduced when the walking distance is increased.

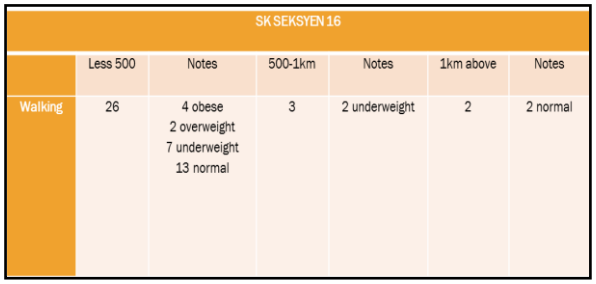


Fig. 6. The Relationship of Walking and Obesity

The walking parameter needs to relate to the distance between the school and home of the students. For example, there are obese and overweight students walking in range of 500m compared to students walking in the range of 1km distance and above, 2 students are normal out of 2. The length of distance is one of the new contributions of obesity among primary school children.

Approaches for Active Mobility Concern

The length of distance and mobility mode is a contributor to obesity among primary school students. The study has identified that there is a large percentage of student that choose parent vehicle and public transport as a mobility mode to school compared to walking and cycling. To address this concerning issues, mobility maps with safety features are needed to improve the lifestyle of the students and encourage physical activity to be a part of their life. This study suggests that instead of opting for passive mobility such as using public transport and parent's vehicle, physical activities such as walking and cycling to school could be considered as an alternative to reduce the number of obesity cases among the primary school students.

Walking Route for Healthy Childhood

Distance between school and the home of the student should be taken into consideration when choosing the mobility mode. Since Shah Alam is a growing urban area, lacking safety measures and features influences the parent's decision on their children's mobility mode. However, constant passive mobility and lack of physical activities contribute to overweight and obesity cases among the children. Even though this issue is not emphasized, the epidemiology remained. Awareness towards having good health conditions is needed at early age by introducing physical activities. The best way to promote health for primary school students is by promoting walking and cycling to school. To support this alternative, the safety of the students must be given priority and it can be done with the intervention of authorities and local community. Safety facilities such as walking and cycling, pedestrian crossing, and road median are early approaches for this concern. This could become a good strategy in planning the healthy routes to school for children and as a respond to the epidemiology of obesity and overweight issue by promoting active mobility mode to school.

IV. Conclusions

Daily physical activity such as walking or cycling to school contributes to a healthy lifestyle that decrease the risk of obesity, diabetes, and cancers. It also reduces harmful emissions in areas where children spend much of their outdoor time, which reduces the risk of respiratory illnesses. Nevertheless, without proper organization and strategy for active transportation plans, policies and programs that support walking or cycling will fail to encourage active and healthy mobility. The amount of parents driving their children to school is only increasing, thus leading to the increase of unhealthy lifestyle due to passive mobility. Government also has an important role to reduce the amount of students that are obese in their early childhood. The location of school to be built must be suitable to ensure that the distance of the school to the surrounding neighborhood is at a walking distance. In addition to that, the safety of pedestrians and cyclist should be focused on to encourage the active mobility among the students. The walk-to-school policy can be considered as a valuable opportunity to increase physical activity of the children, and feasibly have an impact on the prevention of childhood obesity.

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References

I. Bong, ASL. & Safurah, J. (1996). *Obesity among year 1 and 6 Primary School Children in Selangor Darul Ehsan.* Malaysian Journal of Nutrition 2; 21-27.

II. Ismail MN & Tan CL (1998). Prevalence of obesity in Malaysia. Country Report at the Regional Advisory Meeting on Obesity. August 1998. Manila, Philippines.

III. Ismail MN & Vicknewary EN (1999). Prevalence of obesity in Malaysia: Data from three ethnic groups. Country report at the Asian BMI/Obesity Workshop. June 1999. Milan, Italy.

IV. Razalee Sedek, Poh Bee Koon and Ismail Mohd Noor (2010). Body Mass Index and Body Composition among Royal Malaysian Navy (RMN) Personnel, Journal of Defence and Security, Vol.1, No 1: 2010.

V. Robert Wood (2009), Active Transportation: Making the Link from Transportation to Physical Activity and Obesity. Active Living Research, San Diego State University.

VI. Subramaniam (2015), the National Health and Morbidity Survey, Ministry of Health Malaysia, retrieved from http://www.themalaymailonline.com/malaysia

VII. Tracy E. McMillan, "The Influence of Urban Form on a Child's Trip to School," paper presented at the Association of Collegiate Schools of Planning Annual Conference, Baltimore, 2002.

VIII. Wang Y and Lobstein T (2006).Worldwide trends in childhood overweight and obesity. Int. J Pediatric Obese, 1(1), 11-25. WHO. Obesity: preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report Series 894. Geneva: World Health Organization, 2000. 268

IX. WHO/IASO/IOTF. The Asia-Pacific perspective: redefining obesity and its treatment. Health Communications Australia: Melbourne, 2000.

X. Xingyou Zhang (2006), Identification of Contrastive and Comparable School Neighborhoods for Childhood Obesity and Physical Activity Research, International Journal of Health Geographics 5:1 doi:10.1186/1476-072X-5-14, pg 1-9.