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Research Report

Effect of Adult Supervision on School Children Crossing Behaviours



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Abstract

School children who cross a road in front of their school are exposed to the danger of traffic accident. Their characteristics of smaller body size and immature thinking contribute to the risk of an accident while crossing the road. The current research was carried out to investigate the effect of adult supervision on children crossing behaviour. Adult in the study refers to parents and school traffic warden of selected primary schools. This quantitative survey-design study was conducted at eight (8) selected primary schools located in Selangor, specifically at four (4) schools with and four (4) schools without crossing facility. Data were collected by site observations using manual and video recorded the children crossing behaviour. Results show that the percentage of adult supervision at school with and without crossing facility are 90% and 89%. Crossing gap and crossing speed were observed at four (4) conditions: i) crossing with parent and warden, ii) crossing alone with warden, iii) crossing with parent without warden and iv) crossing alone without warden. The crossing gap of children at school with crossing facility was higher than the crossing gap of children at school without crossing facility, whereas, the lowest crossing gap emerged when children crossed the road alone without being assisted by school traffic warden. The crossing speed for children at school with crossing facility showing higher mean speed for all four (4) conditions observed. Findings of this study indicated that the supervision of school traffic warden for school children crossing is crucial to enhance the safety of young pedestrians.

1. Introduction

Travelling to school is part of the daily routine of children in Malaysia. A different mode of travel used by the school children aged from 7 to 17 years old, which including travelling by school bus or van, car, motorcycle, bicycle or by walking. Despite different types of transport mode to school, all these students are exposed to the risk of the road accident. Their risk would be higher as they cross a high-speed road in front of their school.

Children, with smaller body size and immature thinking were the most at risk to cross a road. A study by Zeedyk, Wallace, and Spry (2002) indicated that crossing performance of children are very poor, as they did not stop and look before crossing a road. A high percentage of the child running to cross and not looking before crossing especially when they cross on their own (Zhang et al., 2013). Running into the street would cause a dart-dash accident, which becomes a common type of accident involving child pedestrian (Preusser, Wells, Williams, & Weinstein, 2002). In addition, children under 13 years old have low response rate and reaction time to traffic hazard (Meyer, Sagberg, & Torquato, 2014).

In regards to the children exposure while walking to school, Rothman, Macarthur, To, Buliung, and Howard (2014) found that increase distance in walking to school is not significantly affect their risk of an accident. There is an effort to promote walking to school as it can reduce childhood obesity (Yu & Zhu, 2016). Thus, several strategies have been proposed to improve the safety of travelling school children. Wearing light colour clothing and wearing school bag are among strategies to increase children visibility while walking on a road (World Health Organization, 2013).

At many schools, crossing facility was provided to promote the safety of school children crossing a road in front of their school. However, inappropriate placement of the crossing facility, for example, if it is located far away, a majority of pedestrian tend to

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jaywalk (Zheng, Chase, Elefteriadou, Schroeder, & Sisiopiku, 2015). In addition to that, speed control measure such as speed hump was placed across the road in front of the school. This speed control is effective to be applied on road with slow traffic. For some schools located in an arterial road, placing speed hump is not the best option and may create a hazard to other road users. Thus, the school located on a busy road with high speed is having a higher risk compared to the school located near to residential area connected with low volume and speed road.

As an alternative option, improvement of behaviour or provide assistant to cross by an adult may be proposed through road safety education. In Malaysia, this programme has been implemented for primary school children. In reality, how effective the road safety module in school is still indefinite. In other countries, supervision of the adult to a group of the student walking to school, known as a 'walking school bus' may also help to increase their visibility to traffic. Supervision of adult is crucial as an adult traffic judgement is better than children. An adult can be their parents or traffic warden that present in front of a school. Without adult supervision, a different measure should be proposed to schoolchildren as their behaviour is different from the adult pedestrian.

To see how crossing assistant by the adult can reduce the risk of children crossing, this study is aimed to examine the effect of adult supervision on children crossing behaviour. Results from this study will provide insight into the importance of adult supervision for school.

1.1 Objectives

This study is aimed to examine the effect of adult supervision on children crossing behaviours, which can be achieved by the following objectives:

- i. To examine the adult supervision in road crossing near school area
- ii. To measure the difference in crossing speed of child crossing with and without adult supervision
- iii. To analyse the crossing gap of child crossing with and without adult supervision

1.2 Scope and Limitation of the Study

Observations at schools are focused on the crossing behaviours of school children at eight (8) identified primary schools in the state of Selangor. Schools sample for this study will cover schools located in an urban and rural area (identified at center stage). Crossing behaviour will be observed manually and using video camera during the noon peak hour, limited to the area of 100 m coverage from crossing facility or school entrance gate.

2. Literature Review

Despite the fact that the young school children are most at risk when crossing a road alone, there are very limited studies have been carried out to explore the effect of adult supervision on school children crossing. One of the most alike can be referred to Zhang et al. (2013) who compared the crossing behaviours of children crossing alone and pair with adult. Analysis of crossing speed showed that children who cross alone more likely to run compared to children – adult pair. In another study, behavioural observation of adult-child pairs by Zeedyk and Kelly (2003) highlighted that adult-child crossing provided good crossing examples to children. Safe crossing behaviours such as crossing within crosswalk, stop at the kerb, wait for Greenman, and holding hand are easily observed. However, adult rarely teaches their children about safe crossing by instructing them to press the push button and look at both directions before execute crossing.

In addition to the school children behaviour, Fu and Zou (2016) investigated the effect of countdown signal at two (2) primary schools. The result indicates that the intersection with countdown signal would increase the proportion of red light violation and behaviour. The comparison made in a case of violation among children crossing alone and with companions. A significant difference was found between difference companion groups. Nonetheless, the presence of countdown signal encourages children to complete their crossing in time.

Looking at the travelling mode to school, McDonald et al. (2015) assessed the injury and fatality rates for different modes to schools in North California. Crash data from the year 2005 – 2012 and exposure estimate (distance travel) from travel survey were collected for six (6) travel modes: school bus, passenger vehicle with an adult driver, passenger vehicle with teen driver, bicycle, walk and others. The result indicates that schoolchildren travelling with teen driver had the highest risk of fatality and injury (per 100 million trips) compared to other modes. When focussing on the risk per 100 million kilometres basis, children riding a bicycle had the highest risk of fatality and injury.

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Rothman, Macarthur, To, Buliung, and Howard (2014) investigated the influence of built environment on walking to school and child pedestrian accidents in Toronto, Canada. Unlike other studies, result from this study indicated that walking proportion is not associated with child pedestrian collision rate. It also unexpected when the collision rate is significantly increased with the presence of school crossing guard and traffic calming.

Giving similar focus on the impact of built environment around schools on child pedestrian accidents, Hwang, Joh, and Woo (2017) investigated 124 public schools in Texas. Unit of analysis was used to identify variables for built environment within the 100-foot buffers of child pedestrian crashes near the school. The impact of each variable on child pedestrian crashes was examined using the logistic regression model. The result indicated that child population, block with a longer length, street segment with missing sidewalk and commercial uses had a higher child crashes occurrences.

Exposure of young children to accident risk studied by Routledge and Howarth (1996) indicate that accident risk per road crossing is much higher for children aged 5 compared to children aged 10. Figure 1 shows the comparison between gender in Routledge and Howarth (1996) also indicated that boys are taking higher risk in road crossing than girls.

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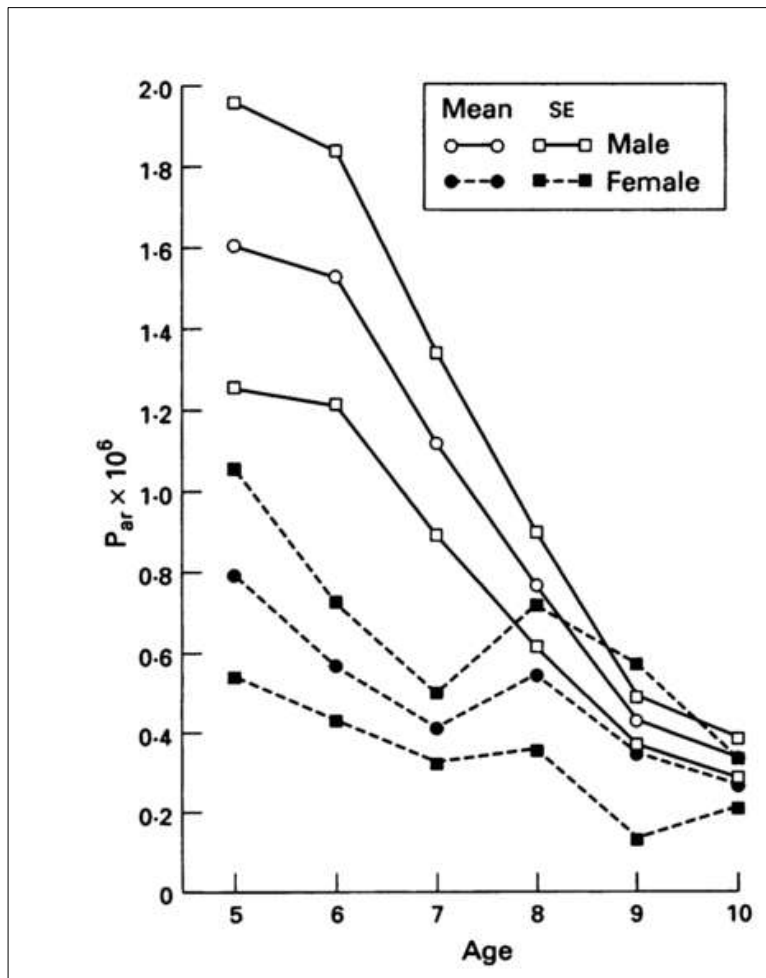


Figure 1 Risk per crossing on all roads
(Source: Routledge & Howarth, 1996)

In response to the growing concern with the safety of school children, Abdel-Aty, Chundi, and Lee (2007) examine the distribution of crashes using Geo-spatial analysis and factors to the crash frequencies using log-linear analysis. About 262 crashes identified, and 71% of the crashes occurred within a half-mile radius from 87 schools. Crashes involving school children is more frequently involved the middle and high school children as compared to elementary school children. Analysis from log-linear indicates

that crashes involving school children are more likely to occur on road with more than two (2) lanes, greater speed ratio, and speed limit higher than 40 mph.

A recent study conducted by Tapiro, Oron-Gilad, and Parmet (2018) focuses on the effect of audio and visual distractions toward child crossing behaviour. Using the dome simulator, four (4) measures of crossing behaviour were observed: safety gap, crossing initiation time, response time and visual attention. A significant linear relationship emerges between age group and safety gap where children aged 7 – 8 years old have the shortest safety gap (0.7 sec) compared to children aged 9 – 10 years old (2.7 sec) and 11 – 13 years old (4.9 sec). Age group also significantly affects the crossing initiation time and response time.

Tapiro, Oron-gilad, and Parmet (2016) in another study, investigated the effect of cell phone conversations on children's crossing behaviour. Based on a simulation setting, cell phone distraction on children's crossing behaviour were observed and compared with experienced adults aged 22 – 29 years old. Crossing performance based on the safety gap was observed according to the following categories:

- i. 'Hit' for safety gap of less than 0 sec
- ii. 'Close call' for safety gap of less than 1 sec
- iii. 'Risky call' for safety gap between 1 – 2 sec
- iv. 'Safe cross' for safety gap larger than 2 sec

Analysis using the linear generalised mixed model (GLMM) showed that the children age and phone distraction significantly affect their crossing performance. Children aged 7 – 8 years old (youngest group) and participants who are busy with cell phone experienced more 'hit' event.

3. Methodology

This section describes the procedures derived to examine the effect of adult supervision on children crossing behaviours. The flow chart describing the research methodology this study is illustrated in Figure 2. It consists of several processes, starting with the selection of sites, pilot and site observation, data analysis and lastly, is to present the results.

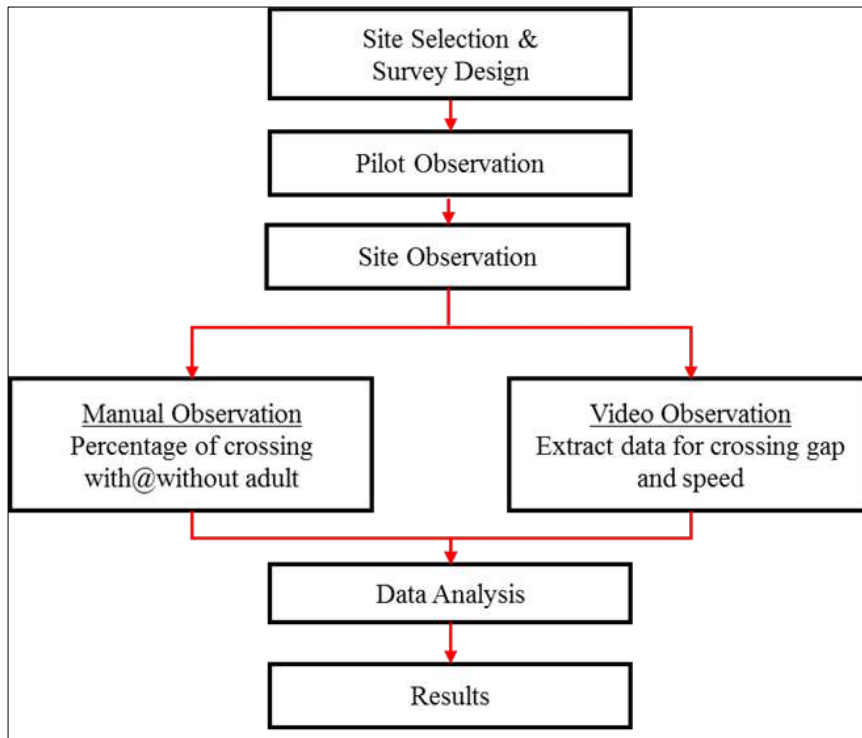


Figure 2 Methodology flow chart

3.1 Site Selection

About eight (8) schools located in Selangor will be selected for this study. School sample distribution considering four (4) schools with and four (4) without crossing facility.

At the survey design stage, method and instrument used for the observation will be identified. On-site data collection will be recorded in the observation form as a survey instrument in this study.

3.2 Pilot Observation

Pilot observation will be conducted at two (2) identified schools to test the practicality of the method chosen. Through pilot observation, the practicality of the data collection process including site observation form, manpower needed and equipment used for data collection can be evaluated. Any weakness found during pilot observation shall be improved before the real observation took place.

Observation form for manual data collection was tested during pilot observation. Improvement made to the data collection method after pilot observation includes:

- i. Arrangement of the table to be filled in the form
- ii. The number of observers needed
- iii. Using symbol instead of words to represent elements observed

3.3 Site Observation

In this study, site observations were conducted at the study locations to collect data related to the pedestrian crossing behaviour. The manual and video observation were taking place simultaneously for at least one (1) hour.

For the manual observation, observers will be utilising observation to record the crossing behaviour of children within 100 m from crossing facility or school gate entrance. An

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interval of 25 m coverage will be used for manual observation. Crossing volume of children (either crossing alone or with adult) that arrived by different mode will be counted. At the same time, the video observation will be conducted by utilising the video camera.

3.3.1 School with Crossing Facility

These four (4) samples of schools with crossing facility were selected in this study. These schools were coded as school A, B, C and D. The view of these school vicinity as shown in Figure 3, 4, 5 and 6.



Figure 3 View of school A

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Figure 4 View of school B



Figure 5 View of school C

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Figure 6 View of school D

3.3.2 Schools without Crossing Facility

Another four (4) samples of schools were selected to represent school without crossing facility, which coded as school E, F, G and H shown in Figure 7, 8, 9 and 10 respectively.



Figure 7 View of school E

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Figure 8 View of school F



Figure 9 View of school G



Figure 10 View of school H

3.4 Data Analysis

Data extracted from manual and video observation were analysed using simple statistical method. Data analysed was presented according to the three sub sections; the percentage of adult supervision, children crossing speed and gap. Results of pedestrian and vehicle behaviours will be compared for all study locations.

Video data will be extracted to identify the crossing gap and speed of school children. Crossing gap and speed of children crossing alone will be compared to the children crossing with adult.

3.4.1 Adult Supervision

An involvement of adult supervision in school children crossing activities in front of schools was measured in this study. Children crossing a road with the assistant of adult supervision were counted for the following situations;

- i. Crossing with parent, with warden

- ii. Crossing alone, with warden
- iii. Crossing with parent, without warden
- iv. Crossing alone, without warden

The percentage of children crossing alone without warden will be calculated, to be compared with the three (3) other crossing situations.

3.4.2 Crossing Gap

Crossing gap is referred to the time elapse after pedestrians crossed the first lane and before the next vehicle arrives at the crossing point (marked as a red point in Figure 11) in that lane. If pedestrian proceeds to execute road crossing task within the time elapsed, he/she accepted the crossing gap available. But, if pedestrian stop and wait until the coming vehicle to pass the crossing point first, he/she actually rejects the crossing gap. In this study, only the accepted crossing gap by school children while in front of their school are considered for analysis. The mean crossing gap of school children at different schools was compared.

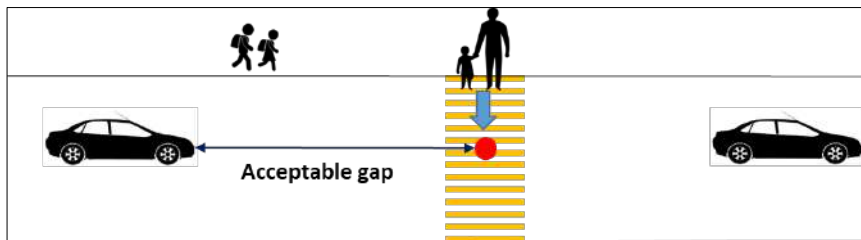


Figure 11 Description of children crossing gap

3.4.3 Crossing Speed

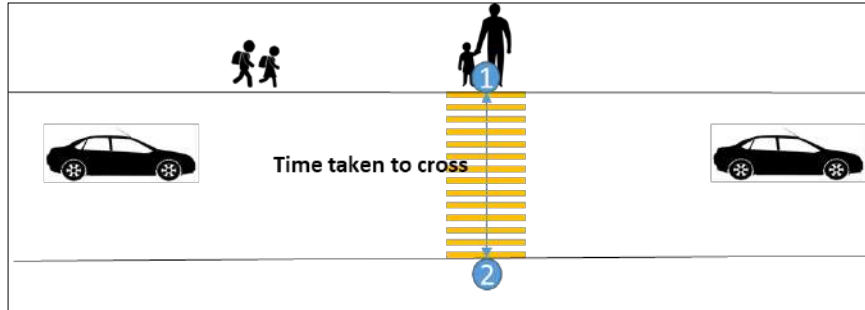


Figure 12 Description of crossing speed

Crossing time is referred to time taken for a child pedestrian to cross from point 1 to point 2 as shown in Figure 12. Then, the crossing speed of schoolchildren either with or without supervision was calculated based on the following equation, where the crossing length is based on the width of the road:

$$\text{Speed (m/s)} = \text{crossing length (m)} / \text{crossing time (s)}$$

4. Results and Discussion

Results of this study were presented in three (3) parts: percentage of adult supervision, comparison of children crossing speed and gap with adult supervision.

4.1 Percentage of Adult Supervision

The number of school children crossing based on the four (4) situations is analysed according to the following: i) school with crossing facility and ii) school without crossing facility. In total, about 936 crossing children were observed, including 432 observed from the four (4) selected schools with crossing facility and 504 from the four (4) schools without crossing facility.

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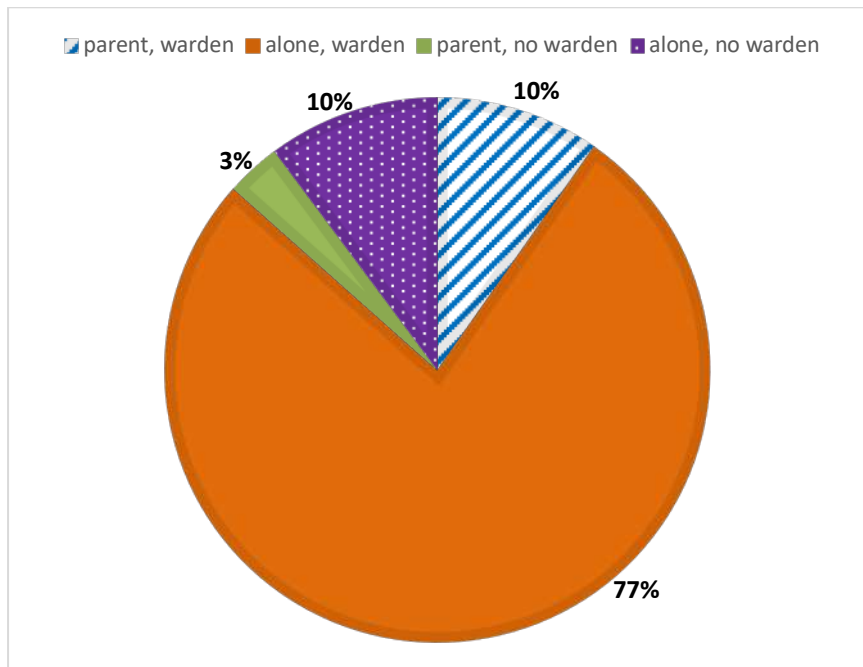


Figure 13 Percentage of adult supervision at school with crossing facility

Refer Figure 13, crossing observation at the four (4) selected schools equipped with crossing facility indicated the high percentage of adult supervision for children road crossing activities. Crossing supervision from warden contribute large portion, accounted for 77% of children alone and 10% of children crossing with parent. It is only 10% of children were crossing alone without any supervision either from warden nor their parent. Supervision from adult on school children crossing is necessary since crossing a busy road with chaotic traffic pattern is risky (Schwebel et al., 2018).

Overall, the percentage of adult supervision on school children crossing at school without crossing facility is considered high (refer Figure 14). About 84% of children crossing alone was supervised by warden and another 5% supervised by parent while the warden is in duty. There is only 11% of school children crossing alone without any supervision.

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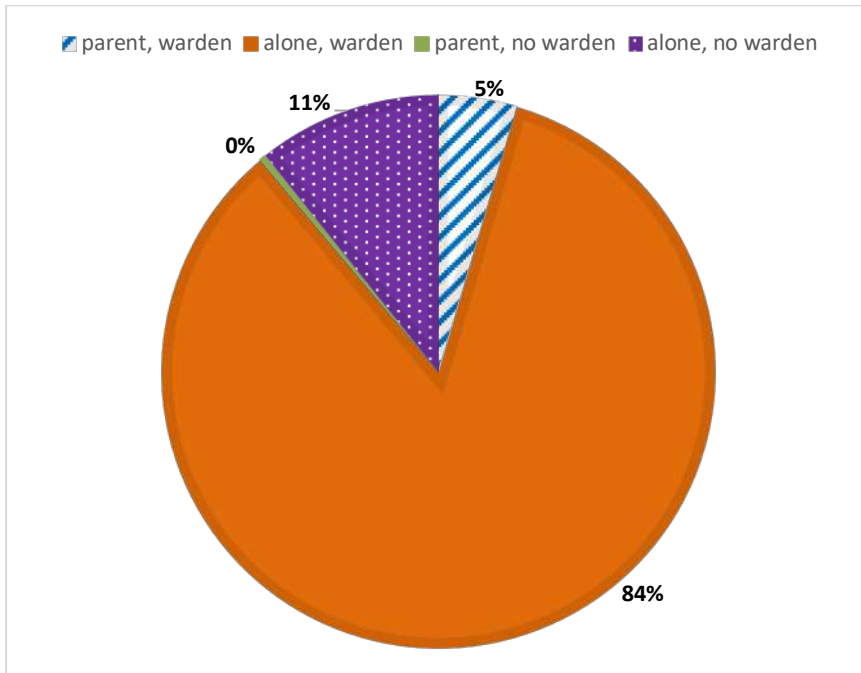


Figure 14 Percentage of adult supervision at school without crossing facility

4.2 Comparison of Children Crossing Gap with & without Supervision

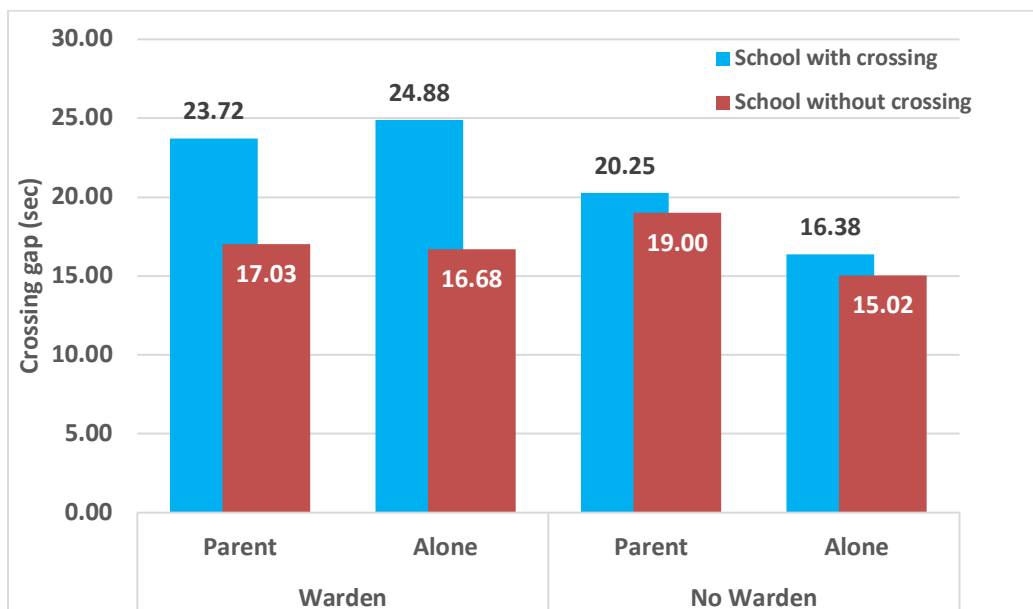


Figure 15 Average crossing gap (second) for children at school with and without crossing facility

Children crossing gap observed at the four (4) schools equipped with crossing facility and another four (4) schools without crossing facility were analysed from video data. Result of the children crossing gap for the eight (8) schools is summarised in Figure 15. The result showed that crossing gap of children at school with crossing facility is higher than the crossing gap of children at school without crossing facility. The comparison of the average crossing gap of school children for the four (4) of crossing conditions indicates that the lowest crossing gap emerged when children crossed the road alone without being assisted by traffic warden (16.38 sec for school with crossing facility and 15.02 for school without crossing facility).

4.3 Comparison of Children Crossing Speed with & without Supervision

Video observation data were analysed to examine the difference between child crossing speed with or without adult supervision. The mean speed of children crossing at school with and without crossing was compared as in Figure 8.

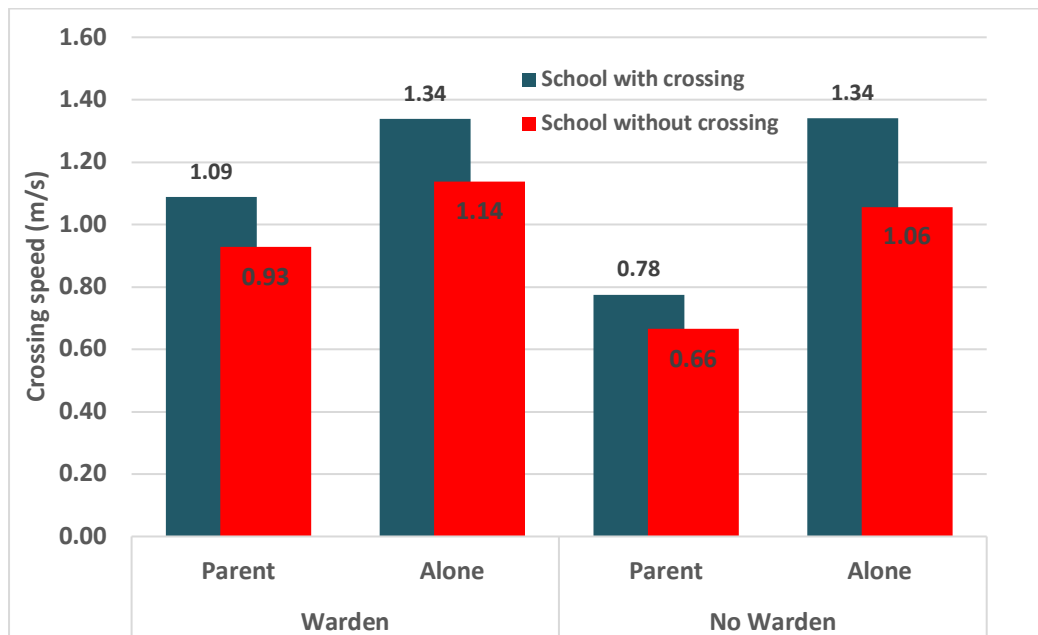


Figure 16 Average crossing speed for children at school with and without crossing facility

The result is shown in Figure 16 provided trend of the school children crossing speed between school with and without crossing. The crossing speed for children at school with facility showing higher mean speed for all four conditions observed.

Referring to the school with facility, the highest mean of children crossing speed observed when they crossed a road in front of their school alone, either with or without the assistance by warden. Lower mean of crossing speed observed when school children accompanied by their parent during crossing. The crossing supervision from parent

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seems to lower the crossing speed of school children while crossing a road. Walking along with their parent, children tend to cross the road with slower walking pace. It may create a condition where the school children feel safe to cross when they are with their parent. This finding is in line with Zhang et al. (2013) who highlighted that school children crossing speed and running across the road are lower with parental supervision.

Refer to the result presented in Figure 8, the school children crossing speed are slightly higher when traffic warden is presence. At the time when traffic warden is on duty, he or she normally standing on the middle of the road to stop traffic and instructing by waving hand to children. In responding to traffic warden on duty, the majority of the children will run to cross the road that is likely to be due to the unsafe feeling to be on the road for a longer period. Comparing the children crossing speed with supervision of parent and warden, it showed that one-to-one pairing in supervising children to cross the road seems to be more effective to improve their crossing behaviour. However, in certain case parent stop in the middle of the road while waiting enough gap to cross, especially in an absence of the warden on duty.

5. Conclusion

Effect of adult supervision on child pedestrian crossing behaviour in front of school was evaluated in this study. Crossing behaviour focused on the crossing speed and gap were compared for two (2) conditions: crossing the road with adult and crossing road alone.

Specifically, several conclusions can be drawn based on the results:

- i. About 77% to 84% of the child pedestrian crossing under adult supervision which accompanies by traffic warden at schools.
- ii. The mean crossing speed of school children is lower when they are accompanied only by their parents (0.66 – 0.78 m/sec)
- iii. School children who cross alone without supervision by warden or parent have the lowest average crossing gap (16.38 sec and 15.02 sec for school with and without crossing facility).

Result from this study support that the supervision of traffic warden for school children crossing is crucial to reduce the risk and also enhance the safety of these young pedestrians.

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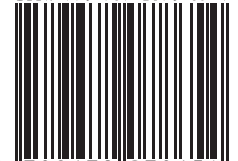
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