


Pedestrian's choice at mid phase of green countdown display at signalized intersections

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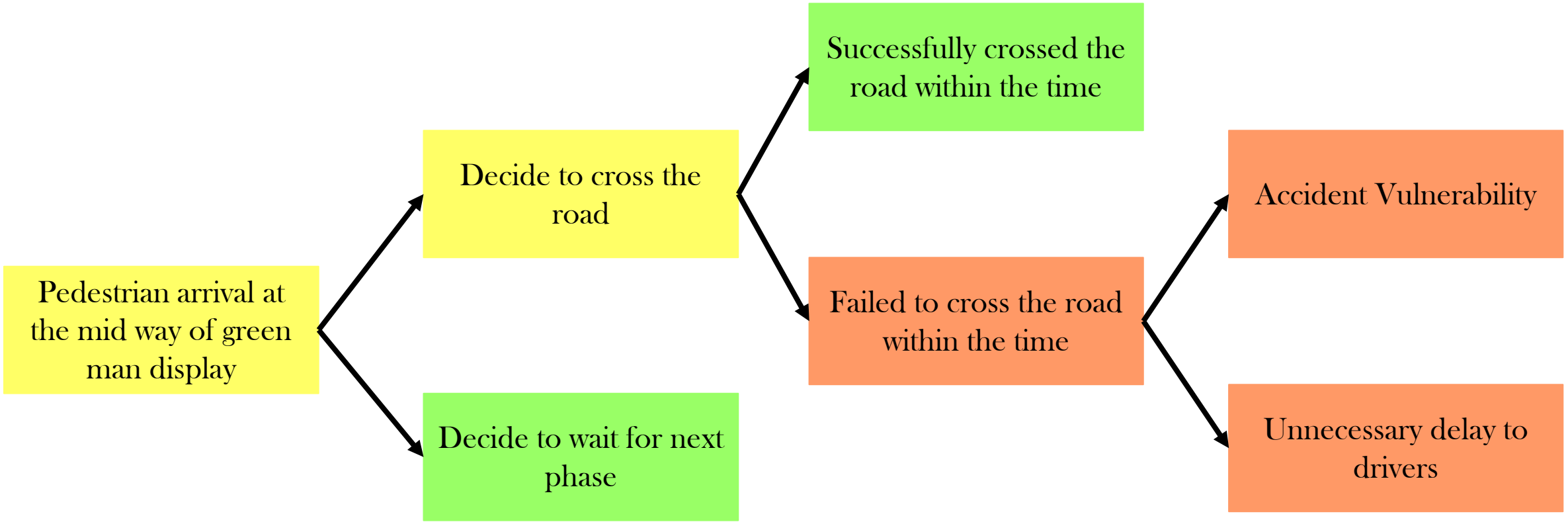
Introduction

Pedestrians' Red-light running behavior is one of the most critical factors for pedestrian involved traffic crashes.

Most of the time, pedestrians like to cross the roads as soon as possible without considering the remaining green man display time in signalized intersections. This behavior results red-light running of pedestrians at signalized intersections.



Significance of the Research

The choice to cross immediately upon arrival is risky unless pedestrians can finish crossing before the traffic lights turns red. However, as observed by Koh et al. (2014), 45% of the observed pedestrians and cyclists began crossing at flashing green phase couldn't finish crossing timely

Crossing based on remaining time in green man display is relatively safe as long as pedestrians can finish crossing within the remaining duration. However, researchers have found that pedestrians tend to cross when the remaining time was too short, indicated by incomplete crossings after the clearance phase ended (Zhuang et al, 2018)

The probability of pedestrian accidents when crossing at the red light is eight times higher compared to probability when crossing the road properly. Therefore, there is a real need to investigate the pedestrian behaviour with respect to existing devices (countdown displays) that should reduce the number of illegal crossings throughout entire duration of the pedestrian red light (Lipovac et al, 2013)

Therefore, this study is highly significant to analyse the pedestrian behaviour who arrive at mid phase of green man display at signalized intersections in Sri Lanka especially at highly crowded locations.

Aim of the Research

This study aims to analyse the pedestrian's behaviour at mid phase of green display in terms of their choices and success with respect to remaining green time at arrival

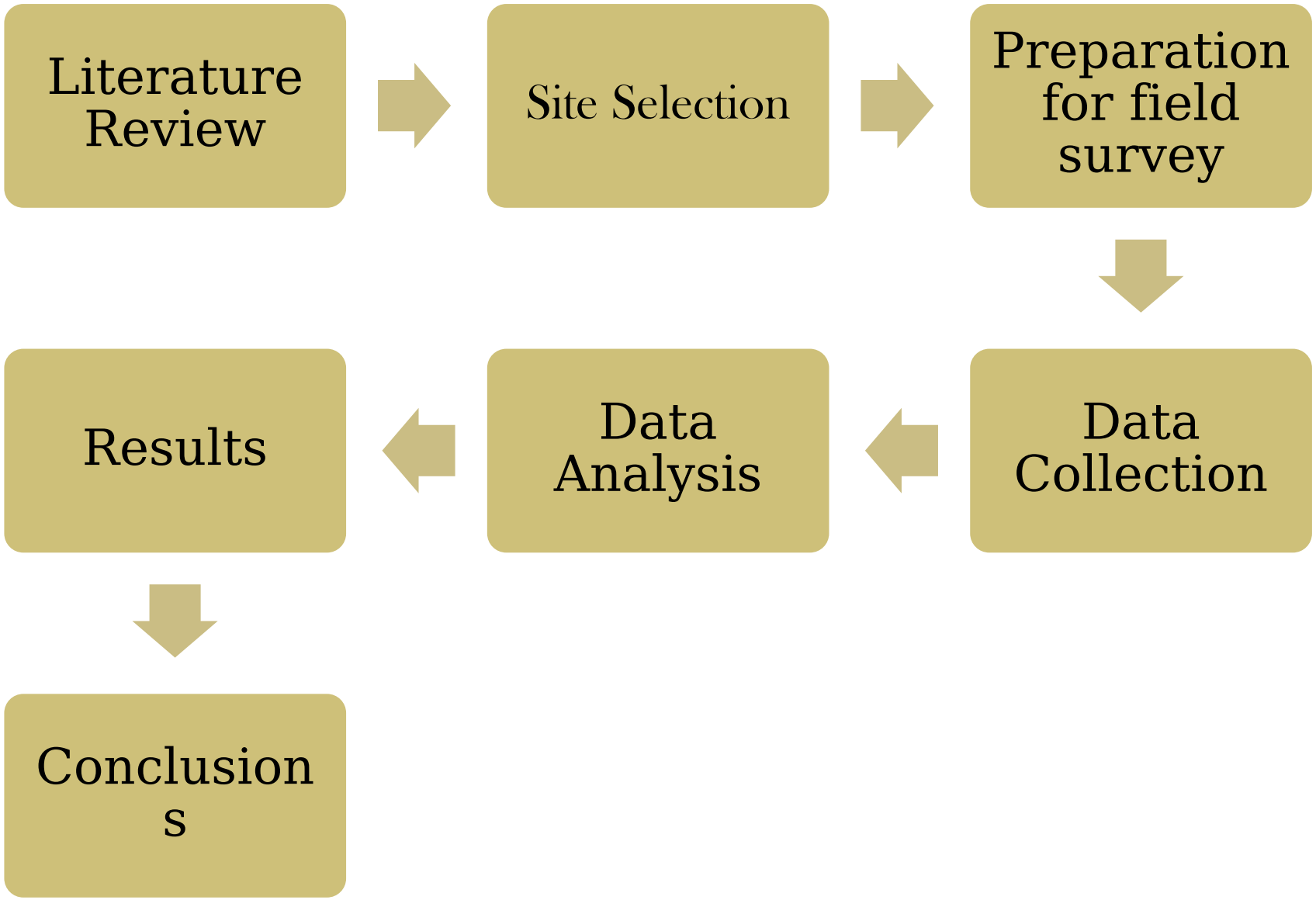
Objectives of the Research

01 To analyze the decision of the pedestrians to cross or wait at intersection based on remaining time at green display and demographic factors

02 To analyze the success of the pedestrians to cross the road based on remaining time at green display and demographic factors

03 To analyze the speed variations of the pedestrians based on the remaining time at green display

Methodology



Methodology – Data Collection

Gender

Remaining countdown time in green man display at pedestrian arrival

Age Group (A/C/E)

Data Collection

Time spend at Red phase

Decision to cross or wait

Time spend at Green phase

Methodology - Location

Criteria	Attribute
GPS Coordinates	7°43′11" N , 81°41′48“E
Type of Intersection	4 way junction
Cross walk length	16 m
Cross walk Width	4 m
Selected cycle time	90 s
Selected green time for pedestrian	15 s

Data Analysis – Objective 01

Coding for binary logistic model (pedestrians' choices)

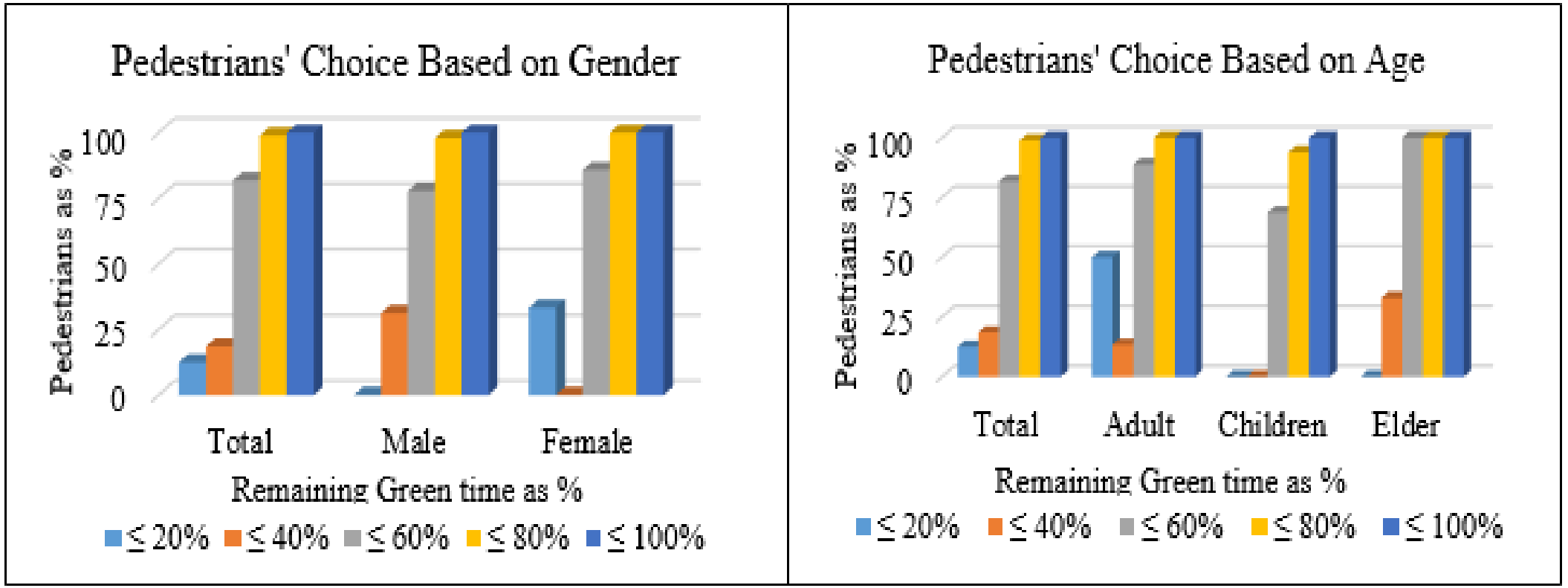
Variable	Notation	Coding		Description
		Parameter (1)	Parameter (2)	
Categorical Variables				
Age Group	A	1	0	Adult
	C	0	1	Children
	E	0	0	Elder
Gender	M	0	-	Male
	F	1	-	Female
Other Variables				
Remaining Green Time at Pedestrian Arrival				Remaining green time at countdown timer when arrival was used in seconds (1s to 15s)
Dependent variable				
Choice to cross the road	Yes	1	-	Decided to cross the road
	No	0	-	No decided to cross the road

Data Analysis – Objective 02

Coding for binary logistic model (pedestrians' success)

Variables	Notation	Coding		Description
		Parameter (1)	Parameter (2)	
Categorical Variables				
Age Group	A	1	0	Adult
	C	0	1	Children
	E	0	0	Elder
Gender	M	0	-	Male
	F	1	-	Female
Other Variables				
Remaining Green Time at Pedestrian Arrival				Remaining green time at countdown timer when arrival was used in seconds (1s to 15s)
Pedestrians' Grouping				Number of pedestrians crossed the road as group including the pedestrian in concern (if a pedestrian crossed the road alone, coding is 1)
pedestrians' involvement in other activities	Yes	0	-	Whether the pedestrian in concern involved in usage of mobile phones, reading books or other prohibited activities
	No	1	-	
Dependent variable				
Pedestrian's success	Yes	1	-	Successfully crossed
	No	0	-	Failed to cross

Results – Objective 01 (Pedestrians' choices)



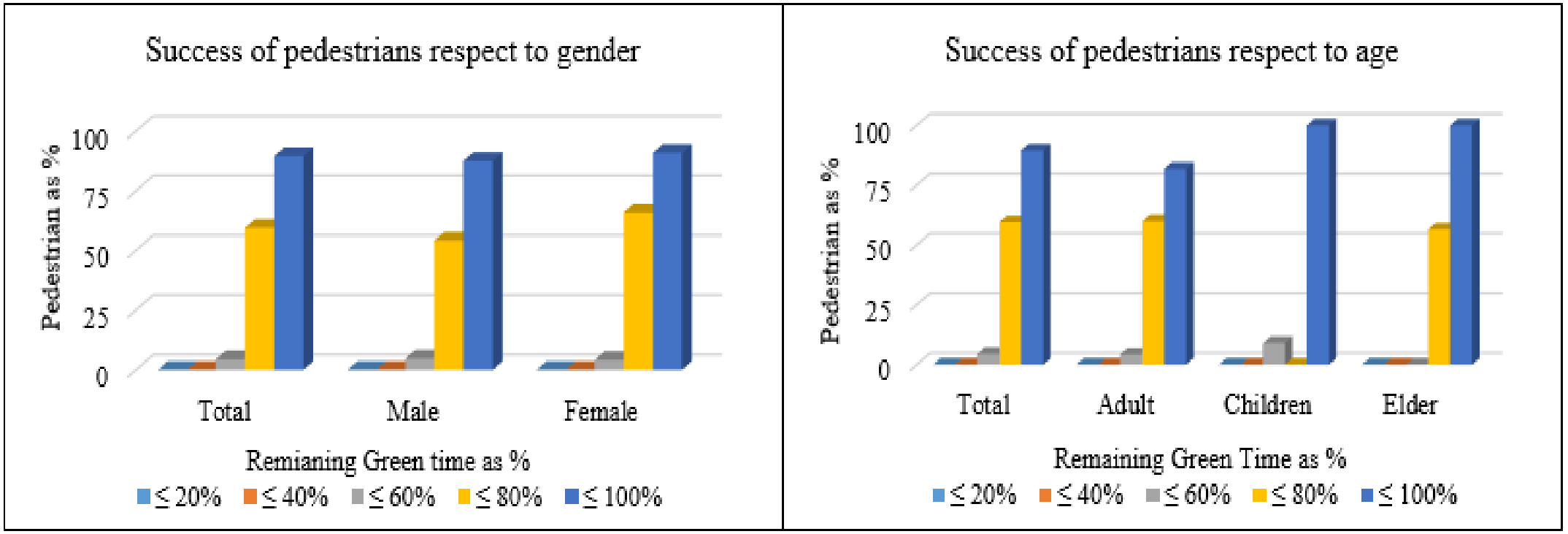
- More than 80% of the pedestrians arrived when the remaining time was greater than 40% have decided to cross the road within the ongoing green phase
- Percentage of female pedestrians decided to cross the road for the particular remaining time range was higher than the male pedestrians
- Children were more reluctant to cross the road when the remaining time was short

Results – Objective 01 (Pedestrians' choices)

Predictors	Estimate	Standard Error	P value	Odd ratio
Age Group			0.006	
Age Group(1)	-0.880	0.853	0.302	0.415
Age Group(2)	-3.286	1.108	0.003	0.037
Gender	0.072	0.632	0.909	1.075
Remaining Green Time at Arrival	1.258	0.231	0.001	3.517
Constant	-7.048	1.124	0.000	0.001

- From the Hosmer and Lemeshow test (χ^2 (8) = 2.9 & p = 0.61) it was found that the model fits with 92% prediction of pedestrians' choices
- Age group (p = 0.006) and remaining green time at pedestrian arrival (p = 0.001) affect pedestrians' choices significantly irrespective their gender
- The odd ratio for gender has the value of 1.075 indicates that, choice of male pedestrians to cross the road is 1.075 times higher than female pedestrians and it elaborates that there are no significant changes in pedestrian choices according to gender demography
- Odd ratios of Age group (1) and Age group (2) clearly indicates that, adult and children are more reluctant than elders to cross the roads at the particular intersection

Results – Objective 02 (Pedestrians' success)



- when the remaining green time at arrival was less than 60%, more than 95% of the pedestrians who have decided to cross the road has been failed to succeed within the available green phase for pedestrians

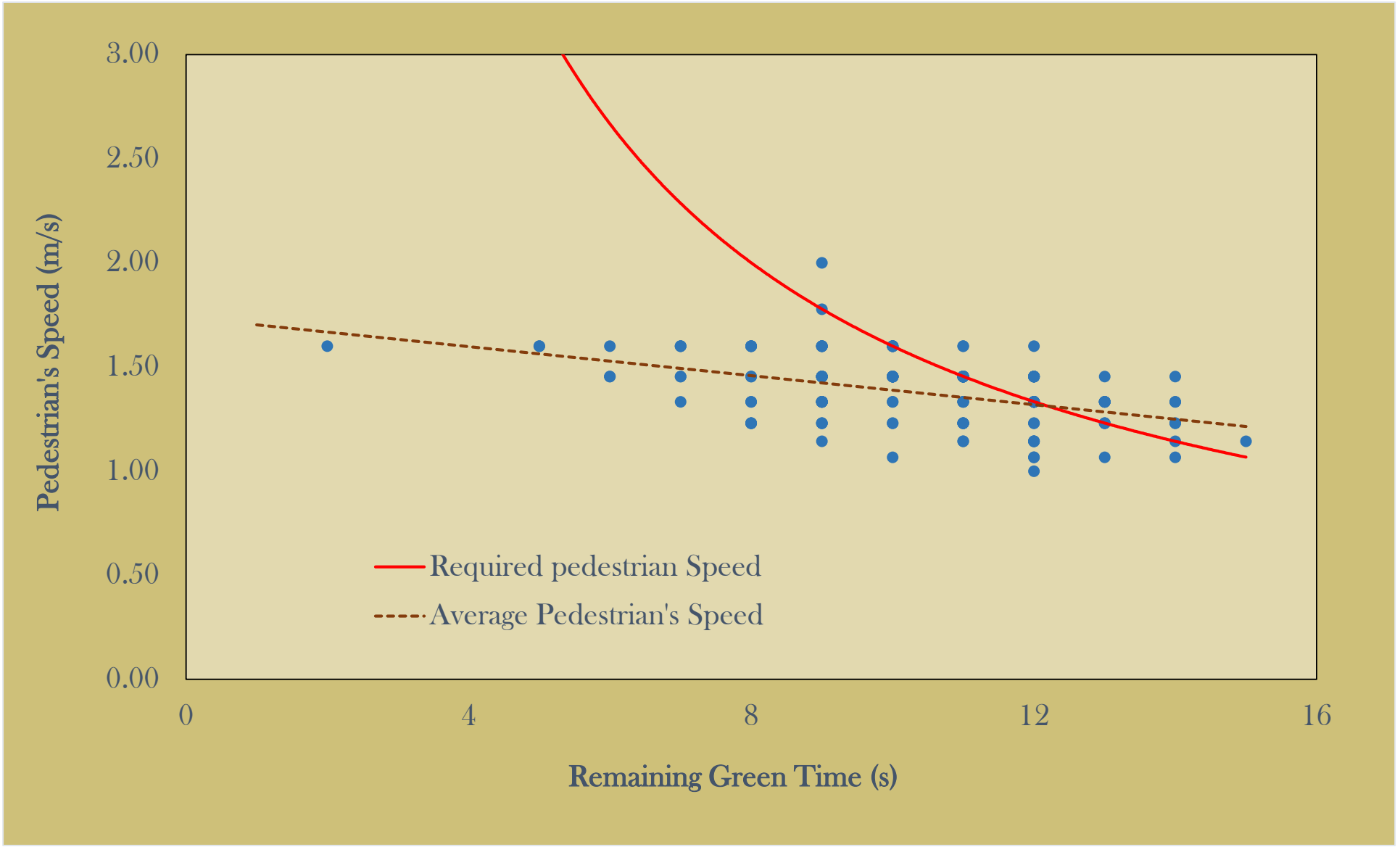
- female pedestrians have more success rate than male pedestrians, children have more success rate than elders and adults

Results – Objective 02 (Pedestrians' success)

Predictors	Estimate	Standard Error	P value	Odd ratio
Age Group			0.620	
Age Group(1)	-0.103	0.067	0.856	0.902
Age Group(2)	0.518	0.144	0.486	1.678
Gender	0.057	0.074	0.904	1.059
Remaining Green Time at Arrival	1.178	0.199	0.001	3.247
Pedestrians' Grouping	-2.571	0.224	0.005	0.076
Involvement in other activities	1.748	0.114	0.014	5.742
Constant	-11.514	1.483	0.000	0.000

- Model predicts the pedestrians' success fits with 93% prediction of pedestrian success as per the Hosmer and Lemeshow test ($\chi 2$ (8) = 3.12 & p = 0.51)
- Remaining green time at pedestrian arrival (p = 0.001), pedestrians' grouping (p = 0.005) and pedestrians' involvement in other activities (p = 0.014) are the significant factors affecting the success of pedestrians to cross the road irrespective to their age and gender
- Odd ratio for the predictor named "pedestrians' involvement in other activities" shows that a pedestrians involved in other activities likely to fail 5.742 times than the pedestrians who are not involved in such activities

Results – Objective 03 (Pedestrians' speed variations)



Results – Objective 03 (Pedestrians' speed variations)

- When the remaining time was less than 80% of the allocated green time average of pedestrians' crossing speeds were laid below the required speed to success.

- It clearly indicates that most of the pedestrians were unable to cross the road successfully when the remaining time is lesser than 80%.

- when the remaining time was less than 9 s (less than 60% of allocated time) all crossing speeds are laid below the required speed line and it indicates that no one were able to cross the roads when the remaining time was lee than 60%.

- Moreover it was found that average crossing speed of male pedestrians were slightly higher than females for each remaining green time on arrival

Conclusions

- Taking decisions to cross or wait based on the remaining green time at arrival is much significant to reduce red-light running behavior of pedestrians.
- Elder pedestrians should have been given more attention than other age groups to educate regarding the usage countdown timers at signalized intersections.
- Pedestrians who decide to cross with short remaining green time are more vulnerable to meet accidents irrespective their age and gender.
- Involvement in prohibited activities at pedestrian crossings and walking as groups at crossings lead significant failure for pedestrians to cross the road within the available time at signalized intersections.


Thank
you!!