International Journal of Innovative Research and Scientific Studies, 8(11) 2025, pages: 303-309

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Evaluating the impact of road safety education on child pedestrian fatalities in Malaysia: A 23-year analysis

Amelia Azreena Abdul Ghani[1], Nurul Khairani Ismail[2*], Azhar Hamzah[3], Nuura Addina Nuura Mohamad[4]

[1,3,4]Malaysian Institute of Road Safety Research 43000, Kajang, Selangor, Malaysia.
[2]Faculty of Education, National University of Malaysia, 43650 Bangi Selangor, Malaysia.

Corresponding author: Nurul Khairani Ismail (*Email: nkhairani@ukm.edu.my*)

Abstract

The objective of this study was to investigate the impact of formal Road Safety Education (RSE) on reducing child pedestrian fatalities in Malaysia, focusing on 6-15 years children. The data of pedestrian-vehicle crashs during the period of 2000-2023 were obtained from the MIROS the Secondary Data & Repository System (M-SEDARS) and road crashes data from Traffic Investigation and Enforcement Department (JSPT), Royal Malaysia Police (PDRM) were used for the analysis. The results showed that pedestrian fatalities were significantly reduce after formal RSE implementation in Malaysia. Data illustrate a dramatic decrease in fatalities for the 6-10 age group, plummeting from 85 cases in 2000 to just 8 cases (90.6%) in 2023, while the 11-15 age group saw a reduction from 34 cases to 5 (85.3%). The average number of fatalities before RSE implementation was 53.57 (SD = 22.89), while post-implementation, this number dropped sharply to 21.06 (SD = 11.64). The reduction is statistically significant with a large effect size, indicating the robustness of the RSE program in safeguarding younger children. Meanwhile, in the older age group, fatalities decreased from an average of 29.29 (SD = 7.06) before RSE implementation to 17.65 (SD = 15.19) afterward. Although the reduction is less dramatic than in the younger age group, it remains statistically significant, reflecting the program's broad impact.

Keywords: Children, Malaysia, Pedestrian fatalities, Road safety education, Royal Malaysia Police.

DOI: 10.53894/ijirss.v8i11.10894
Funding: This study received no specific financial support.
History: Received: 10 September 2025 / **Revised:** 29 October 2025 / **Accepted:** 3 November 2025 / **Published:** 17 November 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

Road traffic deaths and injuries continue to pose a significant global challenge, affecting both public health and development. Despite a modest 5% decline in global road traffic fatalities from 1.25 million in 2010 to 1.19 million in

2021, pedestrians remain particularly vulnerable. Worldwide, they account for 21% of all road traffic deaths. In the South-East Asia Region, pedestrians represent the third-highest category of road user fatalities (17%), following motorcyclists (46%) and occupants of other vehicles (22%) [1].

In Malaysia, the crisis mirrors the global situation. According to the Royal Malaysian Police (RMP) data for 2023, road traffic incidents resulted in 6,080 deaths and 40,116 injuries, with children disproportionately affected. This alarming statistic highlights a critical need for effective interventions tailored to protect young pedestrians. Several factors contribute to child pedestrian injuries globally and within Malaysia. High vehicle volumes and speeds, absent lane demarcations, and environmental characteristics such as longer block lengths, and missing sidewalks have been identified as significant risk factors [2]. Moreover, socioeconomic status influences vulnerability, with children from lower socioeconomic classes facing higher risks [3, 4]. Understanding these multifaceted contributors is essential for formulating effective strategies to enhance child pedestrian safety.

To address these pressing issues, the formal RSE program was introduced in Malaysia in 2007, targeting primary and secondary school students. The program underwent revisions based on stakeholder feedback and began utilizing a new module in 2019, along with Teacher's and Educator's Guidebooks for kindergartens and preschools introduced in 2021. While the RSE program aims to educate children on road safety from an early age, challenges remain, particularly regarding children's heightened vulnerability as pedestrians. Their physical fragility, lower visibility to drivers, and inadequate protective measures contribute to their high risk on the roads.

Despite the introduction of the RSE program, existing literature reveals a significant research gap concerning its effectiveness in the Malaysian context. While studies have documented successful RSE programs in other countries, there is a lack of comprehensive evaluations focusing specifically on Malaysia's unique challenges and the specific factors influencing child pedestrian safety. This paper aims to fill this gap by examining the effectiveness of RSE initiatives and their role in preventing child pedestrian injuries in Malaysia.

2. Literature Review

2.1. Development of formal RSE in Malaysia

The initiative to introduce RSE in Malaysia's education system began in the early 1990s, led by the late Dato' Professor Ir. Dr. Radin Umar Radin Sohadi, former Director-General of the Malaysian Institute of Road Safety Research (MIROS). His efforts, along with a research team from the Road Safety Research Centre, Universiti Putra Malaysia (UPM), successfully convinced the Ministry of Education (MOE) to approve RSE as part of the Bahasa Melayu curriculum in selected pilot primary schools. Pasir Mas, Kelantan, was chosen as the pilot district, where UPM researchers developed a RSE module embedded into Bahasa Melayu lessons.

In 2005, UPM conducted a feasibility study on the RSE module in pilot schools, which demonstrated its effectiveness in improving students' road safety knowledge and skills. As a result, between 2007 and 2008, the program expanded to other districts, supported by a collaboration between the Ministry of Transport (MOT) and the Ministry of Education. The Road Safety Department (JKJR) currently known as Division of Road Safety in Road Transport Department (RTD) was tasked with overseeing the first official RSE module, while Innovate Solutions played a key role in module development, with input from experienced Bahasa Melayu teachers and education officers. Between 2007 and 2010, UPM evaluated the module's effectiveness, confirming that four years of formal RSE in primary schools significantly improved students' awareness and understanding of road safety [5].

2.2. National Expansion and Curriculum Review

Encouraged by these positive results, the MOE approved the nationwide implementation of RSE in primary schools starting in 2011. However, by 2012, research by MIROS highlighted the need to review and update the RSE module due to curriculum changes and technological advancements. Consequently, between 2012 and 2014, RSE was gradually introduced into lower secondary schools (Forms 1–3).

After seven years of implementation in primary schools and three years in secondary schools, the Technical Committee on Road Safety Education convened on September 11, 2014, to assess the curriculum. The review, which involved teachers and subject matter experts, aimed to align RSE with Malaysia's curriculum transition from KBSR/KBSM to KSSR/KSSM. MIROS conducted a needs assessment in 2015, confirming the necessity for an updated RSE module to incorporate evolving road safety challenges, digital advancements, and global trends.

2.3. RSE Enhancement and Teacher Training

In 2016, the Malaysian government allocated fund for the RSE Module Review and Redevelopment Project, managed by JKJR and executed by MIROS. This initiative led to the development of revised RSE modules for primary schools, as well as Educator Guides (BPP) for preschools and Teacher Guides (BPG) for kindergartens in 2016, followed by secondary school modules in 2017. To ensure effective implementation, pilot studies were conducted at all educational levels. In 2017, the revised primary school module was tested in 24 schools, while the BPP and BPG were trialed in 29 preschools and 25 kindergartens. In 2018, 12 secondary schools across six states participated in a similar pilot study.

Recognizing the critical role of teachers in delivering RSE effectively, a specialized Teacher Training Module (DéGuru RSE) was introduced in 2018 for primary school teachers and expanded in 2019 for secondary, preschool, and kindergarten educators. The module aimed to enhance teachers' capabilities in integrating RSE into Bahasa Melayu lessons. Pilot training sessions were conducted to assess its feasibility and identify areas for improvement, involving experts from JKJR, education departments, and experienced teachers.

2.4. Nationwide Implementation and Future Outlook

Between 2018 and 2020, a large-scale teacher training initiative was rolled out using the DéGuru RSE module. Over 15,750 primary school teachers, 5,046 secondary school teachers, 6,575 preschool teachers, and 1,460 kindergarten teachers were trained nationwide. The training also extended to teachers in Islamic schools, residential schools, MARA Junior Science Colleges (MRSM), private institutions, and international schools following the national curriculum. By 2019, the revised RSE primary school module was officially implemented nationwide, followed by the secondary school module and the preschool/kindergarten guides in 2020. These efforts continue to strengthen road safety education at all levels, ensuring future generations develop a strong foundation in road safety awareness and responsible behavior.

3. Methodology

Data in this study was obtained from the M-SEDAR System or M-SEDARS. This system allows secondary data such as annual reports and statistics obtained from various agencies to be stored and accessed for the use of MIROS research and road crashes data from Traffic Investigation and Enforcement Department (JSPT), Royal Malaysia Police (PDRM) were. PDRM is the main organization that is responsible for road crash management in the country, including official crash reporting and data collection. In this study, the authors considered the 23-year period from 2000 to 2023 pedestrian fatalities among children aged 6 to 15 years old. Following the Royal Malaysia Police (PDRM) [6] classification, road death or fatalities refer to anyone who has fallen victim to any road crash and died within a period of 30 days since the crash occurred while pedestrian refers to those who use any parts or section of any road without using or being in or on any type of vehicle. The Royal Malaysia Police (PDRM) [6] also reserves for anyone boarding, alighting or falling from any vehicle as not under the pedestrian category.

Analysis performed in this study included descriptive, Independent Samples T-Test and Time Series analysis. Time series analysis was performed using PROPHET functions by JASP version 0.18.3 software. Modelling of the children pedestrian fatality data utilized Markov Chain Monte Carlo (MCMC) following Bayesian analysis. The analysis specifically aims to detect any changepoints in the data growth supported by Gelman-Rubin R^ (R-hat) and effective sample size (ESS). R-hat is a degree of convergence after Markov Chain iterations in which the values less than 1.01 is considered adequate convergence. ESS on the other hand is the effective sample size where the MCMC chains finally converge to the data's prior distribution. Larger ESS of at least 400 is preferable to explain the posterior convergence. To perform the MCMC modelling and detect the changepoints, no covariate is included in the time series analysis. Sampling is set at 1000; the growth is set to be linear and automatic changepoints are set as a maximum of four. The analysis results will look at the posterior and changepoints summary tables for each group of children age.

4. Results

This study examines the impact of the formal implementation of Road Safety Education (RSE) on reducing pedestrian fatalities among children in Malaysia, focusing on two age groups: 6-10 years and 11-15 years.

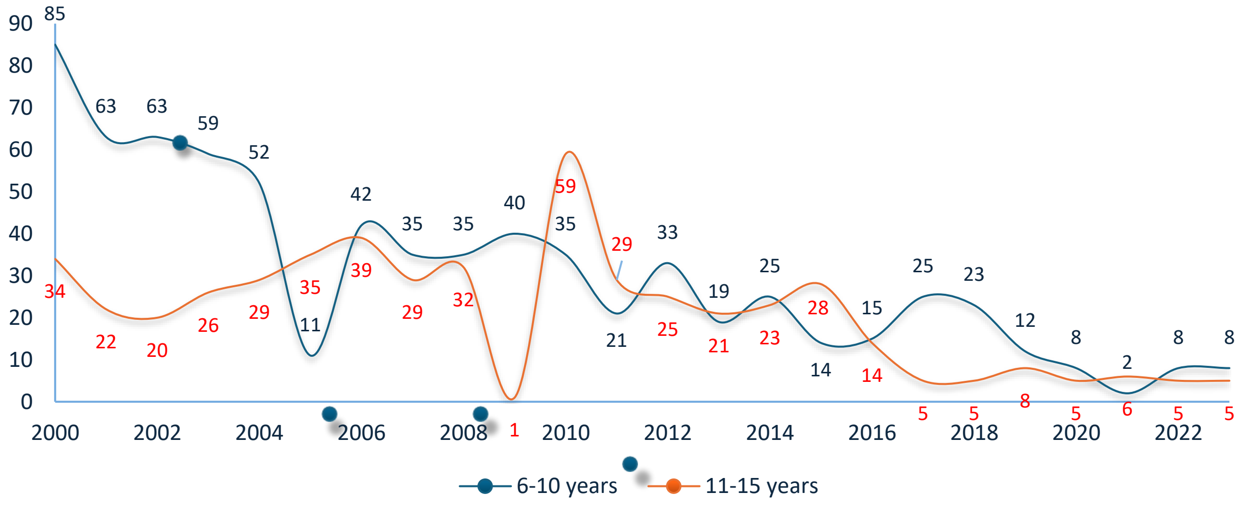

Figure 1.
Pedestrian Fatalities Trend among Children 6-15 years in Malaysia (2000-2023).

4.1. Longitudinal Trends (2000-2023)

The analysis draws on data collected before and after the introduction of RSE, aiming to demonstrate the effectiveness of this educational intervention. For the 6-10 age group, fatalities decreased from 85 cases in 2000 to just 8 cases in 2023. Similarly, for the 11-15 age group, fatalities dropped from 34 cases in 2000 to 5 cases in 2023 (Figure 1). This decline highlights the success of RSE in changing behaviours and attitudes towards road safety among children. The program's sustained impact over more than a decade suggests that it has become an integral part of the educational landscape in Malaysia, contributing significantly to public safety.

4.2. Impact on Pedestrian Fatalities

The data analysis shows a significant reduction in child pedestrian fatalities following the formal implementation of RSE in Malaysia. This reduction is observed across both targeted age groups, indicating that the program has successfully addressed one of the most vulnerable road user demographics children.

Table 1.
Descriptive Statistics of Child Pedestrian Fatalities Before and After the Implementation of Formal RSE.

Age Group	RSE Implementation	N	Mean	SD	SE	Coefficient of variation
6-10 Years old	Before	7	53.571	22.890	8.652	0.427
	After	17	21.059	11.638	2.823	0.553
11-15 Years old	Before	7	29.286	7.064	2.670	0.241
	After	17	17.647	15.194	3.685	0.861

The average number of fatalities before RSE implementation was 53.57 (SD = 22.89), while post-implementation, this number dropped sharply to 21.06 (SD = 11.64). The reduction is statistically significant with a large effect size, indicating the robustness of the RSE program in safeguarding younger children. Meanwhile, in the older age group, fatalities decreased from an average of 29.29 (SD = 7.06) before RSE implementation to 17.65 (SD = 15.19) afterward. Although the reduction is less dramatic than in the younger age group, it remains statistically significant, reflecting the program's broad impact.

Table 2.
Independent Samples T-Test.

Age Group	Test	Statistic	df	p	Effect Size	SE Effect Size
6-10 Years old	Student	4.660	22.000	< .001	2.093	0.717
	Mann-Whitney	106.000		0.002	0.782	0.259
11-15 Years old	Student	1.924	22.000	0.034	0.864	0.505
	Mann-Whitney	93.000		0.018	0.563	0.259

Note: For all tests, the alternative hypothesis specifies that group Pedestrian fatalities among children before Formal RSE implementation is greater than group Pedestrian fatalities among children after Formal RSE implementation for the Student t-test and Welch t-test, effect size is given by Cohen's d.

Various statistical tests were employed to ensure the reliability of the findings (Table 2). Student's T-Test and Welch's T-Test confirmed the statistical significance of the reductions in both age groups, with Cohen's d values indicating large effect sizes (d = 2.093 for 6-10 years, d = 0.864 for 11-15 years). Mann-Whitney U-Test further supported these findings, with results suggesting that the pre-intervention fatalities were significantly higher than those observed post-intervention. These results underscore the effectiveness of the RSE program, particularly in the critical age group of 6-10 years, where the program has had a substantial impact in reducing road fatalities.

Table 3.
Posterior Summary Table for Fatalities among children aged 6 - 10 from Year 2000 to 2023.

			95% CI				
Parameter	**Mean**	**SD**	**Lower**	**Upper**	**R-hat**	**ESS (bulk)**	**ESS (tail)**
Growth rate (k)	-0.759	0.128	-1.028	-0.517	1.003	801	926
Offset (m)	0.724	0.057	0.614	0.842	1.000	1055	1057
Residual variance (sigma)	0.135	0.023	0.100	0.188	1.004	1359	987

The mean growth rate of -0.759 indicates a significant downward trend in pedestrian fatalities over the study period. This confirms the downward trend in children fatalities aged 6-10 throughout 2000-2023 illustrated in Figure 1. The 95% CI does not include zero confirming a consistent decline in fatalities and the negative value highlights the success of interventions like formal RSE in reducing fatalities in this age group. The offset mean is 0.724, with a narrow 95% suggesting stability in the baseline level of fatalities before changes were observed. This value supports the interpretation of a steady initial trend before the impact of the intervention was fully realized. The mean residual variance of 0.135, with a 95% CI reflects the variability in fatalities that cannot be explained by the model. This low variance suggests the model provides a good fit for the observed data. All R-hat values are close to 1.0, indicating proper convergence of the Markov Chain Monte Carlo (MCMC) sampling process. This ensures the reliability of the posterior estimates. The ESS values for both bulk and tail are well above the recommended threshold of 400, with ESS (bulk) at 801 and ESS (tail) at 926 for the growth rate. This indicates good convergence of the MCMC sampling.

Table 4.
Changepoint Posterior Summary Table for Fatalities among children aged 6 - 10 from Year 2000 to 2023

Changepoint	Change in growth rate (δ)	SD	95% CI	
	Mean		Lower	Upper
2005	0.026	0.078	-0.119	0.212
2009	0.025	0.068	-0.091	0.185
2013	0.024	0.075	-0.116	0.182
2018	0.006	0.070	-0.133	0.160
2005	0.026	0.078	-0.119	0.212

Table 4 shows changepoints for pedestrian fatalities among children aged 6–10 years from 2000 to 2023. Four key years 2005, 2009, 2013, and 2018 were identified as potential moments when the trend in fatalities shifted. In 2005, the mean change in growth rate (δ) was 0.026, but the 95% credible interval (CI) ranged from - 0.119 to 0.212, meaning no significant change was detected. Similarly, in 2009 and 2013, the changes were 0.025 and 0.024, respectively, with their CI also including zero, indicating no major shifts. By 2018, the change was minimal at 0.006, and the CI (-0.133 to 0.160) confirmed that the trend remained stable. The results show no sudden or significant changes in the trend of fatalities at these changepoints. Instead, the overall decline in fatalities was gradual and steady, likely reflecting the continuous impact of road safety measures like the RSE program.

Table 5.
Posterior Summary Table for Fatalities among children aged 11 - 15 from Year 2000 to 2023.

Parameter	95% CI						
	Mean	SD	Lower	Upper	R-hat	ESS (bulk)	ESS (tail)
Growth rate (k)	-0.465	0.151	-0.755	-0.164	1.003	929	851
Offset (m)	0.596	0.078	0.442	0.750	1.002	1042	1326
Residual variance (sigma)	0.202	0.031	0.151	0.270	1.001	1640	1292

Table 6.
Changepoint Posterior Summary Table for Fatalities among children aged 11 - 15 from Year 2000 to 2023.

Changepoint	Change in growth rate (δ)	SD	95% CI	
	Mean		Lower	Upper
2005	-0.006	0.068	-0.160	0.138
2009	-0.017	0.074	-0.189	0.122
2013	-0.017	0.081	-0.206	0.137
2018	0.003	0.066	-0.151	0.140

Almost opposingly, the average growth rate of -0.465 reflects the sudden drop and spikes in children fatalities aged 11 - 15 particularly in 2009 - 2010. However, the R-hat test results come out with good fit at no more than 1.01 with acceptable estimate size effect as shown in Table 6. As expected from the graph, year 2009 in one of the changepoints for children pedestrian aged 11 - 15 along with year 2005, 2013 and 2018.

5. Discussion

The effectiveness of the Formal RSE program in Malaysia reducing pedestrian fatalities among children is evident in the significant decline in fatality rates following its implementation. Data illustrate a dramatic decrease in fatalities for the 6-10 age group, plummeting from 85 cases in 2000 to just 8 cases (90.6%) in 2023, while the 11-15 age group saw a reduction from 34 cases to 5 (85.3%). The average number of fatalities before RSE implementation was 53.57 (SD = 22.89), while post-implementation, this number dropped sharply to 21.06 (SD = 11.64). The reduction is statistically significant with a large effect size, indicating the robustness of the RSE program in safeguarding younger children. Meanwhile, in the older age group, fatalities decreased from an average of 29.29 (SD = 7.06) before RSE implementation to 17.65 (SD = 15.19) afterward.

RSE programs in Malaysia have shown promising results in reducing pedestrian injuries among children and adolescents. Studies have demonstrated that RSE interventions lead to a significant reduction in road crashes involving children aged 7-12 years. The positive findings of the study led the Ministry of Transport and Ministry of Education in Malaysia to implement the RSE intervention nationwide in primary schools starting in 2010, and later in secondary schools as well [7]. The implementation of RSE in primary schools has positively impacted road safety behavior, although the relationship with knowledge acquisition is less clear [8, 9]. Research indicates that the level of RSE module usage significantly predicts self-reported road safety behavior [9]. Furthermore, road safety knowledge has been found to have an inverse correlation with risky behavior among adolescents aged 13-15 years, with gender and age influencing both knowledge and behavior [10].

However, despite the positive outcomes, challenges remain regarding the effectiveness of RSE in fostering actual behavior change from previous research. Twisk, et al. [11] noted that while many RSE programs led to improved self-reported safety behaviors, the proportion of participants who changed their behavior was modest, ranging from 3% to 20%. Moreover, Alonso, et al. [12] found that knowledge of traffic rules did not significantly predict road behaviour among children and young people. The results from the changepoint analysis indicate a downward trend in pedestrian fatalities among children in Malaysia, with negative growth rates of -0.277 for those aged 6-10 years and -0.465 for those aged 11-15 years. This decline suggests the effectiveness of the Road Safety Education (RSE) program in mitigating risks and reflects broader improvements in road safety practices. The timing of the decline aligns with the RSE program's implementation, indicating a cultural shift in road safety awareness among children and guardians.

However, the available research does not consistently support the notion that RSE programs have uniformly effective outcomes in reducing fatality rates. For instance, Poulter and McKenna [13] found that educational interventions for pre-drivers yielded only small, short-term effects on road safety beliefs, with no long-term impacts and potential unintended consequences. Similarly, Twisk, et al. [11] indicated that only three out of five RSE programs significantly improved self-reported safety behavior, with just 3-20% of participants demonstrating actual behavior changes compared to reference groups. Furthermore, Kingham, et al. [14] observed that while overall crash rates in Christchurch, New Zealand, decreased from 1980 to 2004, there were notable increases in incidents during morning rush hours and school travel times, suggesting that targeted policies around schools may be insufficient without broader traffic reduction measures. Additionally, Twisk, et al. [11] highlighted that psychological determinants were linked to risk behaviors among young cyclists and pedestrians, further complicating the efficacy of RSE programs. This complexity emphasizes the need for sustained educational efforts and comprehensive strategies that address both knowledge and behavior to effectively enhance child pedestrian safety in the long term.

Empowering children through Road Safety Education is vital for reducing pedestrian injuries in Malaysia. By enhancing awareness and promoting safe practices, RSE plays a crucial role in protecting one of the most vulnerable segments of the population children. Continued efforts in curriculum development, government policy changes, and community engagement are essential for achieving significant reductions in road traffic injuries among children.

6. Study Strengths, Limitations and Recommendation

This study is unable to isolate the specific impact of the RSE program on the reduction of road fatalities from other concurrent road safety initiatives. While the study provides robust evidence of the program's effectiveness, it does not take into account the influence of additional factors such as improvements in road infrastructure, enforcement of traffic laws, and public awareness campaigns. These factors may have independently or synergistically contributed to the observed decline in road traffic injuries, leading to ambiguity in attributing the success solely to the RSE program. This lack of clarity may hinder policymakers from understanding the relative effectiveness of the RSE program and could result in misguided resource allocation if the program is perceived as the sole driver of improved road safety outcomes.

To effectively address this limitation, it is recommended that researchers develop a comprehensive evaluation framework that integrates the assessment of the RSE program with other road safety initiatives. This framework should employ a mixed-methods approach, combining quantitative data analysis (such as traffic crash statistics, infrastructure conditions, and enforcement outcomes) with qualitative assessments (such as stakeholder interviews and community feedback). By employing longitudinal studies, researchers can track trends over time and assess the individual contributions of various initiatives to the overall improvement in road safety. This integrated approach will not only provide clearer insights into the effectiveness of the RSE program but also facilitate a better understanding of how different elements of road safety interplay. Ultimately, this will enable policymakers to make more informed decisions regarding resource allocation and the development of future road safety strategies.

7. Conclusion

In conclusion, this study provides compelling evidence of the effectiveness of the formal Road Safety Education (RSE) program in significantly reducing child pedestrian fatalities in Malaysia, particularly among the vulnerable 6-10 age group, where fatalities decreased by an impressive 90.6% from 2000 to 2023. The statistical analysis indicates a robust and sustained impact of the RSE program, highlighting its crucial role in enhancing road safety awareness among children. However, it is essential to consider the influence of other concurrent road safety initiatives, such as infrastructure improvements and stricter law enforcement, which may have also contributed to these positive outcomes. Therefore, the success of the RSE program should be viewed within a broader context of a comprehensive road safety strategy. Ongoing evaluations and further research into the program's long-term impacts will be vital for fostering a safer road environment for children in Malaysia.

References

[1] World Health Organization (WHO), *Global status report on road safety 2023*. Geneva: World Health Organization, 2023.

[2] J. Hwang, K. Joh, and A. Woo, "Social inequalities in child pedestrian traffic injuries: Differences in neighborhood built environments near schools in Austin, TX, USA," *Journal of Transport & Health,* vol. 6, pp. 40-49, 2017. https://doi.org/10.1016/j.jth.2017.05.003

[3] M. Malek, B. Guyer, and I. Lescohier, "The epidemiology and prevention of child pedestrian injury," *Accident Analysis & Prevention,* vol. 22, no. 4, pp. 301-313, 1990. https://doi.org/10.1016/0001-4575(90)90046-N

[4] N. Shoari, S. Heydari, and M. Blangiardo, "A decade of child pedestrian safety in England: A Bayesian spatio-temporal analysis," *BMC Public Health,* vol. 23, no. 1, p. 215, 2023. https://doi.org/10.1186/s12889-023-15110-2

[5] H. Hamid *et al.*, *Establishing baseline for the 2017 revised road safety education module for primary school through context, input, process and product (CIPP) model (MIROS Report No. 214)*. Kajang, Malaysia: Malaysian Institute of Road Safety Research, 2017.

[6] Royal Malaysia Police (PDRM), *Road crash data and statistics report 2000–2023*. Malaysia: Traffic Investigation and Enforcement Department (JSPT), Royal Malaysia Police, 2023.

[7] K. K. C. Mani, H. Hamid, A. H. Hashim, and L. Teik Hua, "Intervening young children with road safety education yields reduction in road crashes," *Journal of Injury and Violence Research,* vol. 11, no. 4 Suppl 2, p. 111, 2019.

[8] N. K. Ismail, N. D. Darmawi, N. Amiruddin, and I. S. Izman, "A safer future for children through road safety education in school: Lessons learned from Malaysia," *International Journal of Academic Research in Business and Social Sciences,* vol. 13, no. 12, pp. 6172–6183, 2023. http://dx.doi.org/10.6007/IJARBSS/v13-i12/20408

[9] R. Shahril, A. H. Abdul Ghani, N. H. Norkhairi, N. A. Elias, and N. Che Haruna Rashid, "Growing up safe: Insights from Malaysian road safety education program on improving road safety behaviours," *Proceedings of the International Conference on Social Sciences,* vol. 9, no. 2, pp. 1–12, 2024. https://doi.org/10.17501/2357268X.2023.9201

[10] N. A. A. B. M. Nor, N. N. B. M. Suhaimi, N. K. B. Ismail, and N. F. S. B. Shah, I, "Protecting the future: How road safety knowledge can prevent risky behaviours among adolescents in Malaysia," *International Journal of Academic Research in Progressive Education and Development,* vol. 13, no. 1, pp. 1890–1898, 2024. http://dx.doi.org/10.6007/IJARPED/v13-i1/20168

[11] D. A. M. Twisk, W. P. Vlakveld, J. J. F. Commandeur, J. T. Shope, and G. Kok, "Five road safety education programmes for young adolescent pedestrians and cyclists: A multi-programme evaluation in a field setting," *Accident Analysis & Prevention,* vol. 66, pp. 55-61, 2014. https://doi.org/10.1016/j.aap.2014.01.002

[12] F. Alonso, C. Esteban, S. Useche, and N. Colomer, "Effect of road safety education on road risky behaviors of Spanish children and adolescents: Findings from a national study," *International Journal of Environmental Research and Public Health,* vol. 15, no. 12, p. 2828, 2018. https://doi.org/10.3390/ijerph15122828

[13] D. R. Poulter and F. P. McKenna, "Evaluating the effectiveness of a road safety education intervention for pre-drivers: An application of the theory of planned behaviour," *British Journal of Educational Psychology,* vol. 80, no. 2, pp. 163-181, 2010. https://doi.org/10.1348/014466509X468421

[14] S. Kingham, C. E. Sabel, and P. Bartie, "The impact of the 'school run' on road traffic accidents: A spatio-temporal analysis," *Journal of Transport Geography,* vol. 19, no. 4, pp. 705-711, 2011. https://doi.org/10.1016/j.jtrangeo.2010.08.011