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Exploring the Relationship between Knowledge of the Child Presence Detection (CPD) System and Intention to Purchase among Adults in Malaysia

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ABSTRACT – *Ensuring children's safety in cars is crucial, especially considering tragic incidents involving kids left alone in vehicles. Child Presence Detection (CPD) systems offer a solution by alerting caregivers when a child is in the back seat, yet adoption rates are low. This study investigates this relationship, surveying 83 participants on CPD awareness and intent to purchase. The results indicate that 22.2% of respondents who had experienced unattended child cases were aware of CPD systems, compared to 17.9% of those without such experiences. Additionally, 74.1% of respondents with a history of unattended children expressed a willingness to buy CPD systems, compared to 64.3% of those without such experiences. Significant associations were found between CPD knowledge and government employment ($X^2 = 6.245$, $p = 0.043$), suggesting workplace education influences attitudes. However, most demographic factors showed no significant correlation with CPD knowledge or purchasing intent. Further analysis revealed no significant association between CPD knowledge and intent to purchase, indicating other factors influence buying decisions. This highlights the need for diverse strategies to promote CPD, focusing on benefits, and reducing barriers, and social norms. Future research should explore more factors affecting purchasing behavior to develop effective promotion strategies and improve child safety in cars.*

KEYWORDS: Child Presence Detection (CPD) system, unattended children, vehicle, Malaysia, purchasing

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1. INTRODUCTION

Ensuring the safety of children during vehicular transportation is a critical concern worldwide. Tragic incidents, where children are left unattended in vehicles, often result in life-threatening situations such as vehicular heatstroke (Husain et al., 2020). These incidents highlight the urgent need for effective preventive measures to protect children, especially in detecting unattended children in vehicles to mitigate the risks (Rosli et al., 2019). In response to this issue, Child Presence Detection (CPD) systems have emerged as promising technological solutions. CPD systems are designed to detect child presence in the rear seat of a vehicle and notify caregivers, providing a crucial safeguard against potential harm. CPD systems utilize various sensor technologies to detect a child's presence in a vehicle and issue alerts to caregivers (Ismail et al., 2019). These systems have garnered significant attention due to their potential to prevent heatstroke deaths and other accidents resulting from children being left unattended in vehicles. Research has shown that even brief exposure to high temperatures in vehicles can pose severe health risks to children, making timely intervention critical (Williams et al., 2018). As such, the development and adoption of effective CPD systems represent a critical step forward in child safety efforts.

The prevalence of child heatstroke incidents in vehicles poses a significant public health concern globally. According to statistics, hundreds of children die annually due to heatstroke after being left unattended in vehicles (Alowirdi et al., 2020). This alarming trend underscores the urgent need for effective preventive measures, including technological solutions like CPD systems. The past few decades have seen significant advancements in vehicle safety technologies within the automotive industry. From airbags to lane departure warning systems, manufacturers continuously strive to integrate cutting-edge features that enhance occupant safety (Alsayaydeh et al., 2023). CPD systems represent the latest frontier in this domain, offering a proactive approach to addressing a specific safety issue. These systems leverage advanced sensors and algorithms to detect child presence and issue timely alerts, thereby preventing potential tragedies (Zhang et al., 2023).

Despite the potential benefits of CPD systems, their adoption rates remain relatively low. The decision to invest in such technology often hinges on individuals' awareness and understanding of its functionality, efficacy, and implications. Despite the potential life-saving benefits of CPD systems, research suggests that many consumers remain unaware of their existence or functionality. Moreover, there may be misconceptions or reservations regarding the reliability and effectiveness of these systems. Understanding consumers' knowledge levels and perceptions is crucial for informing marketing strategies and promoting adoption. Studies indicate that greater knowledge and awareness of safety technologies positively correlate with purchase intentions (Wang & Hazen, 2016). Several factors influence individuals' intention to purchase safety features in vehicles. These include perceived usefulness, perceived risk, perceived ease of use, and subjective norms. The Technology Acceptance Model (TAM) and related frameworks suggest that perceived ease of use and usefulness significantly affect technology adoption (Sugandini et al., 2018). However, cultural and contextual factors may influence these relationships differently across regions.

Malaysia represents a unique cultural and market environment where factors such as affordability, technological literacy, and cultural attitudes toward child safety converge. While the Malaysian government has taken steps to promote child safety in vehicles, including regulations mandating child restraint systems, the adoption of advanced safety technologies like CPD systems may vary among different demographic segments. Comprehending these variations is essential for designing effective interventions specific to the Malaysian context. By synthesizing existing literature on child heatstroke incidents, technological innovations in vehicle safety, consumer perceptions of CPD systems, and factors influencing purchase intentions, this study aims to enhance our understanding of the dynamics shaping the adoption of CPD systems among adults in Malaysia. This research aims to provide valuable insights that can inform strategies to encourage the use of CPD systems, thereby enhancing child safety in vehicles.

2. METHODOLOGY

2.1 Study Design

This research utilized a cross-sectional survey design to investigate the relationship between knowledge of Child Presence Detection (CPD) systems and the intention to purchase CPD among respondents. This design allowed for capturing data at one point in time, making it possible to examine the relationship between CPD system knowledge and purchase intention within a specific timeframe.

2.2 Participants

Participants were recruited using convenience sampling techniques, ensuring a diverse representation across various demographics. The sample comprised 83 individuals, strategically sourced from online platforms and community networks. This approach aimed to capture a broad spectrum of perspectives and experiences regarding CPD system awareness and purchase intent.

2.3 Data Collection

Data collection was executed through the dissemination of meticulously structured questionnaires via electronic platforms. These questionnaires were thoughtfully designed to encompass multifaceted sections addressing demographic particulars, incidences of unattended children, familiarity with CPD

system, and the inclination towards procuring the CPD system. The electronic format of data collection facilitated convenience and accessibility for participants, enhancing the likelihood of robust responses.

2.4 Data Analysis

Upon data collection, the statistical software Statistical Package for Social Science (SPSS) version 22 was used to analyze the gathered information. Descriptive statistical techniques were utilized to summarize the demographic composition of the sample, instances of unattended children, levels of CPD system awareness, and the intensity of the desire to purchase a CPD system. Furthermore, inferential statistical methods, including chi-square tests and odds ratios, were systematically applied to delve into the potential correlations between all the variables. These analytical approaches allowed for a rigorous examination of the relationship between the variables under investigation.

2.5 Ethical Considerations

This study followed strict ethical guidelines to ensure the protection and well-being of all participants. This study received ethical approval from the IIUM Research Ethics Committee (IREC) [ID Number: IREC 2022-123]. All participants provided informed consent before participating in the study. Confidentiality and anonymity were rigorously maintained throughout the research process.

3. RESULTS

3.1 Demographic Data

Eighty-three respondents participated in this survey. Table 1 presents their demographic data. Most respondents are female (75.9%), while males represent 24.1%. The largest age group is 31 to 40 years old (55.4%), followed by those aged 41 to 50 (37.3%). Respondents aged 20 to 30 years comprise 3.6% of the sample. Most respondents are married (89.2%), with single individuals making up 7.2%, and a small percentage (3.6%) are divorced or widowed. Degree holders constitute the majority (78.3%), followed by diploma holders (14.5%) and high school graduates (7.2%). Household incomes are predominantly above RM5,000, with 49.4% earning RM7,500 or more. Government employees are the largest employment sector (53.0%), followed by the private sector (27.7%), with 19.3% being unemployed. Most respondents have 3-4 children (50.6%), while those with 1-2 children constitute 30.1%, and 6.0% have no children. Approximately one-third (32.5%) have experienced leaving a child unattended in a vehicle, while 67.5% have not.

3.2 Child Presence Detection System (CPD) and Cases of Unattended Children

All respondents were asked about their knowledge of Child Presence Detection (CPD) systems in vehicles and their willingness to purchase such systems if available. Among the 27 respondents who had experienced cases of unattended children, 22.2% reported knowing CPD systems. In contrast, 17.9% of the 56 respondents without such cases were aware of CPD systems. Overall, 19.3% of the entire sample reported knowledge of CPD systems. The odds ratio (OR) of 1.314, with a 95% confidence interval (CI) of 0.422 to 4.094, suggests a slightly higher likelihood of CPD system knowledge among those with cases of unattended children, though this is not statistically significant. Regarding the intention to purchase CPD systems, 74.1% of respondents with cases of unattended children expressed a willingness to buy CPD systems, compared to 64.3% of those without such cases. Overall, 67.5% of the entire sample indicated an intention to purchase CPD systems. The OR of 1.587, with a 95% CI of 0.573 to 4.400, indicates that respondents with a history of unattended children are more likely to intend to buy CPD systems compared to those without such a history, although this finding is also not statistically significant.

TABLE 1: Demographic data of respondents

Items	*n*	%
Gender		
Male	20	24.1
Female	63	75.9
Age		
20 – 30 years old	3	3.6
31 – 40 years old	46	55.4
41 – 50 years old	31	37.3
≥ 51 years old	3	3.6
Marital Status		
Single	6	7.2
Married	74	89.2
Divorced/Widowed	3	3.6
Education Background		
High School	6	7.2
Diploma	12	14.5
Degree	65	78.3
Household Income		
RM 1000 – 2999	3	3.6
RM 3000 – 4999	22	26.5
RM 5000 – 7499	17	20.5
≥ RM 7500	41	49.4
Working Sector		
Government	44	53.0
Private	23	27.7
Unemployed	16	19.3
No. of Children		
0	5	6.0
1 – 2	25	30.1
3 – 4	42	50.6
≥ 4	11	13.3
Unattended Children Case		
Yes	27	32.5
No	56	67.5

Note. *N* = 83

TABLE 2: Estimation of total weight and impact speed of striking vehicles

	With Case of Unattended Children (*n* = 27)		**Without Case of Unattended Children (*n* = 56)**		**Total (*N* = 83)**		**OR**	**95% CI**
	n	**%**	***n***	**%**	***n***	**%**		
Knowledge on CPD								
Yes	6	22.2	10	17.9	16	19.3		
No	21	77.8	46	82.1	67	80.7	1.314	.422, 4.094
Intention to Buy CPD								
Yes	20	74.1	36	64.3	56	67.5		
No	7	25.9	20	35.7	27	32.5	1.587	.573, 4.400

3.3 Relationship Between Demographic and Child Presence Detection (CPD) System

The relationship between demographic characteristics and knowledge of the CPD system, as well as the intention to buy the CPD system, was analyzed. Table 3 presents the results of this analysis. The findings indicate no significant associations between knowledge of CPD system and various demographic factors, including gender ($X^2 = 0.310$, $p = 0.578$), age ($X^2 = 1.474$, $p = 0.688$), marital status ($X^2 = 0.790$, $p = 0.674$), education level ($X^2 = 2.960$, $p = 0.228$), household income ($X^2 = 5.485$, $p = 0.140$), number of children ($X^2 = 1.429$, $p = 0.699$), and the presence of unattended children ($X^2 = 1.429$, $p = 0.699$). However, there is a significant association between knowledge of the CPD system and the employment sector of the respondents ($X^2 = 6.245$, $p = 0.043$), indicating that government employees may have better knowledge about CPD compared to those in the private sector. Regarding the intention to buy CPD system, the results show no significant association with any demographic factors, including gender ($X^2 = 0.077$, $p = 0.782$), age ($X^2 = 2.079$, $p = 0.560$), marital status ($X^2 = 0.003$, $p = 0.999$), education level ($X^2 = 3.774$, $p = 0.151$), household income ($X^2 = 4.837$, $p = 0.184$), employment sector ($X^2 = 2.735$, $p = 0.255$), number of children ($X^2 = 1.267$, $p = 0.737$), and the presence of unattended children ($X^2 = 0.795$, $p = 0.373$).

TABLE 3: Demographic and Child Presence Detection (CPD) System

Items	Knowledge on CPD		Intention to Buy CPD	
	X^2	p	X^2	p
Gender	0.310	0.578	0.077	0.782
Age	1.474	0.688	2.079	0.556
Marital Status	0.790	0.674	0.003	0.999
Education Background	2.960	0.228	3.774	0.151
Household Income	5.485	0.140	4.837	0.184
Working Sector	6.245	0.043*	2.735	0.255
No. of Children	1.429	0.699	1.267	0.737
Unattended Children Case	0.233	0.637	0.795	0.373

*$p < 0.5$

3.4 Relationship Between Knowledge of CPD System and Intention to Buy CPD System

The analysis examined the connection between knowledge of the CPD system and the intention to buy the CPD system, with results presented in Table 4. The non-significant p-value indicates a lack of strong evidence for an association between CPD system knowledge and the intention to purchase it ($X^2 = 1.267$, $p = 0.737$). The OR is 0.761 which would typically suggest that higher knowledge about the CPD system is associated with a lower intention to buy the CPD system. However, since the value is not statistically significant, we can conclude that the odds of intending to buy a CPD system are not significantly influenced by CPD system knowledge. This suggests that factors beyond CPD system knowledge likely impact the decision to purchase a CPD system.

TABLE 4: Knowledge of the CPD system and intention to buy the CPD system

	Knowledge on CPD			
	X^2	p	OR	95% CI
Intention to Buy CPD	0.223	0.637	0.761	0.244, 2.370

4. DISCUSSION

This study explored the relationship between knowledge of Child Presence Detection (CPD) systems and the intention to purchase such systems among respondents, with a particular focus on those who had experienced cases of unattended children in vehicles. The results indicate that 22.2% of respondents who had experienced unattended child cases were aware of CPD systems, compared to 17.9% of those without such experiences. Additionally, 74.1% of respondents with a history of unattended children expressed a willingness to buy CPD systems, compared to 64.3% of those without such experiences. The findings of this study are consistent with previous research on consumer behavior and safety device adoption. According to the Health Belief Model (HBM), individuals are inclined to take health-related actions when they perceive personal risk and believe that a specific action can reduce this risk. (Orji et al., 2012). In this context, the slightly higher knowledge of CPD systems among respondents with unattended child cases could be attributed to their direct experience with the risks involved, which may heighten their perceived need for such systems.

However, the lack of statistical significance in the relationship between knowledge and intention to purchase CPD systems suggests that knowledge alone may not be sufficient to drive purchasing decisions. While knowledge and awareness are important, they must be complemented by other factors such as perceived benefits, perceived severity, and cues to action to effectively influence behavior (Alshaikh & Adamson, 2021). Moreover, consumer research indicates that purchasing decisions, especially for safety devices, are often influenced by multiple factors including perceived product efficacy, cost, and social influences (Santy & Atika, 2020). The Theory of Planned Behaviour (TPB) suggests that the intention to engage in a behavior is affected not just by attitudes and knowledge, but also by subjective norms and perceived behavioral control (Simatupang et al., 2022). In this study, the higher intention to purchase CPD systems among those with unattended child cases could reflect their heightened perceived need for the product, influenced by their personal experiences. However, the broader lack of significant association implies that factors such as product affordability, perceived ease of use, and societal norms might also play crucial roles.

The analysis of the relationship between demographic characteristics and both knowledge of Child Presence Detection (CPD) systems and the intention to purchase CPD systems revealed several key findings. Notably, most demographic factors, including gender, age, marital status, education level, household income, number of children, and the presence of unattended children, showed no significant association with knowledge of CPD or the intention to buy CPD systems. However, a significant association was found between knowledge of CPD and the employment sector of respondents, suggesting that government employees may have better knowledge about CPD systems compared to those in the private sector. The lack of significant associations between most demographic factors and knowledge of CPD is consistent with existing literature, which often highlights that knowledge and awareness of safety technologies can be relatively uniform across different demographic groups, provided they have access to similar information channels (Li et al., 2021). For instance, a study by Abuhlega & Abduljalil (2022) found that demographic variables such as age and gender were less predictive of safety knowledge than factors like exposure to safety information and educational interventions.

The significant association between the employment sector and knowledge of CPD is intriguing and suggests that workplace environment and professional exposure can influence individuals' knowledge and attitudes toward certain technologies. Government employees often have more structured access to safety training and information dissemination compared to those in the private sector, potentially explaining their higher awareness of CPD systems (Abd Rahman & Kamil, 2022). Additionally, public sector employees may be more engaged in regulatory and policy-related information dissemination, which can enhance their knowledge about safety technologies. Regarding the intention to purchase CPD systems, the lack of significant associations with demographic factors is noteworthy. The Theory of Planned Behaviour suggests that intention is influenced by subjective norms, attitudes, and perceived behavioral control rather than demographic characteristics. This theory suggests that while demographic factors can provide context, they are not the primary drivers of intention to engage in specific behaviors, including the purchase of safety devices. Furthermore, previous research has indicated that the intention to purchase safety devices is more strongly influenced by individual perceptions of risk, perceived benefits of the technology, and personal experience with safety incidents (Vafaei-Zadeh et al., 2021). This perspective helps to understand why demographic variables did not

show significant associations with the intention to buy CPD systems in this study. Personal experiences, such as having dealt with unattended children incidents, although not statistically significant in this analysis, could still be more influential on purchase intentions compared to static demographic characteristics.

The analysis of the relationship between knowledge of Child Presence Detection (CPD) systems and the intention to purchase these systems revealed that there is no statistically significant association between the two variables. The odds ratio (OR) suggests a trend where greater knowledge about CPD could be associated with a lower intention to buy, but this finding is not statistically significant, indicating that knowledge alone does not substantially influence purchasing decisions. This suggests that other factors likely play a more critical role in influencing the decision to purchase CPD systems. The finding that knowledge of CPD systems does not significantly influence the intention to purchase aligns with prior literature that highlights the complexity of consumer behavior in the context of safety technology adoption. According to the Theory of Planned Behaviour, behavior intention is influenced not only by knowledge but also by subjective norms, attitudes, and perceived behavioral control (Hagger et al., 2022). Therefore, while knowledge is a component, it is not solely determinative.

Research by Sheeran et al. (2016) suggests that the gap between knowledge and action can be substantial in health-related behaviors, and this can extend to the adoption of safety technologies. Intention to act is more strongly influenced by personal attitudes and the perceived efficacy of the intervention. In the context of CPD systems, individuals might possess the knowledge but may not perceive the systems as necessary or effective, thereby reducing their intention to purchase. Moreover, literature on risk perception indicates that personal experiences and perceived vulnerability are significant determinants of safety behavior adoption (Rimal & Real, 2003). For instance, parents who have had near-miss experiences or are more anxious about the risk of leaving a child unattended may be more likely to purchase CPD systems, regardless of their knowledge level. This aligns with the finding that the presence of unattended children was not a significant factor in influencing knowledge but showed some correlation with purchase intention, though not statistically significant in this study.

In the domain of consumer technology adoption, factors such as cost, ease of use, and perceived benefits often outweigh simple knowledge of the product (Featherman et al., 2021). The Diffusion of Innovations theory by Rogers suggests that innovations are adopted not just based on awareness but also on how potential users perceive the relative benefit of the innovation, its compatibility with current values and practices, and its level of complexity (Dearing & Cox, 2018). For CPD systems, practical considerations such as the cost of the system, ease of installation, and maintenance, as well as the perceived direct benefit to the user, might significantly influence the intention to purchase more than just knowledge of the system.

4.1 Research Implications

The findings of this study have important implications for public health campaigns and marketing strategies aimed at increasing the adoption of Child Presence Detection (CPD) systems. Simply raising awareness about CPD systems may not be sufficient to drive their adoption. Effective strategies should address other influencing factors, such as enhancing the perceived benefits of CPD systems, reducing perceived barriers to purchase such as cost concerns, and leveraging social norms to encourage uptake. Additionally, targeted interventions could be designed to reach specific demographic groups, such as parents who have experienced unattended child incidents, as they may be more receptive to adopting CPD systems. Increasing knowledge and intention to purchase CPD systems may require strategies beyond targeting specific demographic groups. Efforts could focus on enhancing general public awareness through targeted educational campaigns and leveraging workplace training programs, particularly in the private sector. Given the significant association between the employment sector and CPD knowledge, partnerships with private companies to integrate safety technology information into employee training programs could be beneficial. These findings highlight the need for comprehensive strategies to increase the adoption of CPD systems. While increasing awareness is important, it is equally crucial to address perceived barriers and enhance the perceived benefits of CPD systems. Public health campaigns and marketing strategies should focus on demonstrating the effectiveness and reliability of CPD systems, potentially through testimonials and endorsements from users who have benefited from these systems. Additionally, policymakers and manufacturers could consider providing

incentives such as subsidies or insurance discounts for users who install CPD systems. Ensuring that these systems are affordable and easily accessible can play a significant role in encouraging adoption.

5. CONCLUSION

In conclusion, this study found a slightly higher likelihood of CPD system knowledge and purchase intention among those with a history of unattended children, but these associations were not statistically significant. Additionally, while there was a significant association between the employment sector and CPD knowledge, most demographic factors were not significantly related to knowledge or intention to purchase CPD systems. These findings suggest that personal experience with child safety risks and workplace education can influence attitudes toward CPD systems, but additional factors must be addressed to significantly impact purchasing behavior. Future research should explore these additional factors, such as personal attitudes, perceived effectiveness, risk perception, and practical considerations, to develop comprehensive strategies for promoting the adoption of CPD systems. Public health campaigns and marketing strategies should focus on enhancing perceived benefits, reducing perceived barriers, and leveraging social norms to encourage uptake, ultimately enhancing child safety in vehicles.

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