Understanding parent and caregiver perceptions of paediatric vehicular hyperthermia: implications for public health messaging from a pilot study

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ABSTRACT

Background Paediatric vehicular hyperthermia (PVH) is the leading cause of non-crash vehicle-related death of children in the USA. Public health messaging is an important mitigation strategy, yet it is difficult to assess the effectiveness in reducing deaths. Here, we seek to better understand parent/caregiver perceptions on PVH to guide risk communication.

Methods This pilot study focuses on a subset of participants (n=127) from a national survey, comprising parents/caregivers who met specific eligibility criteria (ie, those who both drive and have children ≤5 years of age). Survey participants answered questions about the perceived severity of forgetting a child in a hot car and their susceptibility to doing so, with responses recorded on a 7-point Likert scale (1=strongly disagree and 7=strongly agree).

Results Our findings indicate that while on average (mean responses of 2.45 and 2.49) parents/caregivers did not consider themselves susceptible, they did acknowledge the severity (mean response of 6.12) of leaving a child unattended in a vehicle. The results suggest that because of this low perceived susceptibility, parents/caregivers are less likely to take protective actions aimed at preventing these incidents from happening.

Conclusions Public health messaging on PVH should emphasise the universal risk to all parents/caregivers so as to foster greater awareness of the need to take protective actions. Furthermore, engaging secondary audiences such as teachers and healthcare professionals can amplify this message and offer concrete behavioural interventions to mitigate the risk of forgetting a child in a car.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Paediatric vehicular hyperthermia (PVH) is one of the leading causes of non-crash vehicle-related deaths of children in the USA. Public health messaging has been a widely used prevention strategy to communicate the risk of PVH to parents/caregivers.

WHAT THIS STUDY ADDS

⇒ Our study provides insight into parent/caregiver risk perceptions that can be used to better inform public health messaging strategies.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Public awareness campaigns and public health messaging should emphasise the universal risk that anyone can forget a child in a car. This approach may foster heightened awareness and increase the likelihood that parents/caregivers will take protective actions to prevent such incidents.

INTRODUCTION

Paediatric vehicular hyperthermia (PVH) is one of the leading causes of non-crash vehicle-related deaths of children under 14 in the USA.[1] On average, approximately 37 children die each year in hot cars, with a total of at least 968 deaths from 1998 to 2023.[2] These deaths are caused by exposure to the very hot temperatures that can occur in a vehicle, which acts like a greenhouse.[3–7] This phenomenon occurs via children forgotten (53%), gaining access (25%), knowingly left in a vehicle (20%) and unknown causes (2%).[2]

Public health messaging campaigns by government agencies and child advocacy groups have been one approach to communicate the risk of PVH to parents/caregivers. The effectiveness of these messaging campaigns, however, is difficult to assess because there is no clear trend in the number of deaths over time.[2] There is little research on understanding parent/caregiver perceptions, which could be used to better inform messaging strategies. A study by Williams and Grundstein[8] interviewed parents/caregivers about forgetting children in hot cars and found that a majority (52%) of parents/caregivers did not think they could forget their child in the car (ie, low risk), indicating low perceived susceptibility.[8] In fact, the majority of participants (84%) felt that 'unfit' parents and those with certain lifestyle factors were most likely (ie, high chance) to forget a child in a hot car.[8] In this pilot study, we expand on this existing work to quantify parents'/caregivers' risk perceptions with regard to PVH and their likelihood of forgetting a child in a car. We hypothesised that parents/caregivers of young children find PVH and its potential consequences serious, but do not believe they could, or would, forget a child in a car themselves.

METHODS

We conducted a national survey using the Qualtrics online survey platform from 20 August 2020 to 8 September 2020 and obtained 1041 complete responses. The survey encompassed a range of

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Table 1 Health believe model-based survey questions and summary statistics of responses*

Question no	Survey question Likert scale (1=strongly disagree and 7=strongly agree)	Mean	SD	Count
Severity				
1	Please indicate your agreement or disagreement with the following statements. I would be devastated if I were to forget a child in a car.	6.12	1.53	127
Susceptibility				
2	Please indicate your agreement or disagreement with the following statement. I believe I am at risk of forgetting a child in a car.	2.45	2.01	127
3	Please indicate your agreement or disagreement with the following statement. I believe that my chances of forgetting a child in a car are high.	2.52	2.14	127
COVID-19-related susceptibility				
4	Please indicate your agreement or disagreement with the following statement. In light of the recent COVID-19 outbreak, I believe my chances of forgetting a child in a car are higher.	2.49	2.12	127

*Responses to all four questions had a minimum=1 and a maximum=7.

topics, one of which was PVH. To focus on our research question, we implemented skip logic that filtered respondents based on two main criteria: (1) if they were the parent or caregiver of a child 5 years of age or younger and (2) if they drove a vehicle. We recognise as a limitation that this filtering of participants may not indicate they are in fact driving small children. In total, we obtained 127 responses that met our criteria and formed our subset of interest.

The health belief model (HBM) was used as a theoretical framework in designing our survey questions. The HBM is a behaviour change theory that assesses the threat perception and behavioural intentions of an individual from among a suite of cognitive variables, including perceived susceptibility to a threat, perceived degree of consequences and the presence of options available to engage in preventative measures.[9] This approach has been applied in the context of heat hazards and as a means to improve communication practices for extreme heat events.[9–11] Here, we focused on questions assessing the severity (question 1) and susceptibility (questions 2 and 3) of HBM variables, building on previous work by Williams and Grundstein (table 1).[8] In addition, considering the study's timeline during the COVID-19 pandemic, we included a COVID-related question (question 4) to assess if our respondents perceived an increase in their susceptibility to forgetting a child due to the pandemic. A seven-point Likert rating scale was used for question responses (1=strongly disagree to 7=strongly agree).

We first assessed the internal consistency among the severity (question 1) and susceptibility (questions 2 and 3) responses using Spearman's rank-order correlation (ρ). Higher correlations approaching 1 (−1) indicate stronger positive (negative) consistency between items. Next, we computed summary statistical measures, including the mean (M), for each of the four survey questions (table 1). Finally, we used within-subject t-tests to compare the means of the susceptibility question responses (questions 2 and 3) vs the mean of the severity question responses (question 1). Statistical significance was identified at the $p<.05$ level. All statistical analyses were performed y using SPSS (V.26; IBM).

RESULTS

The subset of 127 complete responses included respondents from 27 states spread across the continental USA and locations that were rural (9%), suburban (48%) and urban (43%). The sample included a diverse population with a mean age of 38.6±9.6 years and included both men (45%) and women (55%), a variety of annual income levels from <US$19k to over US$150k, and races including white non-Hispanic, white-Hispanic, black/African American, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander.

We observed a strong correlation (ρ=0.836) between the two susceptibility questions (questions 2 and 3), which indicates that these questions capture the same concept. There were inverse correlations between the severity and susceptibility questions with ρ=−0.466 between questions 1 and 2, and ρ=−0.427 between questions 1 and 3.

We compared the mean values of participant responses from questions 1–3 (table 1). On average, parents/caregivers felt they were at low risk of forgetting a child in a car as shown by the perceived susceptibility question responses (question 2 M=2.45 and question 3 M=2.52 on the 7-point scale), but their perception of the severity, if these were to occur, was greater (question 3 M=6.12) (table 1). The difference in the mean between each susceptibility question and severity question (ie, question 1 vs 2, and question 1 vs 3) were significant at $p<.001$. Finally, parents/caregivers, on average, did not feel that they were more likely to forget a child in a car in light of the COVID pandemic (question 4 M=2.49; table 1).

DISCUSSION AND CONCLUSIONS

Our findings are consistent with other studies.[8 12] We found that parents/caregivers, on average, did not personally feel susceptible to forgetting a child, although they did feel leaving a child in a car was a serious matter. Therefore, parents/caregivers with low perceived susceptibility may neglect crucial steps like double-checking the backseat, using visual cues or even installing child safety devices, putting their children at increased risk. Alternatively, it is possible that participants did not feel susceptible because they were taking some sort of protective actions.

The work of Williams and Grundstein[8] helps to provide context to our findings. Parents/caregivers in their study mostly did not feel they were at risk of forgetting a child but overwhelming believed that others who had lifestyle factors like being a single parent or low income had a higher likelihood of doing so. Experts interviewed in this study suggested that media narratives highlighting cases where children were intentionally left in vehicles may amplify the 'others but not them' bias, framing the issue as one primarily driven by irresponsible parents.

The problem of low perceived susceptibility is recognised more broadly in heat hazard messaging. Research suggests that people, even vulnerable groups such as older adults, tend to

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underestimate the personal risks caused by extreme heat and are less likely to take protective actions.[13–19] Participants in these studies, similar to the parents/caregivers in Williams and Grundstein[8] often saw themselves as separate from the 'vulnerable' group in terms of age, health status or social situation, and they did not personally feel vulnerable to the health risks from heat. Building on these findings, Li and Howe[20] observed that communicating the idea that 'anyone can be at risk' was more personally relevant than those messages that included susceptibility information (eg, older adults are more at risk).[20] Thus, our findings suggest that public awareness campaigns on PVH should emphasise the universal risk that anyone can forget a child in a car, prompting heightened awareness to take protective actions.

Further, Grothmann *et al*[11] noted that public health messaging to a secondary group who often interacts with the target audience may be helpful.[11] For example, they observed that mobile nurses who often interact with older adults could act directly as 'protectors' (eg, provide hydration, take measures to cool patients), serve as 'multipliers' (eg, raise awareness among the older adults and their relatives) and as 'motivators' to encourage self-protective behaviour. A second recommendation, then, is that public health messaging targeted towards groups such as teachers and medical professionals, who regularly interact with parents/caregivers, could be an effective additional approach for raising perceived susceptibility.

Third, we recognise that technology may be a powerful tool in reducing PVH deaths. For example, car seats with sensors that alert parents if a child is left behind could help prevent PVH deaths, even for parents who believe they will never forget their child. Yet, it may take decades for the vehicle fleet to be fully equipped with reminder and detection technology, and in the meantime, public health messaging is a critical tool in mitigating PVH.

Finally, while supportive of previous work, our exploratory study's small sample size limits its conclusiveness. Future research with larger and more representative samples can further validate these findings and inform effective PVH prevention strategies. A larger study could also engage the suite of HBM questions more fully and investigate other circumstances leading to PVH such as knowingly leaving a child in a car.

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Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and this study received IRB approval from the University of Georgia on 7/31/2020 (IRB ID: STUDY00001227). Participants gave informed consent to participate in the study before taking part.

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