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Driving Safety: Concerns and Experiences of Parents of Adolescent Drivers with Type 1 Diabetes

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Abstract

Driving is a dangerous activity for adolescents, perhaps being even more precarious for adolescents with type 1 diabetes due to the possibility of extreme blood glucose (BG). There is no available data on adolescent driving safety concerns and type 1 diabetes. To begin addressing this issue, we surveyed parents regarding their observations and concerns. Seventy-two parents (87.5% mothers) of adolescent drivers aged 16–19 with type 1 diabetes provided analyzable data. Females comprised 36% of their adolescents, with 74% using pump therapy. In the past year, 13% and 84% of parents reported their adolescent had experienced severe or moderate disruptive hypoglycemia, respectively. Over half (56%) of the parents reported moderate to extreme worry about how diabetes impacted their adolescent's driving, while only 21% of parents thought their adolescents had similar concerns (p=.037). Almost a third (31%) of parents thought their adolescent need not treat low BG until it fell below 70mg/dl; 13% thought their adolescent could safely drive with BG below 65mg/dl. And, 31% and 14% of parents, respectively, reported their adolescent had been in a collision or stopped by the police in the past year, which they attributed to both hypo- and hyperglycemia. Adolescents reportedly took steps to prevent hypo- and hyperglycemia while driving, but more aggressively avoided hypoglycemia (p's<.001). While this data is limited, lacking a non-diabetic control group and randomized sample, it does suggest that driving and adolescent type 1 diabetes deserves further attention and investigation.

Keywords

Hypoglycemia; Hyperglycemia; Driving; Parents; Adolescent Type 1 Diabetes

INTRODUCTION

Adults with type 1 diabetes have nearly twice as many vehicular collisions than their non-diabetic spouses[1]. This increased risk of vehicular collisions is attributed to the cognitive-motor-perceptual disruptions caused by extreme blood glucose (BG) levels, especially those associated with hypoglycemia.[2,3] Like risk of severe hypoglycemia,[4] risk of vehicular collisions is not equally distributed across all drivers with type 1 diabetes. Adult drivers with type 1 diabetes at higher risk for vehicular collisions differ in several ways from those drivers at lower risk. These include greater insulin sensitivity, less epinephrine release when hypoglycemic, increased cognitive and driving impairments at mild hypoglycemia, and fewer discriminating symptoms of hypoglycemia, as well as poorer judgment regarding when not to drive during hypoglycemia.[5,6,7,8]

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Vehicular collisions are more common among adolescents than drivers between the ages of 21–80, and collisions are the leading cause of death for adolescents in the U.S.[9] This high accident rate is traditionally attributed to inexperience and poor judgment.[10] Adolescents with type 1 diabetes have shown a deterioration in their diabetes management in the transition from parental care to self-care, resulting in poorer metabolic control and more extreme BGs.[11] Therefore adolescents with type 1 diabetes may be particularly vulnerable to vehicular collisions. As a preliminary exploration into this area, we conducted an Internet survey of parents of adolescent drivers with type 1 diabetes to test the hypothesis that parents are concerned that diabetes impacts the adolescents' driving safety due to extreme BG.

METHODS

Participants

We posted an Internet survey (complete survey available upon request) via SurveyMonkey on three diabetes-specific websites (www.childrenwithdiabetes.com, www.dLife.com, and http://behavioraldiabetesinstitute.org/). Of the 139 parents who started the survey, 18 came from the same IP address and were dropped to reduce possible redundancy. Of the remaining 121 surveys, 40 were incomplete, allowing full data analysis of 72 parent surveys (87.5% mothers). For the included parents, all of their children were between the ages of 16 and 19 with type 1 diabetes, 36% of whom were female. All of their adolescents had an independent driver's license. The sample was 100% Caucasian, and the age of diagnosis ranged from 1–17 years. Most parents (90%) reported that their adolescents performed self-measurement of blood glucose (SMBG) three or more times a day, and 7% reported that their adolescents used continuous glucose monitoring. Adolescent insulin pump therapy usage was reported by 74% of parents. Severe hypoglycemia in the past year was only reported by 13% of the parents. However, over that same time period, 84% reported at least one episode of moderate disruptive hypoglycemia (BG so low that the adolescent could not continue his/her routine behavior due to neuroglycopenia, and had to stop and treat the low BG) and 40% of the sample reported ten or more such episodes. Only eight parents responded when queried about co-morbidities that could also impact driving and contribute to collisions. Of those eight parents, five said that their adolescent was diagnosed with Attention-Deficit Hyperactivity Disorder (ADHD; two of which were medicated), three with insomnia, one with narcolepsy, and one with epilepsy.

RESULTS

Concerns

As seen in Table 1, 56% of the parents reported being moderately to extremely worried about how diabetes impacted their adolescent's driving, while only 21% of the parents thought their adolescents had similar concerns. A chi-square test revealed significant differences between parents' worry and their perception of their teen's concern, i.e. parents thought they were significantly more concerned than were their teens ($\chi^2 = 4.33$, p=.037). Nevertheless, 8% never worried about hypoglycemia and driving for their adolescent. When asked, *how low does your adolescent's blood sugar need to go before YOU think s/he should treat it?,* 18% of the parents said 65–69mg/dl while 13% endorsed a treatment threshold below 65mg/dl.

This concern is put in perspective when considering the parents' responses to the 15-item Worry Subscale of the Hypoglycemia Fear Survey.[12] Parents' top two concerns about hypoglycemia were: *having an insulin reaction (hypoglycemic episode) while asleep* and *getting into an accident while driving due to low blood sugar*, where 65% of the parents

reported worrying about such events *sometimes* or *often*, using a four-point scale (*never, rarely, sometimes, often*).

Experiences

Most parents (67%) were unaware of their adolescent being involved in any vehicular collision, while 29% and 3% of the parents reported their adolescent had been in one or two collisions, respectively. Of those collisions, 9% of parents attributed one accident to extreme low BG and 5% attributed one accident to extreme high BG.

For police traffic stops, 11 and 3% of parents reported that their adolescent had been pulled over by police once or twice, respectively. These stops were not attributed to low BG. High BG was reported as a cause by two of the ten parents who reported that their teen had been stopped by the police.

Using questions from our adult prospective study,[3] 7% of the parents affirmed the questions, *did your adolescent become disoriented, get lost, or arrive at their destination with no memory of driving there due to hypoglycemia* and *did someone else take control of your adolescent's car due to hypoglycemia.* Four percent of the parents reported their adolescent had experienced at least one episode of severe hypoglycemia while driving and 29% reported their adolescent had at least one episode of disruptive moderate hypoglycemia while driving.

Prevention

Table 2 lists what parents believed their adolescents do to avoid diabetes-related driving mishaps. Parents reported adolescents taking more proactive steps to deal with hypoglycemia than hyperglycemia. Paired-sample t-tests revealed significantly higher responses to *deciding not to drive if BG were too low* ($M = 3.9$, $SD = 1.1$) and *pulling over when BG became too low* ($M = 3.8$, $SD = 1.1$) compared to their responses to these same questions about high BG ($M = 2.8$, $SD = 1.2$; $M = 2.6$, $SD = 1.2$), $t_1 = 9.0$, $p < .001$; $t_2 = 9.1$, $p < .001$). Of note, less than half of the parents believed their adolescent *often* or *always* checks their BG either before they drive (44%) or when they experience symptoms while they drive (42%).

DISCUSSION

These preliminary data suggest that parents are concerned about diabetes impacting their adolescent's driving safety, more than the adolescents themselves, and that the parents' greatest worry is the impact of hypoglycemia on driving safety. The legitimacy of this parental concern is supported by the fact that 40% of the parents reported their adolescents having 10 or more episodes of disruptive moderate hypoglycemia within the past 12 months. It is important to note that moderate hypoglycemia has been repeatedly shown to impair driving performance of adult drivers with type 1 diabetes[13,14,15,16] and presumably this can be extrapolated to adolescent drivers with type 1 diabetes.

Consistent with the growing evidence that both acute hypoglycemia and hyperglycemia are associated with cognitive-motor-perceptual dysfunction and vehicular collisions,[17,18,19,20,21,22,23] parents reported that their adolescent would *often* or *always* pull off the road if their BG was *too high or rising rapidly* (26%) and *too low or falling* (59%). Additionally parents attributed some driving mishaps to both hypoglycemia and hyperglycemia.

Two major limitations to this study are: 1) this is subjective data, reflecting retrospective recall and attributions, and 2) this is not a random sample of parents with adolescents

dealing with type 1 diabetes and driving. Parents who completed this survey may represent more engaged parents or those most concerned about driving issues.

Nevertheless, these data have some notable implications. First, they suggest the need for a more detailed survey of a larger and representative sample of parents and adolescents with and without type 1 diabetes, along with laboratory studies where BG is manipulated while assessing judgment and actual driving behaviors. Second, they suggest that parents need education in terms of the impact of moderate hypoglycemia on cognitive-motor functioning/driving performance. Parents should be informed that adolescents should measure their BG before drives and during long drives, not drive when BG is below 70mg/l, and that low-normal BG (e.g. 70–90mg/dl) prior to driving, may require prophylactic carbohydrates to prevent hypoglycemia during the drive (especially if the drive is going to be lengthy). This is consistent with the recently released American Diabetes Association's Standards of Care Diabetes and Driving Position Statement.[24]

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Table 1

Percentage of parents who endorsed degree of worry over diabetes and driving for themselves and their adolescent

	Not at all	Some what	Moderately	Very much	Extremely
1. How worried are you about the impact of diabetes on your adolescent's driving?	8%	36%	29%	17%	10%
2. How worried do you believe your adolescent is about the impact of diabetes on their driving?	32%	47%	18%	1%	1%

Table 2

Preventive steps parents think their adolescent engages in

How often do you think your adolescent…	Not at all	Rarely	Some times	Often	Always
Would pull over or stop the vehicle if their blood sugar became too high or started rising rapidly	22%	32%	20%	18%	8%
Would pull over or stop the vehicle if their blood sugar became too low or started dropping rapidly	0%	20%	21%	24%	35%
Would decide not to drive if their blood sugar were too high or rising rapidly	17%	29%	25%	19%	10%
Would decide not to drive if their blood sugar were too low or dropping rapidly	2%	10%	23%	23%	42%
Checks their blood sugar before getting behind the wheel to drive	5%	24%	27%	24%	20%
Checks their blood sugar if symptoms start while driving	10%	18%	31%	29%	13%
Carries “fast acting” carbohydrates like glucose tablets/gels, candy, soda or juice while driving	0%	6%	12%	28%	54%