



ORIGINAL ARTICLE

# Hypoglycemic Confidence in the Partners of Adults with Type 1 Diabetes

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## Abstract

**Background:** Hypoglycemic confidence (HC) represents the degree to which an individual feels secure regarding his or her ability to stay safe from hypoglycemia-related problems. Self-report scales assessing HC in adults with type 1 diabetes (T1D) have found that greater HC is associated with better glycemic control and that HC rises significantly after real-time continuous glucose monitoring is introduced. To determine whether HC might be similarly meaningful in the partners of T1D adults, we developed the Hypoglycemic Confidence Scale for Partners (Partner-HCS). This article describes the construction and validation of the Partner-HCS and examines how HC in T1D partners is related to hypoglycemia-related experience and key psychosocial constructs.

**Methods:** Items were developed from interviews with seven T1D partners, resulting in 12 self-report items. Exploratory factor analysis (EFA) was then conducted on data collected from T1D partners ( $n=218$ ). Variables to establish construct validity for the Partner-HCS included partner-reported diabetes distress, hypoglycemic fear, generalized anxiety, and confidence regarding glucagon use, as well as frequency of recent severe hypoglycemia in the T1D adult. Hierarchical regression analyses examined the unique contribution of Partner-HCS scores, independent of hypoglycemic fear, to key psychosocial constructs and hypoglycemia-related factors.

**Results:** EFA of the 12 items yielded a single-factor solution, accounting for 51.2% of the variance. Construct validity was demonstrated by significant univariate associations with key psychosocial constructs. Importantly, Partner-HCS total score was, independent of hypoglycemic fear, significantly associated with diabetes distress ( $P<0.05$ ), overall relationship satisfaction ( $P=0.004$ ), number of severe hypoglycemic episodes in the last 6 months ( $P<0.05$ ), and confidence using glucagon ( $P=0.007$ ). In total, 38.5% of T1D partners indicated relatively low HC.

**Conclusions:** HC is an important facet of the experiences of T1D partners. It is related to, yet distinct from, hypoglycemic fear. The Partner-HCS is a reliable, valid method for assessing HC in partners of T1D adults.

**Keywords:** Hypoglycemia, Confidence, Type 1 diabetes, Partners.

## Introduction

WORRIES AND FEARS about hypoglycemia, especially severe hypoglycemia, are recognized as relatively common among adults with type 1 diabetes (T1D)<sup>1,2</sup> and also among their spouses/partners.<sup>3-6</sup> Furthermore, such fears

may contribute to both poor glycemic control and impaired quality of life.<sup>7,8</sup> Aside from these negative affective experiences, researchers have recently begun to examine the potentially positive side of this dimension—the concept of hypoglycemic confidence (HC). HC represents the degree to which the individual feels able, secure, and comfortable

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regarding his or her ability to stay safe from hypoglycemia-related problems. Using newly developed scales to assess this dimension, cross-sectional studies have observed that higher levels of HC are significantly associated with better glycemic control in adults with T1D and type 2 diabetes (T2D).<sup>9</sup> Furthermore T1D longitudinal trials have found that HC rises significantly following the introduction of real-time continuous glucose monitoring (RT-CGM).<sup>10-12</sup> In most of these cases, improved HC scores were independent of changes in hypoglycemia-related fear, pointing to an important and independent role for HC.

Might HC be similarly meaningful in the spouses/partners of T1D adults? To date, no HC measures exist for this population, but the development of a brief self-report scale to assess HC in T1D spouses/partners could lead to: greater understanding of how important this dimension may be for this population; how HC in spouses/partners may be linked to their experience with hypoglycemia, and how T1D therapies, including both new medications and devices, may influence HC in spouses/partners as well as the person with T1D (the PWDs). Therefore, we examined the beliefs and experiences regarding HC in qualitative interviews with T1D spouses/partners and, from these, developed the Hypoglycemic Confidence Scale for Partners (Partner-HCS). In this report, we first describe the construction, evaluation, and validation of the Partner-HCS. We then examine how Partner-HCS scores are associated with key psychosocial variables as well as hypoglycemic experiences, and whether these associations are independent from the influence of hypoglycemia fear.

## Research Design and Methods

Semistructured interviews were conducted with seven T1D partners to explore their thoughts about the concept of HC, their experiences witnessing and addressing hypoglycemia in their PWDs, and their views regarding how their PWDs managed their own diabetes and hypoglycemia. After these interviews were completed, it was apparent that content saturation had been reached, indicating no additional themes were likely concerning HC. A review of respondent comments led to the creation of an initial set of 12 self-report items that focused on two major areas: (1) confidence regarding their PWDs' ability to stay safe from serious problems with hypoglycemia during specific critical events (7 items; e.g., while sleeping, while traveling, and during moderate/strenuous physical activity) and (2) a broader sense of confidence in their PWDs' ability to stay safe in the face of hypoglycemia (5 items; e.g., confident that "he/she will let someone know if help is needed because of serious hypoglycemia"). The draft scale was formatted so that each item had a 4-point response scale: 1 = "not confident at all," 2 = "a little confident," 3 = "moderately confident," and 4 = "very confident." The 12 items were part of a larger, online assessment battery that included a set of validated instruments that were used to examine the construct validity of the new scale.

Project announcements were sent to T1D families on the e-mail lists of several major diabetes centers across the United States and directly to T1D partners who had attended the 2018 Taking Control of Your Diabetes ONE Conference, a 3-day program for adults with T1D and their

loved ones. In addition, announcements were placed on several popular diabetes websites. T1D partner inclusion criteria were as follows: >21 years old, read and write English, being together with their PWD >1 year, and PWD had been diagnosed with T1D at least 1 year previously. Respondents completed a brief, online eligibility questionnaire, followed by an informed consent and the survey battery. They received a \$25 electronic gift card for participation. The online survey was conducted anonymous and participation was completely voluntary. Questionnaire data were entered into a central database using a Health Insurance Portability and Accountability Act (HIPAA)-protected server. The research protocol was approved by the Ethical and Independent Review Services, a community-based, institutional review board, and data were collected in 2019.

## Measures

In addition to the 12 items of the newly developed draft scale, the self-report battery explored demographic, diabetes-related, psychosocial, and hypoglycemia-specific variables. *Demographic* measures included T1D partners' and their PWDs' age, gender, ethnicity, years of education, and duration of relationship. *Diabetes-related* variables consisted of the PWDs' T1D duration, type of insulin delivery system (pump vs. multiple daily injections), whether or not RT-CGM was currently being used, and T1D partners' estimate of current A1C. *Psychosocial* measures included the 7-item generalized anxiety disorder assessment (GAD-7), a widely used measure of global anxiety ( $\alpha=0.92$ ),<sup>13</sup> the Diabetes Distress Scale for Partners of T1D adults ( $\alpha=0.96$ ),<sup>3</sup> and the Hypoglycemia Fear Scale for Partners (Partner-HFS), which includes a 15-item behavior subscale (HFS-B;  $\alpha=0.94$ ) and an 18-item worry subscale (HFS-W;  $\alpha=0.95$ ).<sup>4</sup> Also included were single items to assess the T1D partners' overall relationship satisfaction (with response options ranging from 1 = "very unsatisfied" to 10 = "very satisfied") and their satisfaction with their ability to help their partner to manage his or her T1D (from 1 = "not satisfied at all" to 4 = "very satisfied"). *Hypoglycemia-specific* variables included T1D partners' report of their PWDs' total number of severe hypoglycemic events in the past 6 months, and whether a severe hypoglycemic event directly requiring the T1D partner's assistance had occurred during that period. Finally, respondents also reported whether or not a current (i.e., not expired) glucagon kit was available in the home, and how confident they were in using the kit if needed (from 1 = "not confident at all" to 4 = "very confident").

## Data analysis

IBM SPSS Statistics 25 was used to obtain descriptive statistics on the sample, and to conduct all subsequent analyses. Exploratory factor analysis (EFA) with promax rotation was conducted to examine the factor structure of the 12-Partner-HCS items. Factor loadings, scree plot, and eigenvalues were reviewed to determine which Partner-HCS items to retain, and whether these items could be grouped into a single coherent scale and/or some meaningful subscales. Internal consistency was determined by Cronbach's  $\alpha$  statistic. Pearson correlations were used to evaluate the construct validity of the Partner-HCS, and to examine associations of the new scale with other key variables. Hierarchical regression

analyses examined the unique contribution of Partner-HCS scores, independent of hypoglycemic fear (Partner-HFS), to relevant diabetes variables.

## Results

### *Clinical characteristics of the sample*

Of the 227 T1D partners who met study criteria and began the survey, 218 (96%) successfully completed the entire survey. The majority were non-Hispanic white (80.7%), male (68.3%), and college educated (68.3%) (Table 1). Ages ranged widely from 22 to 85 years ( $M=43.6\pm 12.6$  years) (Table 1). Not surprisingly, reported demographics of the PWD sample were similar, with mean age at 42.6 ( $\pm 12.8$ ) years and the majority being non-Hispanic white (82.6%) and college educated (78.4%). Mean T1D duration was 17.2 ( $\pm 15.8$ ) years. According to T1D partner reports, this appeared to be a well-controlled population, with most recent A1C estimated at 6.9% ( $\pm 1.0\%$ ) and the majority on insulin pumps (60.6%) and using RT-CGM (92.2%). Most of the couples were married (93.1%), and these were typically long-standing relationships, with a mean duration of 18.1 ( $\pm 12.3$ ) years.

Recent episodes of severe hypoglycemia were quite common, with partners reporting an average of 2.4 ( $\pm 2.8$ ) events over the past 6 months. Majority of partners (63.8%) reported that they had helped their loved one to recover from >1 severe episode during the previous 6 months. Of note, more than two-thirds of the sample (68.8%) indicated that they had a current (nonexpired) glucagon kit available in their homes.

### *Factor analysis of the Partner-HCS*

An EFA of the 12-Partner-HCS items yielded a single-factor solution, accounting for 51.2% of the common variance in the overall sample. A review of eigenvalues and scree plots did not reveal the presence of additional factors. All factor loadings were >0.50 and ranged from 0.53 to 0.84 (Table 2), and so, all items were retained. Partner-HCS total scores were calculated as the mean of the 12 items and demonstrated high internal consistency ( $\alpha=0.91$ ). The mean Partner-HCS score for the sample was 3.1 ( $\pm 0.6$ ), with observed scores ranging from 1.5 to 4.0. Of note, more than one-third of T1D partners (38.5%) indicated relatively low levels of HC overall (i.e., mean score <3). An examination of individual item scores suggests that concerns about their PWDs' safety while exercising was the most common partners' concern, with 31.9% of T1D partners indicating little or no confidence on this issue (Table 2).

### *Partner-HCS construct validity and associations with other key variables*

Partner-HCS scores were generally unrelated to T1D partners' personal characteristics, but links to PWDs' characteristics were common (Table 3). Lower Partner-HCS scores were significantly lower (reflecting less confidence) when the PWD was male ( $P<0.05$ ), was non-Hispanic white ( $P<0.05$ ), and had fewer years of education ( $P<0.05$ ), elevated A1C ( $P<0.05$ ), and fewer years living with T1D ( $P<0.001$ ). Substantiating the construct validity of the new

TABLE 1. SAMPLE DESCRIPTION ( $n=218$ )

	Mean (SD)
T1D partner, general characteristics	
Age (years)	43.6 (12.6)
Male, $n$ (%)	149 (68.3)
Ethnicity, $n$ (%)	
Asian or Pacific Islander	4 (1.8)
Hispanic	32 (14.7)
Non-Hispanic white	176 (80.7)
Other	6 (2.8)
College education, $n$ (%)	149 (68.3)
Duration of relationship (years)	18.1 (12.3)
PWD, general characteristics	
Age (years)	42.6 (12.8)
Male, $n$ (%)	65 (29.8)
Ethnicity, $n$ (%)	
Asian or Pacific Islander	2 (0.9)
African American	1 (0.5)
Hispanic	33 (15.1)
Non-Hispanic white	180 (82.6)
Other	2 (0.9)
College education, $n$ (%)	171 (78.4)
PWD, diabetes-specific factors	
Duration of diagnosis (years)	17.2 (15.8)
HbA1c <sup>a</sup>	6.9 (1.0)
Current insulin delivery system, $n$ (%)	
Multiple daily injections	84 (38.5)
Pump	132 (60.6)
Other/do not know	2 (0.9)
CGM user, $n$ (%)	201 (92.2)
T1D partner, contextual factors	
Relationship satisfaction (1–10 scale)	8.4 (1.4)
Generalized anxiety (GAD-7; 0–21 scale)	5.3 (5.1)
Diabetes distress (0–4 scale)	1.3 (0.9)
Hypoglycemic fear (0–4 scale)	
Behavior subscale	1.0 (0.8)
Worry subscale	1.3 (0.7)
Ability to help PWD manage diabetes (1–4 scale)	3.3 (0.8)
Hypoglycemia experiences	
Helped PWD recover from hypoglycemia at least once in last 6 months, $n$ (%)	139 (63.8)
Number of hypoglycemic episodes requiring assistance in last 6 months	2.4 (2.8)
Has (unexpired) glucagon in the home, $n$ (%) <sup>b</sup>	150 (68.8)
Confidence administering glucagon (0–3 scale) <sup>b</sup>	2.0 (0.9)

All scales are positively scored; higher scores reflect greater severity/presence of a construct.

<sup>a</sup>Data available for  $n=161$  T1D partners who knew PWDs' most recent HbA1c result.

<sup>b</sup>Data available for  $n=213$  T1D partners who were familiar with glucagon.

CGM, continuous glucose monitor; GAD-7 questionnaire, generalized anxiety disorder-7 questionnaire; PWD, person with diabetes; SD, standard deviation; T1D, type 1 diabetes.

scale, Partner-HCS scores were negatively associated with measures of T1D partners' diabetes distress, generalized anxiety and hypoglycemic fear (both worry and behavior subscales), as well as their estimates of relationship satisfaction and perceived ability to help their PWDs manage T1D (in all cases,  $P<0.001$ ). Furthermore, the frequency of severe

TABLE 2. PARTNER-HYPOGLYCEMIC CONFIDENCE SCALE ITEMS

	Factor loadings	n (%) reporting low confidence <sup>a</sup>
How confident are you that your partner can stay safe from serious hypoglycemia problems		
While sleeping?	0.59	59 (27.1)
When in social situations? (e.g., at a party, café with friends, theater)	0.71	32 (14.7)
When he/she is alone	0.64	52 (23.9)
During moderate or strenuous physical activity (e.g., sports, bicycling, brisk walking, yard work)? <sup>b</sup>	0.77	57 (31.9)
While driving? <sup>b</sup>	0.81	56 (26.8)
While at work? <sup>b</sup>	0.82	44 (16.9)
While traveling? <sup>b</sup>	0.84	57 (27.5)
More broadly, how confident are you that		
He/she will let someone know if help is needed because of serious hypoglycemia?	0.55	57 (26.1)
He/she will respond well to your efforts to help treat serious hypoglycemia?	0.55	54 (24.8)
He/she has all the tools that are needed to stay safe from serious hypoglycemia? (e.g., emergency glucose on hand, injectable glucagon, CGM).	0.53	34 (15.6)
He/she is personally concerned enough about avoiding serious hypoglycemia?	0.68	41 (15.1)
Overall, he/she can avoid serious problems due to hypoglycemia?	0.65	36 (11.9)

<sup>a</sup>“Low confidence” defined as a score of 1 (“not confident at all”) or 2 (“a little confident”) on the Partner-HCS item.

<sup>b</sup>Item-level *ns* reduced slightly due to respondents indicating that the PWD does not engage in a particular activity; valid cumulative percentage is reported.

HCS, Hypoglycemic Confidence Scale.

hypoglycemic episodes over the previous 6 months was negatively associated with Partner-HCS scores; not surprisingly, Partner-HCS scores were lower in T1D partners who reported needing to assist their PWDs in recovering from at least one recent severe event (vs. those who had not needed to do so) (in both cases,  $P < 0.001$ ). Finally, confidence in using glucagon was positively associated with Partner-HCS scores ( $P < 0.05$ ).

#### The independent value of the Partner-HCS

Multiple regression analyses were conducted to document the unique contribution of T1D partners' HC, over and above their level of hypoglycemic fear, in predicting key diabetes variables (Table 4). In Step 1, PWD characteristics (age, gender, ethnicity, education, years since T1D diagnosis, and duration of relationship) were entered; Partner HFS-B and HFS-W scores were added in step 2, and Partner-HCS scores in step 3. The seven remaining measures that supported construct validity in the univariate analyses (partner's diabetes distress, generalized anxiety, relationship satisfaction, perceived ability to help their PWDs manage T1D, number of severe hypoglycemic episodes in the last 6 months, whether the T1D partners had directly helped their PWDs to recover from at least one recent severe event, and confidence using glucagon) were examined as outcomes in separate multiple regression models. In the final step, Partner-HCS remained as an independent and significant predictor of all outcomes, except for generalized anxiety (in all cases,  $P < 0.05$ ).

#### Discussion

As originally conceptualized, HC signifies the degree to which individuals living with diabetes feel comfortable and secure regarding their ability to stay safe from hypoglycemic-related problems, especially severe hypoglycemia. While we previously developed a tool for assessing HC in T1D and

T2D adults, the current study demonstrates a new self-report measure, with documented reliability and validity, for assessing HC in the partners of T1D adults. Using this new 12-item tool, the Partner-HCS, greater HC in T1D partners was found to be significantly associated in the expected direction with a range of diabetes-related and broader contextual variables, including lower levels of diabetes distress, hypoglycemic fear, and generalized anxiety. Greater HC in T1D partners was also linked to fewer recent severe hypoglycemic episodes in their PWDs, having not had to directly assist their PWDs in recovering from a recent severe event, and greater confidence in using glucagon.

Given the conceptual overlap between HC and hypoglycemic fear, multivariate analyses were conducted, which found that HC, independent of hypoglycemic fear, remained significantly associated with diabetes distress, relationship satisfaction, perceived ability to help their PWDs manage T1D, frequency of recent episodes of severe hypoglycemia, and whether the T1D partners had directly helped their PWDs to recover from at least one recent severe event. These results support earlier findings from the original HC study in T1D and T2D adults, suggesting that HC may represent a unique and important dimension of hypoglycemic experience.<sup>9</sup> Whether the focus is on T1D adults or their partners, feeling safe and confident regarding hypoglycemia appears to be more than merely the absence of fear and worry; instead, it represents the individual's belief that hypoglycemia-related problems can be mastered or, at the least, mitigated.

HC was relatively low in more than one-third (38.5%) of T1D partners, which was striking given that the vast majority of the PWD sample (92.2%) was reportedly using CGM. We speculate that in a more representative sample of T1D adults and partners (where CGM use is known to be less widespread),<sup>14</sup> lower levels of HC in T1D partners would be even more common. There were few significant associations between HC and partner demographics, indicating that the

TABLE 3. ASSOCIATIONS WITH THE PARTNER-HYPOGLYCEMIC CONFIDENCE SCALE

	<i>Partner-HCS (r)</i>
T1D partner, general characteristics	
Age	0.02
Gender (male = 0, female = 1)	-0.05
Ethnicity (white = 0, nonwhite = 1)	0.17*
Years of education	0.08
Duration of relationship (years)	-0.07
PWD, general characteristics	
Age	-0.02
Gender (male = 0, female = 1)	0.14*
Ethnicity (white = 0, nonwhite = 1)	0.21*
Years of education	0.15*
PWD, diabetes-specific factors	
Duration of diagnosis (years)	0.35**
HbA1c <sup>a</sup>	-0.14*
Insulin delivery system (MDI = 0, pump = 1)	0.11
CGM user (no = 0, yes = 1)	0.09
T1D partner, contextual factors	
Relationship satisfaction	0.44**
Generalized anxiety (GAD-7; 0-21 scale)	-0.43**
Diabetes distress (0-4 scale)	-0.48**
Hypoglycemic fear (0-4 scale)	
Behavior subscale	-0.55**
Worry subscale	-0.58**
Ability to help PWD manage diabetes (1-4 scale)	0.29**
Hypoglycemia experiences	
Helped PWD recover from hypoglycemia in last 6 months (no = 0, yes = 1)	-0.41**
Number of hypoglycemic episodes requiring assistance in last 6 months	-0.35**
Has (unexpired) glucagon in the home (0 = no/unsure; 1 = yes) <sup>a</sup>	-0.08
Confidence administering glucagon (0-3 scale) <sup>a</sup>	0.18*

All scales are positively scored; higher scores reflect greater severity/presence of a construct.

<sup>a</sup>Analyses were conducted both with (via mean substitution) and without individuals with missing values on these variables. As findings did not differ substantively between these two methods, the former was used to allow for reporting on the entire *n* = 218 sample.

\**P* < 0.05, \*\**P* < 0.001.

MDI, multiple daily injections.

degree of HC was independent of the respondent's age, gender, education level, or the length of the relationship. However, lower HC in T1D partners was evident when their PWDs were reported as being male, having fewer years of formal education, and fewer years of T1D experience. In addition, HC levels were lower when the T1D partners or their PWDs were non-Hispanic white.

These findings may have important implications, since low levels of HC may not only affect the T1D partner's quality of life but may also influence how the T1D partner provides support to his or her PWD. For example, the unconfident T1D partner may be more likely to repeatedly remind his or her PWD to check glucose levels, which, if this is experienced as

TABLE 4. HIERARCHICAL REGRESSION ANALYSES

	<i>Hypoglycemia requiring assistance<sup>a</sup></i> β	<i>Partner diabetes distress</i> β	<i>Partner generalized anxiety</i> β	<i>Relationship satisfaction</i> β	<i>Perceived ability to help PWD manage T1D</i> β	<i>Helped PWD recover from severe hypoglycemia</i> β	<i>Partner's confidence using glucagon</i> β
Step 2							
Partner HFS-B	0.18*	0.27**	0.18*	-0.23*	0.17	0.25*	0.14
Partner HFS-W	0.39**	0.40**	0.46**	-0.22*	-0.39**	0.18*	-0.10
Step 3							
Partner HFS-B	0.13	0.24**	0.17*	-0.18*	0.21*	0.21*	0.19*
Partner HFS-W	0.30**	0.34**	0.45**	-0.12	-0.29*	0.09	<.01
Partner-HCS	-0.24*	-0.14*	-0.03	0.24*	0.24*	-0.23*	0.24*

<sup>a</sup>Outcome is the partner-reported number of hypoglycemic episodes experienced by the PWD in the last 6 months that required assistance.

\**P* < 0.05, \*\**P* < 0.001.

HFS-B, Hypoglycemia Fear Survey-Behavior subscale; HFS-W, Hypoglycemia Fear Survey-Worry subscale.

nagging, may lead the PWD to resist by reducing his or her own glucose monitoring frequency. Alternatively, the unconfident T1D partners might encourage their PWDs, directly or indirectly, to keep their glucose levels higher than would be recommended (of interest, we did find that lower HC in T1D partners was significantly associated with poorer glycemic control in PWDs). In either case, interventions to enhance HC in T1D partners may therefore be of value. Toward this goal, it is notable that HC was independently linked with the T1D partner's confidence regarding the use of glucagon, but HC was not associated with merely having an unexpired glucagon kit available. It is, therefore, the T1D partners' faith in their own ability to use glucagon easily and effectively that appears to be important.<sup>15</sup> More broadly, we suspect that as a range of innovative T1D treatment options to reduce hypoglycemia risk are more widely adopted, including sensor-augmented pumps,<sup>16</sup> the latest insulin analogues,<sup>17</sup> and new glucagon formulations,<sup>18,19</sup> T1D partners (and, perhaps, T1D adults as well) are likely to gain greater confidence regarding hypoglycemia.

We envision the Partner-HCS as a potentially valuable clinical tool, especially in health care settings where diabetes education is available and both partners are present. With this new tool, the health care professional could use the resulting data as an opportunity to discuss the T1D partners' concerns regarding hypoglycemia and hypoglycemia interventions for their PWDs.

Especially for the concerned T1D partner, the tool may provide guidance for the health care team when reviewing and recommending treatment options that better address hypoglycemia. Ultimately, improved HC may serve as an important contributor to improved health outcomes and quality of life for PWDs and their caregivers,<sup>9</sup> although this remains to be examined in future studies.

Several study limitations must be acknowledged. First, all data were self-reported and the linkages reported were cross-sectional, so any conclusions regarding cause and effect must remain speculative. While the study sample was relatively large, the respondents were highly educated, mostly non-Hispanic white, and their relationships were typically long-standing (mean duration of 18.1 years). Their PWDs were heavily engaged with diabetes technology (61% were pump users, and 92% were using CGM) and the reported frequency of recent episodes of severe hypoglycemia was surprisingly high (mean of 2.4 events over 6 months). This contrasts with the fairly low frequency of such events as reported in the T1D Registry,<sup>20</sup> but is similar to the numbers reported by Choudhary et al.,<sup>21</sup> who were retrospectively studying a small sample of T1D adults with problematic hypoglycemic awareness. In total, the high rate of severe hypoglycemia in the current study suggests that this sample does not represent a truly diverse group of T1D partners, which makes us very cautious about generalizing from these findings. As a next step, we recommend further examination and validation of the Partner-HCS across a wider range of T1D partners as well as partners of insulin-using T2D adults.

In summary, HC in T1D partners is a unique and important dimension, distinct from partners' fears and worries about hypoglycemia, which is worthy of additional study. The newly developed Partner-HCS is a valid and reliable self-report measure that can be used for these investigations moving forward and may also be of clinical value.

## Authors' Contributions

Study conception/protocol: W.P. and A.F. Statistical analysis: A.F. Interpretation of data: W.P., A.F., K.J., A.N., and C.B. Article development: W.P., A.F., K.J., A.N., and C.B. All authors read and approved the final article.

## Author Disclosure Statement

W.P. has worked as a consultant for Dexcom, Servier, Novo Nordisk, Lilly Diabetes, Astra Zeneca, Sanofi Diabetes, Roche Diabetes, Abbott Diabetes, Xeris Pharmaceuticals, and Johnson & Johnson. A.F. reports no competing interests. K.J. and A.N. are employees of Xeris Pharmaceuticals. C.B. is a consultant for Xeris Pharmaceuticals.

## Funding Information

This investigator-initiated study was supported by Xeris Pharmaceuticals.

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