How online peer support affects management efficacy and mitigates difficulties of parents caring for children with type 1 diabetes

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ABSTRACT

The proper management of pediatric type 1 diabetes depends substantially on the parents of affected children. Parental psychological traits specifically related to diabetes caregiving influence the quality of their care and management of the disease in their children. Parents often use Facebook groups as sources of peer support and information about diabetes care. The present study aimed to examine the influence of devices used in diabetes management, ascertain the impact of Facebook peer-support groups on parental perceptions of problems and probe parental self-efficacy. 318 parents of children with type 1 diabetes completed an online questionnaire on demographics, diabetes-related data, and diabetes care-related psychological characteristics. Data analysis revealed three variables that determined competence in diabetes management: the utility of information and suggestions offered in the Facebook groups on diabetes; the form of insulin administration and membership in Facebook groups. Our results underpin that peer-support groups on social media platforms can serve as sources of the necessary information, support, and feedback on diabetes management competence for parents of children living with type 1 diabetes, they may thus facilitate parental diabetes management capabilities.

1. Introduction

Pediatric diabetes management depends strongly on family functioning [1]. Diabetes management poses several unique challenges for parents concerning their everyday responsibilities, continuous supervision, and caregiving [2]. These difficulties include physical growth, blood glucose monitoring, adjustments in insulin administration, changes in food preferences, unpredictable physical activities, and the constant need for supervision and care [3].

Certain psychological difficulties observed in parents of children with diabetes can be linked to the health issues of the children. Parents usually have never-ending concerns about their child's health [4,5]. Parental feelings of guilt and worry may even lead to psychological conditions of depression and anxiety [6,7]. Additionally, caregivers of people living with type 1 diabetes commonly experience isolation and burnout [8]. These aspects must be addressed because parental stress and burnout serve to obstruct the proper family management of type 1 diabetes in children [9,10]. Parental stress is particularly associated with a child's psychological adjustment to the illness: it has been observed that higher levels of stress diminish the ability of parents to

effectively manage the disease [11]. According to Hilliard et al. [12] the experienced stress by parents relates to the perception of their child's (living with type 1 diabetes) behavior problems. This may interfere with disease management and affect well-being [12]. Tully et al. evaluated a theoretically based model of diabetes-specific functioning among parents of newly diagnosed children [13]. They found that child-illness factors were directly related to more difficulties with parent diabetes-specific and emotional functioning.

The fear of hypoglycemia [14] is the anxiety and concern in both patients with diabetes and their family members caused by the discomfort of hypoglycemia, the possibility of long-term complications, and the unpredictability of such episodes [15]. It may vary depending on the time of day and diabetes management tools that are deployed. According to Van Name et al. [16] parents of children with diabetes exhibit the greatest fear of hypoglycemia when it is difficult to detect the condition (especially during sleep). Parents of children using continuous subcutaneous insulin infusion (CSII) and continuous glucose monitor (CGM) worry more about night-time hypoglycemia than those whose children use multiple daily injection (MDI). The explanation for this can be twofold: on the one hand, fear of hypoglycemia encourage parents to

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choose CGM so that parents of children with advanced technologies are more likely to mention their fear of hypoglycemia (which is obviously a retrospective fear from before the CGM was used). On the other hand, a heightened awareness of previously unknown glucose excursions, due to the use of these technologies may also increase parental concerns [16].

Many individuals with diabetes use Facebook to search for health-related information [17]. Participation and involvement in such online diabetes communities have been noted to exert a positive impact on the emotional experiences of individuals, their attitudes toward diabetes, and their engagement with diabetes management behaviors [8]. Furthermore, individuals who are actively engaged in an online diabetes community are more likely to have better glycemic levels than those who are less engaged [18]. Stellefson et al. [19] analyzed the content of public Facebook groups dedicated to diabetes-related phenomena and found that these groups offer emotional support and information sharing, especially concerning nutrition.

Zhang et al. [20] elucidated that participation in Facebook groups dedicated to diabetes management is associated with improved knowledge, skills, confidence, and improved patient self-management. Overall, such communities are built on a spirit of altruism that strengthens confidence in others and encourages members to pay it forward [21]. Merkel and Wright [22] found that the web-based social support platform triggers an improvement in parental self-efficacy scores. Hence, the online social support platform represents an easily adaptable, cost-effective, and innovative means of networking and information sharing for families facing similar challenges of raising a child with type 1 diabetes.

The present investigation studied the psychological factors related to diabetes care. It purposed to examine whether the form of blood glucose monitoring and insulin administration, membership in a peer-support Facebook group, and the utility of the information shared in the online group influenced identified psychological factors in parents of children living with type 1 diabetes.

The literature data above enabled the formulation of the following three hypotheses:

a) Parents using advanced diabetes management technologies (CGM, CSII) sense and exhibit higher diabetes management-related self-efficacy but perceive diabetes management as being more problematic than parents who use less advanced devices (Self-monitoring of blood glucose, multiple daily injections).
b) Active participants of diabetes peer-support Facebook groups feel more competent in diabetes management than passive members.
c) Active participants of diabetes peer-support Facebook groups consider diabetes management to be less complicated than passive members.

2. Methods

An online questionnaire was administered to the study's participants, most of whom were recruited from a Facebook group for parents of children with type 1 diabetes (n = 288). A snowball sampling procedure was also applied to identify additional participants. Only the primary caretakers (mainly mothers) of children with type 1 diabetes were asked to fill out the questionnaire. A total of 318 participants completed the survey, their demographical characteristics are given in Table 1, while the distribution of diabetes management tools they used in Table 2.

The procedures used for this study complied with the ethical standards of the Human Investigation Review Board at the University of Szeged Albert Szent-Gyorgyi Clinical Center (Approval no. 19/2019-SZTE).

The questionnaire encompassed 14 questions. The following demographical data were collected for the participating parents: gender, age, the highest level of educational attainment, and employment status. Diabetes-related data queries included the age of the child living with

Table 1
Demographical characteristics.

Parent characteristics	%
Gender	
Female	92
Male	8
Education	
Primary school	1
High school	31
University	15
Advanced degree	53
Employment status	
Homemaker	29
Employed	61
Entrepreneur	10
Child characteristics	**%**
Age	
Younger than 3 years	4
3–5 years	13
6–12 years	47
13–18 years	29
Older than 18 years	7
Illness duration	
A few months	18
1–2 years	24
3–5 years	26
6–10 years	24
More than 10 years	8

Table 2
Diabetes management technologies used.

Form of treatment	SMBG		CGM		All	
	Participants	%	Participants	%	Participants	%
Whole sample size (n = 318)						
MDI	127	39.9	59	18.6	186	58.5
CSII	68	21.4	64	20.1	132	41.5
All	195	61.3	123	38.7	318	100
Members of the peer-supporting Facebook group (n = 288)						
MDI	114	39.6	59	20.5	173	60
CSII	56	19.4	59	20.5	115	40
All	170	59	118	41	288	100

SMBG: Self-Monitoring of Blood Glucose.
CGM: Continuous Glucose Monitoring.
MDI: Multiple Daily Injection.
CSII: Continuous Subcutaneous Insulin Injection.

diabetes, the time since diagnosis, and the combination of tools currently used for diabetes management.

The psychological characteristics of the participants were queried through five statements that required participants to evaluate the extent to which they agreed with each statement on a five-point Likert scale. Parents rated their level of knowledge about diabetes management to indicate subjective diabetes management competence. Statements about self-efficacy related to diabetes management probed the commitment levels of the respondents to the treatments they used and the extent of their trust in their abilities to manage these tools. The perceived diabetes management problems were determined via participant ratings of how problematic they considered the following issues: controlling the blood glucose level, managing insulin delivery devices, and adapting to lifestyle changes precipitated by diabetes.

Regarding social network activities, the first question revolved around the frequency and extent of Facebook usage by the participants. Respondents were also asked whether they were active or passive

members of the peer-support Facebook group. The last question inquired about the degree of usefulness (or lack thereof) of the information and suggestions offered on the Facebook peer-support group. Seven sub-topics (information on diabetes, -nutrition and -management technologies; legal information; advice on handling specific situations, -emergencies; support of the peer community) were represented under this question, and the answers for each item were indicated on a five-point Likert scale.

Statistical analysis was accomplished using SPSS version 23 and the obtained results were considered statistically significant at $P < .05$. A principal component analysis was conducted to determine the underlying psychological characteristics. This analysis incorporated all data collected from the 318 participants. Bartlett's Test of Sphericity and the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (*KMO*) were applied to examine the associations between items. The items of the final analysis were found to be related to each other (Bartlett: $\chi^2(36) = 909.188$, $P < .001$; $KMO = 0.791$). Further analysis was conducted on data pertaining only to the participants who were members of the Facebook group (n = 288). We eliminated the data of 7 participants (see data exclusion). Therefore, the final sample comprised 281 participants. We used the backward method with 12 independent variables to generate two exploratory multivariable linear regression models. The significance level of the variable exclusion process was set at equal or greater than 0.1 ($P \geq 0.1$) for both models.

Missing answers required the data of three participants to be eliminated. Additionally, the data of four participants were discarded because they were considered outliers as their factor scores (which were obtained during the Principal Component analysis) were below -3 or above $+3$.

3. Results

3.1. User statistics

The independent variables for the two exploratory multivariable linear regression models are shown in Table 3. The last seven independent variables concerned the usefulness of the information and suggestions extended to parents on the Facebook group.

The investigation queried whether the assumptions of the regression analysis were satisfied [23,24]. All the predictors varied in value. There was no perfect multicollinearity, there were no significant correlations (Pearson) between variables greater than 0.655 ($r(265) = 0.655$, $P < .001$). The Pearson correlation between predictors and outside variables, these were significant between the following variables: parents' age with child's age ($r(273) = 0.056$, $P < .001$), with the duration of diabetes ($r(273) = 0.256$, $P < .001$), and with parents' highest level of education ($r(270) = 0.152$, $P = .012$). Child's age with the legal information ($r(279) = 0.128$, $P = .032$) and with the advice on handling emergencies ($r(277) = 0.136$, $P = .023$). No autocorrelation was noted (Durbin-Watson was computed at 2.052 for the first model and 2.002 for the second). Homoscedasticity was examined via a visual inspection of scatterplots and no salient differences of serious concern were observed.

Table 3
Independent variables of the two linear regression models.

the form of blood sugar monitoring (SMBG or CGM)
the form of insulin administration (MDI or CSII)
the biological sex of the parent (male or female)
the parent's age (ratio scale),
active or passive membership of the type 1 diabetes themed Facebook support group
usefulness of information on diabetes
usefulness of information on nutrition
usefulness of information on diabetes management technologies
usefulness of information on legal matters
usefulness of information on handling specific situations
usefulness of information on handling emergencies
usefulness of peer support

A linear relationship was thus assumed between the modeled variables. Histograms were also investigated, and it was concluded that the residuals were normally distributed.

3.2. Principal components analysis of psychological characteristics

The analysis was initiated using 15 items. Six variables were excluded from the analysis because their extraction communalities were less than 0.4. Consequently, the final analysis entailed nine items. Ultimately two components with eigenvalues of 3.384 and 1.808, respectively, were identified because all the other emerging components evinced eigenvalues less than 1. The two components accounted for 57.689 % of the variability. Table 4 exhibits the factor loadings of the nine items.

The nine items yielded two factors: diabetes management competence (Cronbach's $\alpha = 0.829$) and diabetes management problems (Cronbach's $\alpha = 0.693$). The rest of the items were discarded in further analyses. Diabetes management competence was related to familiarity with information on diabetes care, the appropriate use of management devices, and the ability to effectively treat diabetes. Diabetes management problems were associated with the extent to which parents found controlling night and daytime blood sugar to be problematic, and adaptation to a new way of living. The two factors were determined by computing the factor scores for the previously described components. The average of these factor scores was zero, negative values indicated less-than-average, and positive scores implied more-than-average competence (or perceived problems). These factor scores were applied to the subsequent calculations.

3.3. Variables that influence diabetes management competence and diabetes management problems

The dependent variable in the first model was diabetes management competence. The final model was built in ten steps and was found to be statistically significant, $F(3,263) = 8.983$, $MSE = 0.733$ $P < .001$, $R^2_{Adj} = 0.083$. Three variables determined diabetes management competence (Table 5).

The more useful they found information about diabetes, the higher their diabetes management competence. CSII users displayed higher

Table 4
Factor loadings of the nine variables of the Principal Component analysis (missing values are less than 0.25 as we excluded them for the perspicuity of data).

Variables	Factor loadings	
	Diabetes management competence	Diabetes management problems
"I am familiar with the treatment possibilities of type 1 diabetes"	**0.843**	
"I am familiar with diabetes management tools"	**0.789**	0.253
"I am familiar with the health consequences one has to face when not treating type 1 diabetes properly in childhood"	**0.693**	
"I am familiar with hbA1c and I know why we keep track of its value"	**0.686**	0.286
"I make good use of the diabetes management tools of my child"	**0.680**	
"I can effectively treat my child's diabetes"	**0.620**	
"Controlling blood sugar levels by night"		**0.803**
"Controlling blood sugar levels by day"	-0.338	**0.773**
"Adapting to this new way of living (type 1 diabetes related)"	-0.295	**0.573**

Table 5
Variables that significantly affected diabetes management competence in the first multiple linear regression model.

Independent variables	β	t	P
The usefulness of the information and suggestions appearing in the Facebook group about the information on diabetes	0.217	3.598	< .001
Form of insulin administration	0.198	3.314	.001
Type 1 diabetes themed supporting Facebook group membership	− 0.122	− 2.041	.042

diabetes management competence than MDI users. More active participants of the Facebook group showed higher diabetes management competence than passive members.

The dependent variable in the second model was diabetes management problems. The final model was built in 12 steps and was found to be statistically significant, $F(1,265) = 5.088$, $MSE = 0.0926$, $P = .025$, $R_{Adj}^2 = 0.15$. The mode of blood glucose measurement was observed to affect diabetes management problems ($\beta = 0.137$, $t = 2.256$, $P = .025$). This result revealed that CGM users considered diabetes management more problematic than participants who self-monitored blood glucose.

4. Discussion

The present paper explored diabetes care-related psychological factors of parents caring for children with type 1 diabetes and examined the variables affecting the identified psychological attributes. The first hypothesis was partially confirmed. Both psychological factors yielded higher values considering only one advanced management device.

The insulin administration method was noted to exert an impact on diabetes management competence. CSII users exhibited higher management competence than MDI users. CSII incorporates more complex functions and thus demands skills that are discrete and more advanced than those required for the use of MDI [25]. However, extant research also demonstrates that parents can teach their children about CSII and share tasks related to its administration more easily than MDI [26]. CSII usage may be perceived as riskier than MDI utilization as CSII users retain a smaller subcutaneous depot of insulin than MDI users [27,28]. It may be assumed that handling a devices requiring more attention can also increase feelings of self-efficacy in parents.

Diabetes management problems were influenced by the blood glucose measurement technique. CGM users considered diabetes management more problematic than participants who self-monitored blood glucose. Participants using CGM scored higher on the scales about daytime and night-time blood glucose control than SMBG users. Van Name et al. [16] obtained similar results for night-time alarms with CGM.

CGM users can track changes in blood glucose levels, so they attain much more information. Noting more of these fluctuations could be a source of concern for parents. Compared to this, SMBG users check blood glucose levels a few times a day. The greater concern of parents using CGM may also be explained by the fact that it displays blood glucose levels with an approximately 9.5-min time delay [29]. The device warns the user about expected changes in blood glucose levels and ensures that they can prepare for the changes in advance [30,31]. However, this function may also be a source of increased worry.

The second hypothesis was confirmed, as more active participants of the Facebook group evinced more diabetes management competence than passive members. Hilliard et al. [8] concluded that the more involved participants become in online diabetes communities, the more positive the effect on their emotional experience of managing diabetes. Members of such communities evince a more positive attitude towards diabetes and are more engaged in diabetes management behaviors [8]. People who are more actively involved may garner more positive feedback from such behaviors, which could serve as motivation for increasing competence in diabetes caregiving.

Zhang et al. [20] found that participation in Facebook groups dealing with diabetes management was associated with improved knowledge, skills, confidence, and improved patient self-management. These findings are aligned with the results of the present study. According to Merkel and Wright [22], the use of online social support improves parental self-efficacy scores. Self-efficacy encompasses perceived competence as an element and deals primarily with cognitive perceptions of competence [32]. Because these two phenomena are closely related to each other, the results of the present study are congruent with the findings of previous studies on diabetes-related self-efficacy.

According to Gilbert et al. [33], people with diabetes distinguish the support they receive from online communities from the support they may receive from health professionals in the form of clinical care. Further, the online community helps with other processes valued as contributing to their diabetes management abilities [33]. Active participants of Facebook groups post more and comment more on questions or diabetes-related circumstances shared by other members. They are thus likely to feel more competent in their diabetes management because they feel they can answer the questions or other members and help people overcome problems. The help they extend could function as positive feedback and enhance their sense of self-efficacy. Gavrila et al. [21] found that social media communities dealing with diabetes can serve as empowerment tools and the community as a whole may exude a spirit of altruism that strengthens confidence in group members including those who pay it forward.

Our results revealed that the degree of importance participants attached to information on diabetes found on the Facebook group exerted the greatest impact on their diabetes management competence. Participants who found information on diabetes useful also evinced higher management competence, suggesting that parents may use Facebook groups as a source of information on diabetes. This finding confirms that the seeking and sharing of information on diabetes is a common theme of online diabetes support groups [8]. Shaw and Johnson [17] discovered that individuals with diabetes use Facebook primarily to search for health-related information. The reliability and usefulness of this information should also be mentioned here because the flow of online health information without professional control raises the possibility that such information may be inaccurate, misleading, or anxiety-provoking [34]. Research in recent years has confirmed that groups are overwhelmingly engaged in correct, useful and supportive communication [21], and only very little evidence of risky or misleading information is supported by social media [35].

Stellefson et al. [19] reported that public Facebook groups offering diabetes support are used by members to seek and provide emotional support and share information, especially on nutrition. In a study conducted by Cleal et al. [36] amongst patients of a clinic for diabetes and hormonal diseases, the new developments in diabetes technology and information specific to the patients' clinic received the most attention in a Facebook group created for the study.

The present study found that general information on diabetes held more value for parents than nutrition-related material. No significant association was observed in this study between the usefulness of information on nutrition and management competence.

The last hypothesis was not confirmed. This assumption was based on the idea that parents can find comfort through peer support and asking each other questions; thus, the problems or complications they face could seem less severe. The use of online social support may improve parental diabetes management-related self-efficacy [22]; at the same time, higher self-efficacy may be associated with a reduced perception of complications in diabetes management.

The psychological traits analyzed in the present study may influence the adequacy and quality of parental diabetes management. Future studies should focus on conditions that can mitigate the perception of diabetes management problems because parents are likely to be more committed to diabetes management and to report higher degrees of self-efficacy if they perceive diabetes management to be a relatively less

complicated task. A qualitative study would complement the present work and provide an opportunity to reflect on the conclusions. Additionally, prospective investigations should probe conditions that enhance management competence because this attribute can also facilitate proper diabetes management. The factors examined in the present study could be compared among parents of different age groups of children afflicted with diabetes. Future studies should also analyze these factors from the perspective of children living with diabetes. The identified traits could also be evaluated for parents of children suffering from other chronic illnesses.

4.1. Limitations

Although the sample cannot be considered representative of the entire target population, the respondents are a good representation of the population most active on social networks. As peer support is most used by these people, their opinions are relevant to the questions addressed by the research.

In this study, no validated questionnaire was used, which means all the conclusions cannot necessarily be made with total confidence. However, the responses were not used to determine quantitative relationships, but to describe different attitudes.

4.2. Conclusions

In conclusion, the findings of this study indicate that a higher sense of diabetes management competence may accompany the use of an advanced diabetes management device; however, this sense of proficiency is also complemented by a greater perception of diabetes management problems in parents of children living with type 1 diabetes. The findings of this study further indicate that being an active member of diabetes-related peer-support Facebook groups and finding information on diabetes useful in such forums positively influences the management competence of parents. Peer-support groups on social media platforms may thus facilitate parental diabetes management capabilities as they can serve as sources of information, support, and feedback on diabetes management competence for parents of children living with type 1 diabetes.

Declaration of the conflicts of interest

There are no conflicts of interest that should be reported from the side of any authors.

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