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Emotional burden and care of adults with type 1 diabetes during the COVID-19 pandemic in Brazilian regions

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ABSTRACT

Aims: This study investigated the emotional burden in persons with type 1 diabetes (PWT1D) during the COVID-19 pandemic in Brazilian regions and evaluated which COVID-19, sociodemographic/clinical characteristics are related to it.

Methods: In a cross-sectional study, T1D adults completed a web-based survey from May to July 2020. We collected sociodemographic/clinical data, and participants answered COVID-19 related questions. Diabetes burnout was evaluated by Diabetes burnout scale. Type 1 Diabetes scale assessed Diabetes Distress and PHQ-8 measured depressive symptoms.

Results: DD and DS levels were similar in all Brazilian regions. DB was higher in Central-West/North/Northeast. Higher DB was associated with females, lower-income, higher HbA1c, and shorter time since T1D diagnosis. Predictors of experiencing higher levels of DD included: difficulty access to safe places to exercise, participants without a partner, male gender, young age, and higher HbA1c. Higher depressive symptoms were associated with difficulty to access diabetes supplies, and higher HbA1c ($p < 0.05$).

Conclusions: The mean levels of DB, DD, and DS were high in all Brazilian regions. A great number of PWT1D had their diabetes care impaired and relied on family as their main support during the pandemic. The subgroups identified at risk should be prioritized in mental health support.

1. Introduction

The SARS-COV2 Coronavirus (COVID-19) disease quickly reached a pandemic level¹ with 82.100.010 million global cases and 1.793.150 deaths by December 30th, 2020.² In Brazil, the first COVID-19 patient was diagnosed on February 26th, 2020.³ Brazil is a large country with a 210 million population,⁴ divided into five large regions: Southeast, Northeast, South, North, and Central- West with respectively 42.04%, 27.09%, 14.26%, 8.83%, and 7.79% of the total population and significant variation in socio-economic status and access to health care.⁵ In the Northeast, 51% of the population receive less than a minimum wage monthly while in Southeast it is only 18%. Regarding access to healthcare, the percentages of population that have a private health insurance plan are: In the Southeast: 37.5%, Northeast: 16.6%, South: 32.8%, North: 14.7%, and Central-West: 28.9%.⁶

Diabetes is the second most prevalent comorbidity in COVID-19 patients⁷ and individuals with suboptimal glycemic control and diabetes complications are more likely to develop severe forms of infection by SARS-COV2.^{8,9} Diabetes is a significant public health concern in Brazil. Type 1 diabetes (T1D) is increasing by almost 3% every year. Brazil ranks third in the number of T1D cases in the world.¹⁰

In order to keep glycemic control, people with T1D (PWT1D) need to follow many steps to control their glucose levels. This involves strict insulin adjustment according to food intake, physical exercise, and the presence of infections or other medical conditions.¹¹ The complexity of T1D requirements is extremely stressful^{12,13} and any disruption that affects T1D management routines can be even more challenging.¹⁴

The COVID-19 pandemic brought a profound and rapid change in people's lives in Brazil.¹⁵ It added several new challenges to PWT1D regarding availability of diabetes care, access to medications, supplies,

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healthy food, safe places to exercise, and mental health support. Many Brazilian hospitals were overwhelmed and cancelled their routine appointments. Quarantine, social isolation, and persons' fear to visit diabetes facilities also negatively affected diabetes outcomes.^{15–17}

Quarantine mobility restrictions, lack of access to space for physical activity, and working at home are often associated with changes in eating, drinking, and sleeping habits that can affect glycemic levels. The pandemic triggered a higher level of stress related to social isolation, loss of loved ones, unemployment, and changes in daily routine.^{18–23} Stressful situations, financial problems, and loneliness are well-known aspects associated with anxiety disorders, depression, suicide attempts, and substance abuse.²⁴ Literature shows that people affected by life-threatening situations are at higher risks of developing psychological and psychiatric disorders.²⁴

Depressive symptoms (DS), diabetes burnout (DB), and diabetes distress (DD) are very frequent among PWT1D^{13,25–27} and they are related to difficulties in diabetes self-management and suboptimal glycemic control.^{13,25,27,28} Psychological aspects and psychiatric comorbidities related to T1D negatively impact diabetes management and screening for them is highly recommended, especially at diagnosis, when treatment is changed, and when there is a modification in the individuals' lifestyle.²⁹ Therefore, screening DS, DB, and DD among PWT1D is an important goal during such a disruptive event like the COVID-19 pandemic scenario. As there is no Brazilian national data in T1D and mental health aspects using reliable instruments, this study aims to 1- measure DB, DD, and DS levels among adults with T1D during the COVID-19 pandemic in Brazil, and 2- evaluate which COVID-19 associated changes, sociodemographic characteristics, and diabetes outcomes are related to DB, DD, and DS.

2. Subjects, materials, and methods

2.1. Study participants

Individuals from all Brazilian regions aged 18 years or older, diagnosed with T1D were eligible to participate. Flyers containing information on study objectives and inclusion criteria were displayed on social media, diabetes support groups, and diabetes blogs from May to July 2020. Potential participants had access to a direct link to the website that included information on eligibility criteria and the consent form.

Inclusion criteria: both genders, 18 years old or older, and T1D diagnosis for at least one year. Exclusion criteria were age under 18 years old, other types of diabetes, and inability to answer the survey digitally. Five hundred and nine persons accessed the survey, four refrained from signing the consent form and 28 participants were not eligible. A total of 477 PWT1D completed the survey. Participants did not receive any financial incentive. The study followed the principles of the Declaration of Helsinki and was approved in Brazil by the University of Campinas Ethics in Research Committee (CAAE: 30899220.7.0000.5404).

3. Materials and methods

3.1. Design

This is a cross-sectional study³⁰ with T1D adults who completed a web-based survey during the initial months of the COVID-19 pandemic (May–July 2020). Their answers were confidential and protected by the researcher's password.

Sociodemographic characteristics were registered: we collected data on age, gender, race (white/others), education (high school degree or less, graduate or post-graduate degree), marital status (with and without a partner), employment status (employed/ student/ unemployed), income (according to Brazilian Institute of Geography and Statistics –IBGE),³¹ residential area (urban area or suburban/rural), and years

since T1D diagnosis.

Diabetes status: Participants self-reported their HbA1c within the last 3 months, and the number of self-blood glucose monitoring/day (SBGM).

Diabetes care, and self-care behavior changes during the COVID-19 pandemic: participants were asked questions regarding the difficulty of accessing diabetes care, diabetes medication and supplies, healthy food, and safe places to exercise, during the pandemic. They also reported their diabetes support systems during the pandemic, any changes in diabetes self-care behaviors, and any hesitation to visit diabetes facilities due to fear of becoming infected by COVID-19. The response options were Yes/No.

DB: A newly developed measure of diabetes burnout developed by Abdoli et al.,³² was used to assess diabetes burnout. This scale is a 12-item scale including exhaustion ($n = 4$), detachment ($n = 5$), and loss of control ($n = 3$) subscales. The scale has a Chronbach alpha of 0.80 with a 5 point Likert scale for response option (1 = strongly disagree to 5 = strongly agree).

We also asked the participants to answer a single-item question about their perceived burnout and the response options were: no, mild, moderate, or severe.

DD: The 28-item Type 1 Diabetes Distress Scale (T1DDS) is comprised of 7 subscales including powerlessness (5 items), management distress (4 items), hypoglycemia distress (4 items), negative social perceptions (4 items), eating distress (3 items), physician distress (4 items), and friend/family distress (4 items). This was used to assess DD. T1-DDS uses a 6 point-Likert scale, in which the participant chooses a number to indicate the degree to which this has been or not a problem for them (1 = not a problem to 6 = serious problem).¹³ The Chronbach alpha of the original scale was 0.91¹³ and the Cronbach alpha of the T1-DDS Brazilian version was 0.93.³³ Established DD cut off points were used in this study (1.00–1.99 = low DD, 2.00–2.99 = moderate DD, and >3 = high DD). DD >2.00 is considered DD clinically relevant.³⁴

DS: To evaluate depressive symptoms, the 8-item Patient Health Questionnaire depression scale (PHQ-8) was used. PHQ-8³⁵ measures depressive symptoms linked to DSM-V criteria for Major Depressive Disorder (alpha = 0.89) and it is a valid tool used to screen depressive disorders in large clinical studies. The cutpoint >10 was used to indicate clinical meaningful depressive symptoms. Levels >10 = moderately-severe depressive symptoms, and >20 = severe depressive symptoms.

Although DBS, T1DDS, and PHQ-8 measure overlapping symptoms, each scale has specificities. DBS loss of control subscale overlaps with T1DDS powerlessness subscale. However, DBS is capable of measuring exhaustion, and detachment from diabetes.³² The T1DDS has subscales that are not well evaluated by DBS such as specific aspects related to hypoglycemia, the relationship with family, friends, and diabetes professionals, and negative social perception of T1D.¹³ On the other hand, PHQ-8 has questions about mood and anhedonia not included in the other instruments and it is proper to evaluate depressive symptoms. While DB and DD are conditions directly related to diabetes, depression is a psychiatric multifactorial disorder, better evaluated by other instruments.^{35,36}

3.2. Statistical methods

Descriptive analysis was used to provide statistics including mean, minimum, maximum, frequency, and standard deviation for the variables under study. The Chi-square and Fisher exact test (for categorical data) and the Kruskal-Wallis test, followed by Dunn's posthoc test (for numerical data) were used to compare variables in different Brazilian geographic regions. The North, Northeast, and Central-West regions were grouped due to the small number of participants. To evaluate COVID-19 and demographic factors related to DD, and DS we used the logistic regression analysis, using the proportional odds model. For analyzing DB-related variables we used the linear regression analysis, the least-squares method. We also performed univariate and

multivariate analysis (through the stepwise selection method). To define the reference and test classifications, the clinically established cutoff points were applied to the scale scores of DD and DS. In the evaluation of the depressive symptoms scale, the moderately severe and severe levels were grouped, because both are clinically relevant (levels >10 = moderately severe depressive symptoms, and >20 = severe depressive symptoms). For the distress scale, moderate/high categories were grouped due to the same reason (Levels of DD >2 = moderate DD, and >3 = high DD; both levels are clinically relevant). Significance level was considered when $p < 0.05$. All analyzes were performed using PROC LOGISTIC and PROC REG, SAS System for Windows (Statistical Analysis System), version 9.4. SAS Institute Inc.

4. Results

4.1. Demographic, clinical, and laboratory characteristics of PWT1D

Eighty-three percent of the patients were female, 78% white, with age: 30.52 ± 9.22 years. The mean HbA1c in the last 3 months was: 7.94% (63.3 mmol/mol) $\pm 1.75\%$. When compared according to Brazilian regions, PWT1D from the Southeast region were older and had been diagnosed as T1D for a longer period.

4.2. DD, DS, and DB levels of PWT1D

DD and DS levels were similar in all Brazilian regions. Mean DD levels were >2 in all regions. Likewise, PWT1D from all regions had mean depressive symptoms scores >10. DB levels were higher in CW/North/Northeast (beta 0.189, CI 95% 0.012; 0.367, p -value: 0.0360), and perceived burnout was reported as moderate or high for a considerable part of PWT1D (32.3% in CW/ North/ Northeast; 30.9% in Southeast, and 25% in South).

The clinical, demographic, and laboratory characteristics of the total sample were described in Table 1, and Table 2 shows the comparison among the variables under study by Brazilian regions.

Table 1
Clinical, demographic, and laboratory characteristics of PWT1D.

Variable	Mean \pm SD	Min	Max
Age (years)	30.52 \pm 9.22	15.00	87.47
Years of T1D	15.29 \pm 9.79	0.00	55.00
HbA1c (last 3 months)	7.94 (63.3) \pm 1.75	5.00	17.00
Glucose self-monitoring	5.14 \pm 4.34	0.00	45.00

Variable	N (%)	N (%)	N (%)
Gender	83.02% – Female	16.98% Male	
Income	45.28% < 2 BMW	34.38% 2-5BMW	18.24% >5BMK
Conjugal status	40.25% – with partner	59.75% – without a partner	—
Race	78.62% – white	21.38% – no white	—
Education	26.42% – high school degree or less	46.54% – graduation	27.04% – post-graduation
Residential area	92.24% – urban area	37 (7.76) – suburban/rural	—
Occupation	71.28% – employed	16.14% – student	16.77% – unemployed
Brazilian regions	27.43% – North, Northeast e central-west	62.20% – Southwest	10.37% – South

PWT1D: Persons with type 1 diabetes; HbA1c: glycated hemoglobin %, and (mmol/mol.) Glucose self-monitoring: self-reported number of glucose measures/day; Income: BMW = number of Brazilian minimum wages, according to IBGE. Descriptive analysis: variables expressed as mean, min, max, and percentage; S.D.: standard deviation.

4.3. Perceived COVID-19 changes in diabetes care

The majority of patients related “family” as the main diabetes support system during the pandemic in all Brazilian regions while a small percentage of participants identified providers as the main support- (CW/N/NE: 1.7%, Southeast: 2.9%, South: 6.7%).

A significant number of PWT1D had difficulty accessing diabetes care services in Brazil (CW/N/NE: 45.8%, Southeast: 41.0%, South: 44.4%). Almost 35% of participants from CW/N/NE had difficulty accessing diabetes supplies and medications. Similarly, the percentages in Southeast and South were 39.2%, and 31.1%, respectively. A great number of participants reported that their diabetes self-care was impaired by the pandemic (CW/N/NE: 39.0%, Southeast: 38.8%, South: 48.9%). The majority of PWT1D avoided visiting diabetes facilities due to the fear of becoming infected with COVID-19. All the results regarding the COVID-19 related questions were described in Table 3.

4.4. Predictors of DB during COVID-19

Higher DB was associated with females, lower-income, higher HbA1c, and shorter time since T1D diagnosis (Table 4).

4.5. Predictors of DD during the COVID-19 pandemic

Predictors of higher levels of DD included: difficulty accessing safe places to exercise, marital status (participants without a partner), male gender, younger age, and higher HbA1c (Table 4).

4.6. Predictors of DS during the COVID-19 pandemic

The predictors of experiencing higher levels of depressive symptoms were: difficulty accessing diabetes supplies, and higher HbA1c level (Table 4).

5. Discussion

The current study demonstrated that levels of DB, DD, and depressive symptoms in all Brazilian regions were relatively high during the first months of the COVID-19 pandemic. There was no difference in DD and DS levels among different regions. Differently, DB levels were higher in participants from the CW/N/NE region. Perceived burnout was reported as moderate or high for a great part of the study participants (32.3% in CW/North/Northeast; 30.9% in Southeast, and 25% in South). The mean DD during the pandemic was higher than 2, which indicates a clinically meaningful DD.³⁴ DD levels were moderate or high in approximately one-third of participants (30.8%) in this current study, compared to 57.0% in Iran, and 13.4% in the USA.³⁷ In Denmark, at the beginning of the pandemic, the levels of DD were 25%, but this study included both T1D and T2D participants.³⁸

More than 50% of PWT1D reported moderate-severe or severe DS in this current study. In the South region, the difficulty of accessing diabetes supplies predicts the depressive symptoms scores. Prior to the pandemic, Brazilian data have documented a DS frequency of 34.9%.²⁷ Studies have shown that DS levels in PWT1D range from 3.8% to 35% before the COVID-19 pandemic.^{13,25,27}

Probably, differences in DD and DS levels among PWT1D from different countries can be accounted for differences in socioeconomic status, access to technology, diabetes education, and health support that facilitate diabetes management, since in populations from low and middle income countries DD, and DS levels were substantially higher.^{27,37}

A substantial number of the study participants experienced negative changes in diabetes care (CW/N/NE: 39.0%, Southeast: 38.8%, South: 48.9%), and difficulty accessing diabetes supplies and medications (CW/N/NE: 34.8%, Southeast: 39.2%, South: 31.1%, respectively). The literature has shown that the initial Brazilian plan to protect individuals

Table 2

Descriptive statistics - demographic characteristics, diabetes outcomes, and psychosocial comorbidities of diabetes by Brazilian regions.

Demographic	CW/N/NE (n = 118)		Southeast (n = 273)		South (n = 45)		P-value
	%/mean	S.D	%/mean	S.D	%/mean	S.D	
Gender							
Male	11.1		20.1		12.5		0.0511 ^a
Female	89.9		79.9		87.5		
Race							0.0289 ^a
White	70.9		81.3		85.4		
Not White	29.1		18.7		14.6		
Age (years)	29.59	8.00	31.36	9.83	28.07	7.78	0.0404 ^b
Time diag (years)	13.57	9.02	16.60	10.13	12.53	8.62	0.0025 ^b
Education level							
High school or less	23.6		26.4		33.3		0.0831 ^a
Graduation	40.9		50.0		37.5		
Post-graduation	35.4		23.6		29.2		
Marital status							0.0183 ^a
With partner	29.9		43.4		47.9		
Without partner	70.1		56.6		52.1		
Residential area							0.9064 ^a
Rural	3.9		3.5		4.2		
Urban	92.9		91.7		93.8		
Suburban	3.2		4.9		2.1		
Income							0.2686 ^a
<2BMW	51.2		40.6		52.1		
2-BMW	30.7		37.5		31.3		
>5BMW	18.1		21.9		168.7		
HbA1C (%) (*mmol/mol)	8.14, * 65.5	2.07	7.78 * 61.5	1.55	8.41 * 68.4	2.01	0.0819 ^b
T1-DDS total	2.72	0.99	2.38	1.00	2.76	1.13	0.1770 ^b
T1-DDS cut-off point							
No/little	64.6%		70.8%		68.8%		0.4456 ^a
Moderate/high	35.4%		29.2%		31.2%		
DBS total	2.76	0.89	2.57	0.84	2.75	0.79	0.0875 ^b
Overall burnout (single item question)							
No	29.9		30.9		43.8		0.5555 ^a
Mild	37.8		38.2		31.3		
Moderate	22.8		23.3		14.6		
Severe	9.5		7.6		10.4		
PHQ-8	10.81	6.10	10.31	6.54	11.83	6.65	0.2925 ^b
PHQ-8 cut off point							
No/mild	43.3%		50.0%		35.4%		0.1163 ^a
Moderately severe/severe	56.7%		50.0%		64.6%		

BMW = Brazilian minimum wages, according to the Brazilian Institute of Geography and Statistics-IBGE.

Significant differences: age (highest in the southeast); time diagnosis (highest in the southeast); marital status (lower proportion of participants with partners in the CW/N/NE).

^a Descriptive statistics: chi-square test.^b Descriptive statistics: Kruskal-Wallis test.

living with diabetes has not covered the majority of the population.¹⁴ The strategy to distribute medical supplies and medications for 90 days, recommended by institutions was effective for only 21% of the 64.5% of the population who received their medications and supplies from SUS, the Brazilian Unified Health System, a public healthcare system providing primary, secondary and tertiary healthcare for the population.¹⁴

Almost 75% of PWT1D in Brazil received their care from SUS.³⁹ This population depends on governmental politics and investments to access diabetes care, including health care professionals, diabetes education, supplies, and medicines. Unfortunately, SUS was not able to respond appropriately to the COVID-19 pandemic and most of this vulnerable population had their diabetes care hampered.¹⁴ Also, Brazil had a broad range of political issues during the pandemic, with a lack of unified health decisions throughout the country, which prevented authorities from taking measures aligned with the global recommendations.^{3,40}

This current study revealed that 12% of people reported fear of losing insurance during the pandemic, which could overload public services even more if it had occurred. The percentages of the population that have a private insurance plan, prior to the pandemic are small among the Brazilian regions (Southeast: 37.5%, Northeast: 16.6%, South: 32.8%, North: 14.7%, and Central-West: 28.9%).⁵ Therefore, the economic issues caused by the pandemic could increase the challenges to

underserved populations.

Most of the study participants avoided visiting diabetes facilities due to the fear of being infected by COVID-19 (70.3% in CW/North/NE, 67.4% in Southeast, and 82.2% in South). Previous data demonstrated that almost 40% of diabetes patients had their medical appointments cancelled or postponed.¹⁶ Fortunately, the Brazilian responsible agency regulated telemedicine in the country during the pandemic, which facilitated remote medical appointments. However, not all patients and health care professionals were familiar with this system. This new reality has been challenging for many patients including the elderly, those with little education, and low-income populations.

Private initiatives, such as those from Juvenile Diabetes Association-(ADJ), an institution that offered remote emergency support for patients to make insulin adjustments during the pandemic were a very important resource for many PWT1D.⁴¹

Our results demonstrated that T1D specific subgroups had even more risks of experiencing worse psychosocial outcomes. Females with lower income and higher Hb1Ac had increased levels of DB. Regarding DD, the T1D male participants without a partner had a higher odds ratio of experiencing high levels of distress. For each 1% increase in HbA1c there was a raise in almost 40% the chances of experiencing clinically meaningful DD. When it comes to DS, HbA1c was a strong predictor of high depressive levels in this current study.

Table 3
Descriptive statistics – COVID-19 questions.

COVID-19 questions	CW/N/NE (n = 116)	Southeast (n = 273)	South (n = 45)	P-value
	PERC	PERC	PERC	
Main diabetes support system				
Family	51.7	49.8	46.7	0.1856 ^a
Friends	5.1	2.9	4.4	
Peers	14.4	18.0	6.7	
Healthcare providers	1.7	2.9	6.7	
Others	6.7	2.6	8.9	
None	23.8	64.4	11.9	
Following precaution recommendations				
Yes	98.3	97.8	97.8	1.0000 ^a
No	1.7	2.2	2.2	
Being tested for the COVID-19				
Yes	5.1	5.1	4.4	0.9811 ^a
No	94.9	94.9	95.6	
Difficulty accessing diabetes care				
Yes	45.8	41.0	44.4	0.6633 ^a
No	54.2	59.0	56.6	
Difficulty accessing diabetes supplies and medication				
Yes	34.8	39.2	31.1	0.4763 ^a
No	65.2	60.8	68.9	
Difficulty accessing healthy food				
Yes	50.9	44.7	35.6	0.1991 ^a
No	49.1	55.3	64.4	
Difficulty accessing safe places to exercise				
Yes	78.0	70.0	75.6	0.2388 ^a
No	22.0	30.0	24.4	
Difficulty to pay for the very basic needs				
Yes	35.3	43.2	31.1	0.1637 ^a
No	64.7	56.8	68.9	
Being worried to lose job				
Yes	57.6	51.7	53.3	0.5533 ^a
No	42.4	48.3	46.7	
Being worried to lose housing				
Yes	33.1	36.6	48.9	0.1707 ^a
No	66.9	63.4	51.1	
Being worried to lose insurance				
Yes	12.7	16.1	6.7	0.2091 ^a
No	87.3	83.9	93.2	
Diabetes self-care has been affected				
Yes	39.0	38.8	48.9	0.4299 ^a
No	61.0	61.2	51.1	
Avoided approaching diabetes facilities due to fear				
Yes	70.3	67.4	82.2	0.1320 ^a
No	29.7	32.6	17.8 ^b	

^a Descriptive statistics: chi-square test.

^b Descriptive statistics: Fisher exact test.

We suggest that subgroups identified as at higher risk for worse psychosocial outcomes should have priority in emotional support and behavioral interventions. The levels of DB, DD, and DS in PWT1D can be used as parameters for psychosocial support and psychological and psychiatric referral when necessary. We also encourage action planning for assistance and guidance on safe places to exercise as well as an effective plan to make it easier for individuals to access diabetes supplies.

The literature has demonstrated the impact of the emotional burden of diabetes self-management and glycemic control.^{13,25,27} The current study demonstrated that T1D individuals with higher HbA1c experienced high DB, DD, and DS levels in most of the Brazilian regions. This reinforces the need for strategies to mitigate and treat mental health conditions and improve glycemic control in PWT1D in Brazil.

The small number of T1D people who meet recommended glycemic

targets is a hard reality in Brazil.⁴² In addition, there is a lack of structured educational programs as Diabetes Self-Management Education (DSME) protocols in the country. Diabetes education is offered in few centers without official national numbers, and psychological and psychiatric support for PWT1D is still scarce in Brazil.²⁷

Remote and online service needs to be developed, evaluated, and implemented. The training of diabetes teams to recognize the pathological levels of the psychosocial comorbidities is needed and the proper referral of patients to the mental health system is crucial. Telemedicine was highlighted during the COVID-19 pandemic and became one of the forefront of diabetes management. Besides decreasing the risk of virus transmission, it's effective in alleviating the emotional burden of T1D individuals.⁴³

This study has some strengths: to our knowledge this is the first national study comparing emotional burden from different Brazilian regions during the pandemic, using valid and reliable instruments that allow the evaluation of data in a trusted way. A considerable number of T1D participants took part in this study, and it increased the reliability of the results. Our study identifies subgroups at risk for worse psychosocial outcomes, which could provide evidence for target interventions. The study limitations are: the data were collected in the first months of the pandemic, therefore we could not draw conclusions about the emotional burden over time. The bias in the study sample should also be considered. The flyers were displayed on social media and web diabetes groups thus, a great part of the sample was composed of female participants with high education, and highly community-engaged, which could underestimate the DB, DD, and depressive levels.

6. Conclusions

The mean levels of DB, DD, and DS clinically relevant were high in all Brazilian regions. DD and DS levels were similar in all Brazilian regions. DB levels were higher in the CW/N/NE region.

More than 50% of PWT1D reported moderate-severe or severe DS in this current study.

A great part of PWT1D had their diabetes care harmed and experienced difficulty in accessing diabetes supplies and medications. The majority of them avoided visiting diabetes facilities, and only a small number of PWT1D relied on health care providers as their main support during the pandemic.

The predictors of the emotional burden in PWT1D during COVID-19 in Brazil included DB: female gender, lower-income, higher HbA1c and shorter time of T1D diagnosis; DD: difficulty accessing safe places to exercise, participants without partner, male gender, younger age, and higher HbA1c, and DS: Difficulty accessing diabetes supplies, and higher HbA1c.

CRedit authorship contribution statement

Below are the authors involved in the study and their contributions and roles to the research study and manuscript writing. There was no funding for this study.

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Table 4
Multivariate analysis of predictors of DB; DD, and DS) during the COVID-19.

	Regions								
	CW/N/NE			Southeast			South		
	Beta	CI95%	P-value	Beta	CI95%	P-value	Beta	CI95%	P-value
DB									
Gender (ref=male)	0.626	0.161; 1.091	0.0097						
Income <2BMW				0.293	0.103; 0.483	0.0007			
HbA1c				0.233	0.174; 0.292	<0.0001	0.233	0.123; 0.356	
Time diagnosis	0.203	0.133; 0.273	<0.0001	-0.010	-0.018; -0.002	0.0226			0.0002
	Regions								
	CW/N/NE			Southeast			South		
	OR ^a	CI95%	P-value	OR ^a	CI95%	P-value	OR ^a	CI95%	P-value
DD									
Difficulty accessing to safe places to exercise				2.053	1.059; 3.984	0.0333			
Marital status (ref=with partner)							26.720	1.508;473.544	0.0251
Gender (ref=female)				3.145	1.133; 8.696	0.0279			
Age							0.645	0.471; 0.882	0.0060
HbA1c	1.403	1.118; 1.760	0.0035	1.702	1.382; 2.097	<0.0001			
	Regions								
	CW/N/NE			Southeast			South		
	OR ^b	CI95%	P-value	OR ^b	CI95%	P-value	OR ^b	CI95%	P-value
DS									
Difficulty accessing to diabetes supplies							0.189	0.041; 0.878	0.0334
HbA1c	1.326	1.041; 1.689	0.0224	1.638	1.322; 2.030	<0.0001			

Multivariate analysis: For the multivariate model, the stepwise selection criterion was used, defining the level of significance (5%; $p < 0.05$) as the criterion for including variables in the model. Blank line - variable not included in the specific model of the region.

Tested variables: Demographic - gender; race; marital status; education; residential area; income; age; time diag and HbA1c.

COVID-19 questions - Difficulty accessing to diabetes supplies; difficulty to pay for the very basic; being worried to lose job.

Being worried to lose housing; being worried to lose insurance; difficulty accessing to healthy food; difficulty accessing to safe places to exercise.

Difficulty accessing to diabetes care; diabetes self-care has been affected; avoided approaching diabetes facilities.

BMW = Brazilian minimum wages, according to the Brazilian Institute of Geography and Statistics-IBGE).

^a Odds ratio for moderate/high distress.

^b Odds ratio for moderate/severe depressive symptoms.

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Informed consent and patient details

This study followed the principles of the Declaration of Helsinki and was approved by the University Ethics in Research Committee CAAE number: 30899220.7.0000.5404. All the patients who took part in this study agreed and signed the Consent Form.

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Declaration of competing interest

The authors declare that they have no competing interests.

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