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COVID-19 Pandemic: Differences in the Necessities, Education and Mental Health of Children and Adolescents with Neurodevelopmental Disorders in Puerto Rico

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ABSTRACT

Objective: *This study's purpose was to investigate significant differences in the (1) necessities, (2) caregiver's attitudes towards education and (3) mental health of children and adolescents with neurodevelopmental disabilities (CAND) in Puerto Rico (PR) during COVID-19, based on their age group and disorder-type.*

Method: *A quantitative-comparative research study was designed. Data was obtained from surveying 612 caregivers of CAND living in PR. Nonparametric statistics were used to research differences in CAND between age groups and disability classifications. For comparing disorders, 339 participants who selected only one disorder-type in their child were used for the analyses.*

Results: *Significant differences were found between age groups and disorder-types of CAND in all variables assessed. Infants and preschoolers required more daycare, therapies and educational materials, while adolescents and young adults needed more technology and internet. Needs between disorders were mostly associated with their specific condition (ex. more nutritional necessities in eating disorders). Preschoolers, cognitive and language disorders had a harder time adapting to distance education and considerably required more homework assistance. Maladaptive behavioral changes were reported more notably in preschoolers, while a depressive mood, stress and anxiety were more observed in those ages 6 – 21yrs. Cognitive disorders had the most prevalent increase of psychological and behavioral changes, compared to other disorders.*

Conclusion: *Substantial differences in the necessities, education and mental health of CAND in PR were confirmed. These findings are of interest to organizations and public policy makers and can be used to create more cost-effective and disability-inclusive intervention programs to assist these families.*

Keywords:

COVID–19, children, disabilities, neurodevelopmental disorders, Puerto Rico, mental health, education

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INTRODUCTION

Fifty-four thousand plus children and adolescents with neurodevelopmental disabilities (CAND) in Puerto Rico (PR)[1] are facing the COVID-19 pandemic after two consecutive Category Five Hurricanes in 2017, continued earthquake swarms[2], and 57% child poverty rates[3] in the island. The first COVID-19 suspected cases in PR were in March 8th, 2020[4] and by March 12th, the local government declared the island in a state of emergency[5]. More than 90 state executive orders for the coronavirus emergency were released, detailing safety procedures that included the activation of the Army National Guard, social distancing and quarantine measures, closures of government and non-government entities, airport control and vaccinations[6]. Additionally in 2021, the island received U.S. federal emergency funds as part of the $2 trillion Coronavirus Aid, Relief and Economics Security Act (CARES ACT)[7,8]. Although emergency response measures have been implemented, literature suggests that few considerations have been taken to create disability-inclusive response measures for people with disabilities (PwD) in the U.S.[9,10] and worldwide[11-14].

CAND before COVID-19 were already predisposed to suffering health inequities, disability related abuse, social exclusion and higher psychological symptoms[15]. Therefore, it is crucial that emergency-responders and healthcare professionals create disability-inclusive actions, tailored in accordance to the disability-type and developmental age. Various researchers[16-19] have reported that social distancing measures have affected children and adults with a variety of disabilities in their daily routines, there access to healthcare, their level of physical activity, recreation time and their access to technology and therapies. Also, literature suggests that special needs' students are having problems adapting to distance learning during the pandemic and are having poorer performance outcomes in schools and universities [16,17, 20- 23]. In relation to mental health, an increase in negative psychological symptoms, mostly anxiety and depressive indicators[19,24-32] have been reported in CAND, and research suggests it is at a higher rate than neurotypical individuals [24,31,32]. However, more information needs to be collected to know the full scope of the pandemic's impact on CAND between their age groups and disorder types.

Most comparison studies available on the effects of social distancing in CAND have been done between a disability group and neurotypical children. These confirm that CAND are having a harder time than their peers during quarantine [24,31,32]. Still, there may be differences between disorder types and age groups. There is very limited information on how the necessities, experiences in education and mental health vary by the type of neurodevelopmental disability (ND). Also, literature is limited on data that compares differences between diverse age groups of CAND in their special needs, adaptation to distance learning and psychological symptoms. ND and age groups may vary in symptoms, therapeutic needs, educational accommodations, and behavioral symptoms, therefore; information on the specific needs and changes during quarantine is valuable to creating tailored disability-inclusive response measures and intervention programs.

The purpose of this quantitative methodology study was to investigate if there are significant differences in the (1) necessities, (2) caregiver's attitudes towards education and (3) mental health of CAND in PR during the COVID-19 pandemic, based on their age group and disorder-type. The disorder classifications compared in our study included sensorimotor, general developmental, language, cognitive, physical and eating disorders. The age ranges contrasted where divided in the following categories: infants (0-2yrs.), preschoolers (3-5yrs.), middle childhood (6-11yrs.), adolescents (12-18yrs.) and young adults (19-21yrs.). Data on the necessities, caregiver's attitudes towards education and mental health was acquired through a survey administered to the caregivers of CAND.

METHOD

Participants

Figure 1 presents the flow and filter of participants. Inclusion criteria were (1) to be an adult ≥ 21yrs. (2) be a caregiver or parent of a child with disability (CwD) 21yrs and (3) live in PR during COVID-19. Ex-

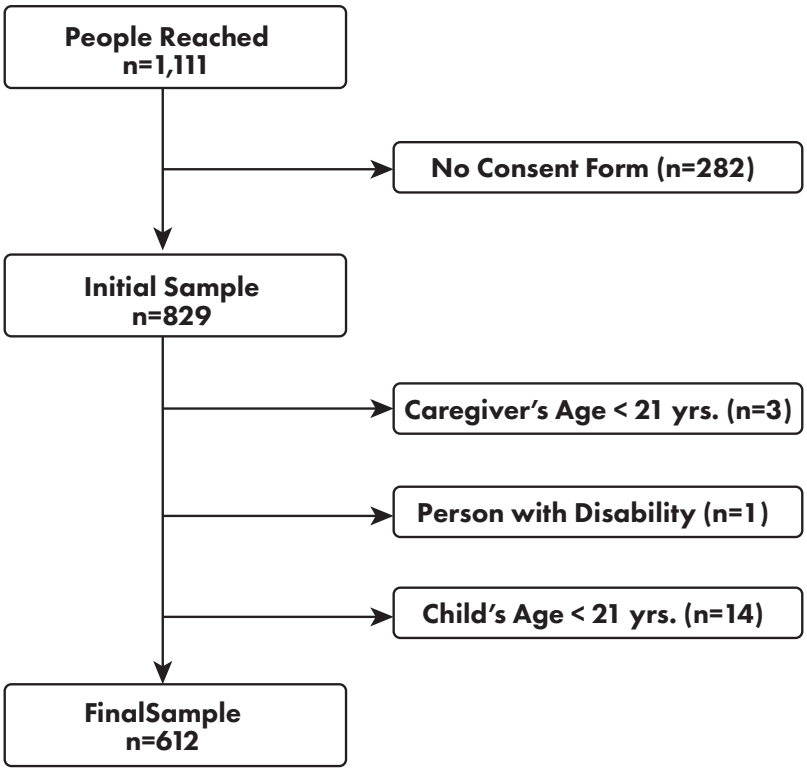

Figure 1. Participant Flow
Note. A total of 1,111 participants were reached, 282 did not sign the consent form and 18 were discounted do to not complying with the inclusion/exclusion criteria. Also, 151 participants were excluded due to insufficient survey answers. The total sample= 612 caregivers.

clusion criteria included the following: (1) have no access to the technology or internet necessary to answer the online survey, (2) participant's age was 21yrs, (3) they were the person/child with a ND and (4) they did not have the ability to consent.

Caregivers were mostly mothers living in the southern (36.1%), western (19.4%) and metropolitan (16.3%) regions of PR, in their 40s (SD_{age} - 9.19), with only one CwD (92.2%), married (49.5%), working full time (41.8%), with an average bachelor's degree education (43.3%). Most lived in a household of four (39.36%) with a total family income between $10,001-$30,999 (39.1%). The M_{age} of the child was 10.31 (SD= 4.88, 5.3%) and most were enrolled in the elementary grade (38.0 %) coursing special education (66.0%). Age groups and disorder-types are presented in tables 1 and 2.

Table 1. Age Groups of CAND

Age Group	N	%
Infants/toddlers (0-2 y.)	18	2.9%
Preschool age (3-5 y.)	95	15.5%
Childhood (6 to 11 y.)	241	39.4%
Adolescence (12-18 y.)	215	35.1%
Young Adults (19-21 y.)	27	4.4%

Note. Caregivers indicated the age of their CwD. Age groups were divided based on the standardized age divisions for pediatric trials published by Williams et al. (2012) in Pediatrics.

Measures

Descriptive data for further analyses in this investigation was obtained as part of a broader study on the effects of social distancing in CAND and their

Table 2. Type of neurodevelopmental disabilities as reported by the caregiver

Disorder Type	Total		Non-Comorbid [b]	
	N	%	N	%
Cognitive disorder	425	69.4	214	63.1
Language Disorder	254	41.5	59	17.4
Developmental Disorder [a]	127	20.8	23	6.8
Physical disorder	83	13.6	22	6.5
Sensorimotor	172	28.1	15	4.4
Eating disorder	95	15.5	6	1.8

Note. Caregivers were asked to select all that applied to their child from a list. Each category provided examples of disorders to further assist the parent in choosing the right category. Of the 612 caregivers, 339 had children with only one disorder type and no comorbidities. Those select cases are presented in the Non-Comorbid column and are later included in further nonparametric analyses (Refer to Data Analysis section).
[a] Included general, global developmental delay and intellectual disability.

families in PR. A questionnaire was created after reviewing literature on the effects of COVID-19 in CAND, inter-rater content validity was established by three expert judges in the social, neurobehavioral and educational fields. The sociodemographic characteristics of participants, multiple selection questions on necessities, and two Likert scales on the perspectives of education and mental health of CAND were included in this study. The parental attitudes towards distance learning scale obtained a good internal consistency (α= 0.773) and the child's mental health scale presented and excellent internal consistency (α= 0.93), evidencing good reliability in both measurements. For CAND's mental health, parents reported emotional and behavioral changes observed in their child with disability (CwD) since the start of the pandemic in PR.

Procedure

After receiving exemption from the Institutional Review Board of the [Ponce Health Sciences University (IRB-PHSU), Study ID: 2007042948], the creation and content validity of the instrument were established. The questionnaire was constructed to be self-administered online through the REDCap platform in the Spanish language, within 10 to 15 minutes. Recruitment was through shared promotions through social media platforms and non-profit organizations working with CAND. Caregivers were asked to sign an informed consent before participating, that provided information on the purpose of the study, the risks and benefits of participating, and the instructions on how to answer the survey. Identifying information, such as names, phone numbers, or addresses were not solicited to maintain the surveyor's anonymity and confidentiality. Data was collected between October 23rd, 2020 and June 7th, 2021 and was stored safely in REDCap. Figure 2 presents the number of participants by month during the recruitment period. Accessibility to the survey data in REDCap was limited to the investigators for data analysis purposes and the IRB-PHSU, for regulatory measures.

Data Analysis

After descriptive statistics were obtained, the Kolmogorov-Smirnov Test (KST) was used to determine the sample distribution and it resulted it was non-parametric. The SPSS Statistics, version 28.0 program was used to compute the non-parametric analyses. The *select cases* function in SPSS was used to divide the child's ages into groups, and later isolate the surveys whose parents reported only one disability-type in their child, without comorbidities (n=339). The Kruskal-Wallis Test (KWT) and later Mann-Whitney U Test (MWUT) were used to compare the medians of the necessities, mental health and educational perspectives between the age groups and disorder types of CAND and find significant differences (*p* value

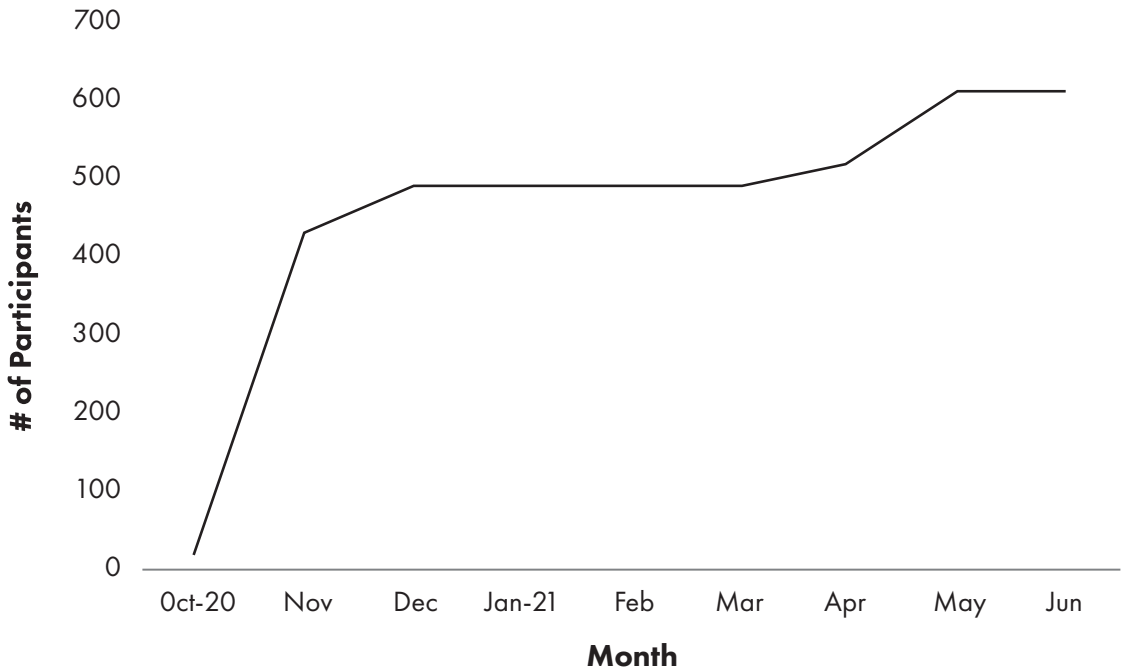

Figure 2. Number of Participants Recruited by Month
Note. Recruitment of participants was from October 23rd, 2020 to June 7th, 2021. However, most participants answered the questionnaire between the months of October to December, 2020.

<.05). Effect sizes (r) were computed to analyze the magnitude of the differences found.

RESULTS

The KWT analyses revealed significant differences ($p<0.05$) were found between the age groups and disorder types for specific necessities, perspectives of education of parents and mental health symptoms in CAND. Those significant differences found between CAND by their age and disorder type in the KWT analyses were further assessed using the post-hoc MWUT.

Differences in Necessities

MWUT revealed that preschoolers and children ages 6-11yrs. had a significantly greater necessity for educational materials, compared to adolescents and young adults (Table 3). Daycare needs were also significantly greater in infants, preschoolers and children ages 6 to 11 yrs., compared to adolescents and young adults. For therapies, a notably larger necessity was reported in infants, preschoolers and children ages 6 to 11 yrs., compared to adolescents and young adults.

For educational necessities, the post hoc test indicated that infants had a significantly lesser necessity for technology such as laptops and headphones for education than all the other age groups; including preschoolers (z = -2.581, p = < 0.05), children ages 6-11 yrs. (z = -3.369, p = < 0.05), adolescents (z = -2.859, p = < 0.05), and young adults (z = -2.325, p = < 0.05). Children ages 6-11 yrs. had a higher necessity for writing and drawing materials compared to adolescents (z = -2.412, p = < 0.05) such as pencils, crayons, markers and erasers.

The MWUT further specified the significant differences between disorder types. Specific nutritional necessities were notably more prevalent in CAND with physical and eating disorders, compared to those with sensorimotor, language and cognitive disorders (Table 4). Physical disorders had a considerably greater necessity for water, compared to language (z = -2.725, p < 0.05) and cognitive disorders (z = -2.725, p < 0.05). For medical equipment

Table 3. Summary of Post-hoc Mann-Whitney U Test for Essential Necessities between Children's Age Group

	1. Education Materials			2. Daycare Services			3. Therapies [a]		
Age Group	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**
Infants	48.06			59.97			61.22		
Preschoolers	58.69	-1.502	-0.06	56.44	-0.513	-0.02	56.20	-0.885	-0.01
Infants	111.28			145.86			141.11		
Childhood	131.40	-1.317	-0.05	128.82	-1.216	-0.05	129.17	-0.947	-0.04
Infants	112.89			143.31			137.56		
Adolescents	117.34	-0.356	-0.01	114.80	-2.694*	-0.11	115.28	-1.718	-0.07
Infants	24.00			27.75			28.00		
Young Adults	22.33	-0.630	-0.03	19.83	-2.991 *	-0.12	19.67	-2.553*	-0.10
Preschoolers	172.47			176.82			168.90		
Childhood	166.94	-0.557	-0.02	165.22	-1.272	-0.05	168.34	-0.068	-0.00
Preschoolers	171.63			175.08			166.50		
Adolescents	148.37	-2.638*	-0.11	146.85	-3.690†	-0.15	150.64	-1.866	-0.08
Preschoolers	65.04			65.41			65.30		
Young Adults	49.04	-2.508*	-0.10	47.76	-3.003*	-0.12	48.13	-2.922*	-0.12
Childhood	241.09			240.66			239.14		
Adolescents	214.39	-2.668*	-0.11	214.87	-2.988*	-0.12	216.57	-2.435*	-0.10
Childhood	137.60			137.47			138.26		
Young Adults	106.85	-2.359*	-0.10	107.96	-2.554*	-0.10	100.98	-3.244*	-0.13
Adolescents	123.02			122.95			123.92		
Young Adults	109.43	-1.271	-0.05	109.98	-1.546	-0.06	102.24	-1.874	-0.08

Note. * p<.05 †p<.001 r = effect size

[a] Therapies= psychological, physical, occupational, speech and language or other therapies

including wheelchairs, communication devices or prostheses; cognitive disorders notably required less aid in this area compared to physical (z= -5.725, p < 0.001), language (z = -2.101, p < 0.05) and eating disorders (z= -3.270*, p < 0.05). Also, needs for medical services were considerably more prevalent for physical and eating disorders, when compared to language or cognitive disorders.

Table 5 details the significant differences (p<0.05) found between disorder-types for nursing, health home caregiver, nutritionist and therapeutic necessities. Mostly physical and eating disorders had significantly greater nursing needs, compared to cognitive and language disorders. CAND with intellectual disabilities required more fulltime at-home health caregivers compared to language (z= -2.279, p<0.05), cognitive, (z= -2.308, p<0.05) or eating disorders (z= -0.736, p<0.05). Likewise, necessities for nutritionist services were more prevalent in minors with eating disorders, compared to cognitive (z= -4.077, p<.001), language (z= -4.051, p<.001), and sensorimotor disorders (z= -2.887, p<0.05). For therapies, CAND with eating disorders had a considerably lesser need for therapeutic services during social distancing, compared to those children with sensorimotor (z= -2.313, p<0.05), language (z= -2.784, p<0.05) and cognitive disorders (z= -2.811, p<0.05). Overall, the differences showed a small effect size (r ≥ 0.1; and <0.2).

Differences during Distance Education

Of the age groups, preschoolers had significantly more difficulties adapting to distance learning compared to children ages 6-11 yrs. (z = -2.898, p < 0.05) (Table 6). Their caregivers also disagreed more frequently that their child had a good academic achievement during distance education and reached their academic goals based on their grade, compared to children ages 6-11yrs. ($z = -2.993_{Edu1}$, p < 0.05; $z = -2.619_{Edu2}$, p < 0.05) and adolescents ($z = -2.877_{Edu1}$, p < 0.05; ($z = -2.383_{Edu2}$, p < 0.05). Results indicate

Table 4. Summary of Post-hoc MWUT for Essential Necessities between ND 1

	Nutritional			Water			Medical equipment			Medical services		
Disorder Type	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**
Sensorimotor	18.00			19.00			19.77			19.80		
Developmental [a]	20.48	-1.438	-0.08	19.83	0.808	0.04	19.33	-0.309	-0.02	19.30	0.200	0.01
Sensorimotor	36.00			37.00			37.97			40.40		
Language	37.88	-0.886	-0.05	37.63	0.504	0.03	37.38	-0.240	-0.01	36.76	1.033	0.06
Sensorimotor	103.50			111.00			121.13			122.40		
Cognitive	115.81	-1.336	0.07	115.28	0.761	0.04	114.57	-1.883	-0.10	114.48	0.755	0.04
Sensorimotor	16.50			17.00			17.23			17.20		
Physical	20.70	-1.958*	-0.11	20.36	1.725	0.09	20.20	-1.284	-0.03	20.23	1.055	0.06
Sensorimotor	9.50			11.00			10.70			10.60		
Eating	14.75	-2.887*	-0.16	11.00	0.000	0.00	11.75	-0.688	-0.038	12.00	0.632	0.03
Developmental [a]	43.85			42.28			41.28			43.63		
Language	40.58	-1.236	-0.07	41.19	0.695	0.04	41.58	-0.138	-0.03	40.67	0.892	0.05
Developmental [a]	121.46			119.65			122.65			123.61		
Cognitive	118.74	-0.334	-0.02	118.93	0.145	0.01	118.61	-1.388	-0.05	118.50	0.573	0.03
Developmental [a]	21.93			21.48			20.98			20.91		
Physical	24.11	-0.840	-0.05	24.59	1.460	0.08	25.11	-1.793	-0.14	25.18	1.423	0.08
Developmental [a]	13.89			15.13			14.63			14.52		
Eating	19.25	-1.956	-0.11	14.50	0.511	0.03	16.42	-1.042	-0.06	16.83	0.844	0.05

Note. * $p<.05$ †$p<.001$ r = effect size
[a] Developmental= intellectual disability, global developmental delay

Table 5. Summary of Post-hoc MWUT for Essential Necessities between ND 2

	Nursing services			Health home carer			Nutritionist/dietician			Therapies		
Disorder Type	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**	**Mean Rank**	**Z-value**	**r**
Sensorimotor	19.00			19.27			19.00			21.43		
Developmental [a]	19.83	-0.808	-0.04	19.65	-0.242	-0.01	19.83	-0.808	-0.04	18.24	-1.036	-0.06
Sensorimotor	37.50			39.47			36.50			37.63		
Language	37.50	0.000	0.00	37.00	-1.983*	-0.11	37.75	-0.718	-0.00	37.47	-0.035	0.00
Sensorimotor	114.50			120.63			108.50			117.97		
Cognitive	115.04	-0.265	-0.01	114.61	-1.501	-0.08	115.46	-0.981	-0.05	114.79	-0.228	-0.01
Sensorimotor	18.00			18.73			17.50			21.57		
Physical	19.68	-1.184	-0.06	19.18	-0.262	-0.01	20.02	-1.472	-0.08	17.25	-1.400	-0.08
Sensorimotor	10.50			11.20			9.50			12.70		
Eating	12.25	-1.581	-0.09	10.50	-0.632	-0.03	14.75	-2.887*	-0.16	6.75	-2.313*	-0.13
Developmental [a]	42.78			44.07			41.78			36.67		
Language	41.00	-1.602	-0.09	40.50	-2.279*	-0.12	41.39	-0.206	-0.01	43.38	-1.421	-0.08
Developmental [a]	123.15			126.80			117.15			103.98		
Cognitive	118.55	-1.929	-0.10	118.16	-2.308*	-0.13	119.20	-0.333	-0.01	120.61	-1.383	-0.08
Developmental [a]	22.48			22.96			21.98			23.72		
Physical	23.55	-0.630	-0.03	23.05	-0.046	-0.00	24.07	-1.082	0.059	22.25	-0.433	-0.02
Developmental [a]	14.63			15.26			3.63			16.20		
Eating	16.42	-1.042	-0.02	14.00	-0.736*	-0.04	20.25	-2.838	-0.15	10.42	-1.710	-0.09

Note. * $p<0.05$ †$p<.001$
a Developmental= intellectual disability, global developmental delay

Table 6. Summary of Post-hoc Mann-Whitney U Test for the Attitudes of Parents towards Distance Education by the Child's Age Group

	Edu 1 [a]			Edu 2 [b]			Edu 3 [c]			Edu 4 [d]		
Age Group	Mean Rank	Z-value	r	Mean Rank	Z-value	r	Mean Rank	Z-value	r	Mean Rank	Z-value	r
Infants	40.00			28.00			24.50			33.67		
Preschoolers	30.02	-1.393	-0.06	31.33	-0.465	-0.02	31.71	-1.320	-0.05	30.15	-0.490	-0.02
Infants	95.75			60.08			55.50			126.50		
Childhood	90.84	-0.237	-0.01	91.55	-1.525	-0.06	91.71	-1.928	-0.08	89.78	-1.758	-0.07
Infants	72.17			47.08			38.00			104.00		
Adolescents	70.43	-0.107	0.00	70.00	-1.445	-0.06	72.47	-2.213*	-0.10	69.53	-2.121*	-0.08
Infants	12.67			9.17			6.50			14.17		
Young Adults	10.33	-0.827	-0.03	11.73	-0.917	-0.04	12.80	-2.364*	-0.10	9.73	-1.556	-0.06
Preschoolers	93.06			95.52			103.34			136.97		
Childhood	122.55	-2.993*	-0.12	121.16	-2.619*	-0.11	118.69	-1.755	-0.07	108.22	-2.898*	-0.12
Preschoolers	77.85			79.61			78.48			117.09		
Adolescents	102.04	-2.877*	-0.12	99.33	-2.383*	-0.10	102.43	-3.061*	-0.13	86.16	-3.663	-0.15
Preschoolers	34.55			34.05			33.11			36.87		
Young Adults	39.00	-0.801	-0.03	38.63	-0.714	-0.03	44.27	-2.295*	-0.10	28.27	-1.530	-0.06
Childhood	153.82			153.46			144.25			160.80		
Adolescents	156.54	-0.276	-0.01	152.39	-0.111	0.00	168.86	-2.668*	-0.11	148.63	-1.238	-0.05
Childhood	96.63			96.14			93.49			95.18		
Young Adults	82.33	-1.010	-0.04	81.77	-1.025	-0.04	112.47	-1.460	-0.06	99.23	-0.286	-0.01
Adolescents	75.23			74.54			75.43			74.52		
Young Adults	64.00	-1.084	-0.04	64.43	-0.917	-0.04	76.10	-0.061	0.00	84.30	-0.868	-0.04

Note. The Likert scale options where 1= Totally disagree, 2= Somewhat disagree, 3= Somewhat agree, 4= Totally agree.
* $p<0.05$ †$p<.001$
[a] Edu 1= My child's academic achievement was excellent during COVID-19.
[b] Edu 2= My child accomplished the learning goals expected for his/her grade or academic level during distance education.
[c] Edu 3= My child mainly did assignments by himself without requiring help.
[d] Edu 4= How has been the adaptation of your child with disabilities or neurodevelopmental disorders with the changes in education brought by the Pandemic?

that caregivers of children less than 12 years reported that their child notably required more homework assistance by an adult, compared to those caregivers of adolescents and young adults.

For disorder types, the results revealed that both language disorders ($z = -2.380$, $p < 0.05$) and cognitive disorders ($z = -3.137$, $p < 0.05$) had greater difficulties adapting to distant education than children with physical disorders, according to their caregivers. The effect size (r) for these differences was generally between 0.1 and 0.2.

Differences in Mental Health

Table A.1 in Appendix provides a summary of the statistical results on the mental health differences between age groups of CAND. Generally, children between 6 to 11yrs. ($z=-3.248$, $p < 0.05$), adolescents ($z = -2.967$, $p < 0.05$) and young adults ($z = -2.974$, $p < 0.05$) presented more symptoms of sadness and depressive moods; compared to preschoolers, according to their caregivers. Similarly, children ages 6 to 11yrs, adolescents and young adults notably presented more stress and anxiety symptoms, compared to younger children. Conversely, an increased fear to staying alone and nocturnal enuresis were greatly reported amongst infants and preschoolers compared to older children. Somatic symptoms were significantly more prevalent in children ages 6 to 11 yrs. ($z= -2.614$, $p < 0.05$), adolescents ($z= -3.088$, $p < 0.05$), and young adults ($z= -2.427$, $p < 0.05$), when compared to preschoolers. An increase in risk-taking ($z = -4.090$, $p < 0.01$) and aggressive behaviors ($z = -3.375$, $p < 0.01$), physical reactions to pandemic-related con-

versations (z = -3.729, p < 0.01) and negativity (z = -4.004, p < 0.05) were very significant in adolescents, compared to preschoolers.

For specific disorders, an increase in appetite was observed considerably more in CAND with physical (z = -1.999, p < 0.05) and cognitive disorders (z = -2.849, p < 0.05) than in sensorimotor disorders. Caregivers of children with cognitive disorders most notably reported a reduced desire to participate in social activities in their child, when compared to minors with language disorders (z = -3.381, p < 0.01). Similarly, higher anxiety symptoms and concentration difficulties were observed in children with cognitive disorders, compared to those with language and physical disorders (Table A.2 in Appendix).

DISCUSSION

The purpose of this study was to investigate significant differences between age groups and disorder types of CAND in PR during the COVID-19 Pandemic. The variables assessed were the (1) necessities, (2) caregiver's attitudes towards education and (3) minor's mental health. Overall, this study confirms the presence of statistically significant differences in all three variables assessed for both the age groups and the types of ND.

For the necessities, the results showed that children ages 11 and under required notably more school supplies, crafting and writing materials than adolescents and young adults. This is consistent with their developmental age and grade level, as reading and writing skills are greatly emphasized in the preschool and elementary years[33]. Our previous descriptive study[34] indicated that 70% of CAND in PR had a necessity for therapies during quarantine; and this investigation adds that this need is significantly larger for children from ages 0 to 11 yrs., and those minors with sensorimotor, cognitive and language disorders. This finding is concerning since occupational; language and psychological therapies are crucial in CAND during the early stages of development to prevent further delays and improve their quality of life. Our study also indicated that daycare needs were significantly greater in preschoolers and elementary school children. This is not surprising since younger children typically are more dependent of caregivers than adolescents and young adults. For disorder classifications, notable differences in necessities were generally consistent with each specific disorder characteristics. For example, more nutritional necessities and services during social distancing were more prevalent in eating disorders, compared to sensorimotor, language and cognitive disorders. Metabolic genetic disorders and eating disorders usually require a specific diet to be followed so it is expected that children of these disabilities required more nutrition-related necessities.

In relation to education, literature reports that CAND are having a hard time adapting to distance education and are presenting a lower academic achievement during social distancing[16,17, 20- 23]. Our study is consistent with previous findings and adds that preschoolers are especially struggling more to adapt to distance learning, compared to older children. According to their caregivers, results in our study indicated that they had greater difficulties reaching their academic milestones for their grade and required more homework assistance from adults, than adolescents. Elementary school children also required significantly more homework assistance than middle, high school and university students. This is also consistent with their developmental age, as younger children, especially those with ND, require assistance in most aspects of their daily routine, including schoolwork.

Both language and cognitive disorders in our study had significantly more difficulty adapting to distant education than children with physical disorders, according to their parents. This is to be expected because education in school requires a higher involvement of language and cognitive abilities, that are reasonably impaired in children with language and cognitive disorders and may be affected less by children with only physical disorders.

Generally, our research confirmed that younger children ages 11 and below presented more fear of being alone, risk taking and aggressive behaviors, and nocturnal enuresis; while adolescents reported more symptoms of anxiety, sadness, stress and somatic symptoms. Literature indicates

that children manifest symptoms related to anxiety and depression differently than adolescents or young adults, and the results in this study are consistent to the symptoms expected by age for mood and anxiety disorders as described in the DSM-5-TR[35]. Also, younger children are still developing emotional intelligence and language, therefore, they may not be able to express their feelings to their caregivers for them to report, as do adolescents and young adults. Parents of infants and preschoolers reported more nocturnal enuresis than adolescents, which is to be expected since bedwetting is most common in children ages seven and below, and it is also associated with an increase in stress levels[36], as reported in this study.

Cognitive and specific learning disabilities (SLD) had higher anxiety, concentration difficulties, irritability and aggressive behaviors during quarantine compared to language disorders. This is congruent with their type of disability since the changes in routine and education can greatly affect children with disorders such as autism, attention deficit and hyperactivity disorder (ADHD), and specific learning disorders (SLD); and with the changes brought by the pandemic, these symptoms may be further exacerbated. General developmental disorders such as intellectual disability experienced more concentration difficulties compared to eating disorders, which is also congruent with their pathology since intellectual disabilities should have a higher cognitive impairment than their neurotypical peers. Overall, the psychological and behavioral changes in CAND experienced during quarantine were also consistent with disorder types, as with the age group differences.

Significance of the study and future implications

To our knowledge, this is the only study dedicated to investigating significant differences on the effects of social distancing between age groups and disability-types in CAND on the needs, education and psychological symptoms in PR, providing a valuable contribution to literature. Our 612 sample size, inclusion of five different age groups and 6 types of disorder categories provide extensive and generalizable information on the different needs, changes in mental health and education in CAND during the COVID-19 pandemic; which is valuable information. This data can be used to create more disability-inclusive intervention programs tailored in accordance to the individual needs by disability and developmental age. Healthcare professionals, educational institutions and governmental entities can create more cost-effective emergency-response programs that include specific aid in accordance to the disability-type and age of the child. Taking into consideration the sociocultural aspects of CAND in PR, and the island's accumulated $72 billion in debt[3], having a more cost-effective program benefits both providers of aid and CAND in this and future emergencies.

Limitations

While this research provides valuable information on CAND during the COVID-19 pandemic, it has some limitations. Although 6 disability categories were included, individual disorders were not assessed. This limits information of specific disorders within a category. For example, minors with autism and ADHD both were categorized as cognitive disorders, but may have different necessities, mental health symptoms and educational changes during COVID-19. Further limitations include that the data was reported by the caregivers; and the educational experiences and mental health changes may be different if reported by the children, or by the clinical evaluation of a clinician. In addition, the reports of caregivers who did not have the technological means to access the online survey were excluded. Furthermore, the differences by age-group and disorder-types may vary with time, as the emergency stage progresses, and the community adaptation continues.

Recommendations for Future Research

To broaden the scope of the findings presented in this study, further investigation is recommended to explore the differences in mental health and educational perspectives during and post-COVID-19 between individual disorders, such as those with autism, compared to those with ADHD. Additionally, it is advised that researchers continue to mon-

itor, examine, and compare how these differences in the needs, education, and mental health evolve over time.

Overall, this study confirmed significant differences in the necessities, caregiver's attitudes towards education and mental health in CAND in PR during COVID-19 pandemic, based on their age group and disorder-type. Differences in the needs were mostly congruent with their developmental stage and the type of ND category. These findings contribute to our knowledge on the effects of social distancing in CAND and can be used to create more cost-effective and disability-inclusive intervention programs to assist these families in this and future emergencies.

Declaration of interests

The authors were not financially or personally affiliated with any person or entity, neither directly nor indirectly, that could influence the creation and results of this work.

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APPENDIX

Table A.1 Summary of Post-hoc MWUT for the Mental Health Symptoms between Children's Age Group

	Depressive mood		Stress		Anxiety (Thoughts)		Fear to stay alone		Somatic Symptoms		Nocturnal enuresis	
Age Group	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value
Infants	43.33		43.62		54.88		58.31		51.81		56.00	
Preschoolers	51.48	-1.138	50.40	-0.863	49.84	-0.686	49.92	-1.032	50.30	-0.298	49.68	-0.955
Infants	73.50		86.31		102.81		126.77		103.88		134.31	
Childhood.	117.29	-2.466	117.77	-1.773	116.79	-0.788	115.36	-0.637	116.20	-0.843	113.30	-1.608
Infants	66.08		72.58		90.35		129.08		90.04		125.77	
Adolescents	104.19	-2.356*‡	104.54	-2.041*‡	104.39	-0.883	99.06	-1.988*‡	104.41	-1.052	99.83	-2.619*‡
Infants	12.25		14.65		16.58		23.62		16.85		21.38	
Young Adults	21.63	-2.809*‡	21.35	-1.916	20.31	-1.074	16.50	-2.090*‡	20.17	-1.143	17.71	-1.315
Preschoolers	129.97		137.10		129.49		147.26		137.29		157.36	
Childhood	162.34	-3.248*‡	157.81	-1.985*‡	162.38	-3.203*‡	156.02	-0.837	158.60	-2.614*‡	149.13	-1.060
Preschoolers	121.23		121.50		118.22		149.65		123.67		150.11	
Adolescents	148.65	-2.967*‡	146.07	-2.541*‡	150.54	-3.362†‡	133.28	-1.743	148.09	-3.088*‡	133.15	-2.602*‡
Preschoolers	52.39		52.20		52.55		58.76		53.45		56.84	
Young Adults	71.58	-2.974*‡	64.92	-1.864	68.50	-2.445*‡	48.21	-1.530	65.25	-2.427*‡	52.96	-0.717
Childhood	205.93		201.10		204.61		219.81		202.64		208.97	
Adolescents	202.88	-0.287	209.46	-0.771	207.58	-0.272	184.59	-3.259*‡	208.72	-0.655	195.14	-1.896
Childhood	119.49		120.28		120.46		124.44		120.04		120.20	
Young Adults	134.69	-1.116	132.56	-0.878	130.98	-0.750	94.83	-2.102*‡	129.67	-0.821	118.25	-0.194
Adolescents	106.31		107.25		108.11		107.27		108.35		106.39	
Young Adults	121.46	-1.239	113.96	-0.540	116.13	-0.632	100.46	-0.572	114.25	-0.536	111.83	-0.718

	Increased Risk-taking behaviors		Increased aggressive/ disruptive behaviors		Games involved events related to pandemics and natural disasters		Abrupt physical reactions or psychological stress with thoughts or conversations of COVID-19		Negative thoughts of himself or the world (Negativism)	
Age Group	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value	Mean Rank	Z-value
Infants	50.54		47.46		54.19		56.19		54.12	
Preschoolers	50.49	-0.006	50.38	-0.377	50.53	-0.852	50.23	-1.178	49.38	-1.248
Infants	127.92		114.12		108.50		112.62		109.15	
Childhood.	114.76	-0.897	115.58	-0.086	113.81	-0.413	115.67	-0.210	115.88	-0.505
Infants	124.00		117.65		103.23		93.85		90.27	
Adolescents	100.49	-2.152*‡	100.39	-1.294	101.92	-0.131	103.09	-0.665	102.27	-0.932
Infants	21.54		19.69		20.27		16.58		17.04	
Young Adults	16.78	-1.800	18.63	-0.328	17.50	-1.909	20.31	-1.176	19.33	-0.862
Preschoolers	164.32		156.77		138.51		137.01		135.60	
Childhood	147.76	-1.866	150.11	-0.665	156.16	-2.498*‡	159.49	-2.796*‡	158.50	-3.183*‡
Preschoolers	160.1		158.08		134.01		119.63		118.20	
Adolescents	129.38	-4.090†‡	128.87	-3.375†‡	142.04	-1.383	149.38	-3.729†‡	147.01	-4.004†‡
Preschoolers	58.40		56.79		56.91		52.49		52.58	
Young Adults	44.52	-2.266*‡	50.88	-0.893	52.50	-1.391	71.19	-3.685†‡	64.04	-2.957*‡
Childhood	214.44		219.88		207.54		198.28		197.87	
Adolescents	192.07	-2.704*‡	184.70	-3.528†‡	195.78	-1.556	211.57	-1.424	209.97	-1.406
Childhood	122.09		121.79		120.77		118.88		119.67	
Young Adults	105.48	-1.451	113.81	-0.598	97.50	-2.339*‡	140.21	-1.808	128.33	-0.799
Adolescents	107.30		105.75		108.57		106.70		106.30	
Young Adults	104.50	-0.332	116.81	-1.041	94.00	-1.886	118.38	-1.038	108.11	-0.173

Note. * $p<.05$ †$p<.001$ ‡ Effect size $r \geq 0.1$; and <0.2

Table A.2. Summary of MWUT for Mental Health Symptoms between ND 1

	Increased appetite		Reduced desire to participate in social activities with peers or adults		Anxiety or exaggerated preoccupations		Difficulties concentrating	
Disorder Type	**Mean Rank**	**Z-value**	**Mean Rank**	**Z-value**	**Mean Rank**	**Z-value**	**Mean Rank**	**Z-value**
Sensorimotor	14.08		18.00		18.81		16.77	
General developmental	19.62	-1.806	17.19	-0.257	16.69	-0.652	17.15	-0.119
Sensorimotor	25.46		40.38		43.04		40.50	
Language	35.47	-1.888	33.11	-1.419	32.48	-2.023*‡	33.08	-1.295
Sensorimotor	56.81		90.04		99.12		95.08	
Cognitive	99.38	-2.849*‡	98.57	-0.569	98.46	-0.043	97.67	-0.173
Sensorimotor	13.69		17.35		20.19		19.96	
Physical	19.86	-1.999*‡	17.60	-0.080	15.83	-1.371	15.98	-1.210
Sensorimotor	9.08		9.96		10.38		11.54	
Eating	12.00	-1.292	10.08	-0.048	9.17	-0.471	6.67	-1.872
General Developmental	37.62		42.95		44.05		45.05	
Language	37.45	-0.033	36.80	-1.288	36.38	-1.583	35.44	-1.796
General Developmental	86.69		90.40		91.69		100.78	
Cognitive	102.12	-1.231	103.34	-1.034	103.74	-0.950	101.02	-0.020
General Developmental	21.33		20.83		22.88		23.90	
Physical	21.67	-0.097	22.17	-0.394	20.12	-0.815	18.24	-1.613
General Developmental	14.02		13.83		14.02		15.20	
Eating	13.92	-0.032	14.58	-0.227	13.92	-0.032	7.83	-2.194*‡
Language	103.10		93.96		91.55		93.71	
Cognitive	120.47	-1.767	126.57	-3.381†‡	127.90	-3.712†§	126.03	-3.280*
Language	37.29		36.03		37.58		38.43	
Physical	38.02	-0.144	44.98	-1.847	40.90	-0.702	38.69	-0.050
Language	30.01		30.38		30.44		32.02	
Eating	29.92	-0.014	36.67	-0.998	36.17	-0.907	21.67	-1.461
Cognitive	102.08		102.81		105.13		104.60	
Physical	87.07	-1.197	94.95	-0.628	79.60	-2.017*‡	74.79	-2.372*‡
Cognitive	93.47		94.70		95.37		95.81	
Eating	79.00	-0.693	88.33	-0.305	83.83	-0.544	39.50	-2.688*‡
Physical	14.07		14.00		13.64		15.14	
Eating	13.75	-0.096	14.00	0.000	15.25	-0.496	10.00	-1.545

Note. * $p<.05$ †$p<.001$ ‡ Effect size r ≥ 0.1; and <0.2 § Effect size r ≥ 0.2; and <0.5