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A Study On The Validity And Reliability Of The Taiwan Version Of The Parent-Child Shared Management Of Chronic Illness Scale

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Abstract:
Background: *This study focused on children with Type 1 diabetes (T1D) and their parents to subject a Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale to reliability and validity testing and explore influencing factors to Parent-Child Shared Management of T1D.*
Methods: *A cross-sectional study design was used. The study sample was selected from a medical center. Structured questionnaires were distributed to 111 parents of children who had been diagnosed with T1D for more than one year.*
Results: *The scale was tested for validity using exploratory factor analysis. After removing the items with a factor loading of less than 0.50 and those that were cross loaded, 84.72% of the variance was explained by three factors: Factor 1 (knowledge, 57.17%), Factor 2 (desire, 15.69%), and Factor 3 (action, 11.86%). In terms of reliability, the Cronbach's α for the total scale was .89, and the Cronbach's α for the three subscales, namely knowledge, desire, and action, were 0.93, 0.87, and 0.77, respectively, indicating good reliability. Parental anxiety (as measured by the State-Trait Anxiety Inventory) and functional status for children with chronic diseases (as measured by the Chinese version of functional status scale for chronically ill children) were tested for criterion-related validity. In the hierarchical regression analysis, child-related variables were added in the first step of the analysis, resulting in $R^2 = 0.28$, $F = 6.65$, $p < 0.05$; child-related variables alone explained 28% of the variance in parent-child shared management of T1D. In the second step, family-related variables were added, which increased the variance explained by 9%. In the third step, parent-related variables were added as predictors, which increased the variance explained by 14%. The total variance explained was 51%.*
Conclusions: *The scale can effectively be used by health providers to assess the parent-child shared management of T1D to provide individualized nursing care.*
Keywords: *Type 1 diabetes, Chronic Illness, Parent-Child Shared Management, Taiwan Version, reliability and validity*

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I. Introduction

Children suffering from type 1 diabetes (T1D) are often required to take long-term care, that affects the psychological and emotional well-being of children and their families. It is important to consider the participation of children with T1D so that they properly develop autonomy and successfully transition into the adulthood phase. There are few tools available to assess the health share-management of parents and their children; as such, under the process of globalization, there is a necessity to translate psychometric tools with good reliability and validity. Kieckhefer and Trahms (2009) proposed the concept of shared management, which refers to parents using their life experience and knowledge to help children with chronic diseases cultivate health management skills.[1]

Manifestation of parental functions and health management of a child with T1D

Studies have indicated that interactions between adolescents with T1D and their parents require support of the adolescents' need for self-reinforcement; autonomy support is a necessary factor in internalization assistance and the promotion of healthy behavior. When children with chronic diseases are making hospital discharge preparations, medical personnel must respect individual preferences and encourage shared decision-making. In this process, parents and children must share the responsibility for health management. The participation of

children with T1D in health care activities from infancy to adolescence and the establishment of stable partnerships between children and parents, help children to take responsibility for self-care and confidently transition into adulthood. [2] Based on the above, parents must pay attention to children with T1D, whose needs change as they grow and develop, and consistently cultivate self-management abilities in their children.

When faced with the challenge of having a child with T1D, many parents will first prepare themselves mentally, and eventually become competent at researching information on care-related knowledge. Having formed their expectations, these parents then play a dominant role in guiding their children to integrate into disease care activities. The accompaniment guidance of such parents are the main factors influencing their children's ability to achieve peace of mind.[3] These factors in turn ultimately affect their children's search for their place in life when living with T1D. Despite parents' self-sacrifice, indifference, or direct confrontation in parent-child interactions, their children will continue to grow. During the process of shared decision-making, children may develop different opinions and beliefs, which often makes it difficult to plan the transfer of the responsibility for health management.[4]

Parent-child shared management concept and related influencing factors

Parents' anxiety may affect the shared management of chronic diseases in children. Anxiety in caregivers may be caused by caregivers' characteristics and the patients' characteristics. The burden of providing care for children with special health needs is often the reason for the physical, financial, and emotional issues faced by caregivers. The functions of children with T1D are related to their characteristics, and cognition. Studies suggested that children's age and disease severity influence their family's return to normality.[5] Hockenberry and Wilson (2018) study on important factors influencing self-care behavior in children with T1D indicated that such self-care behavior was affected by the education levels of caregivers, the income of the family, the performers of insulin injections, the performers of blood glucose tests, and the number of school days missed due to diabetes. Children with diabetes differ in terms of their calorie intake and insulin regulation.[6] Relatedly, diet plans must be formulated based on their activity levels. Parents' attitudes, meanwhile, are influenced by multiple factors, including their knowledge of the disease. By learning how to calculate the intake of carbohydrates and convert it into insulin doses, young patients and their families can improve the patients' blood glucose control.[7] The core tasks in the health management of children with T1D include performing insulin injections, blood glucose monitoring, diet regulation, and exercises. School-age children can inject insulin under supervision. In the case of children with T1D, children's confident social integration requires parental guidance provided with a positive attitude. The proper age for doing so varies from person to person, and it is important for caregivers to recognize when to let children perform injections themselves. Studies have indicated that school-age children can assume responsibility for half of the disease management tasks.[4]

Measurement tools for parent-child shared management of chronic diseases

Regarding the methods used to assess the health of children with chronic diseases, studies have proposed that the health status of such children can be most conveniently and effectively assessed using various scales. The earliest tool allowing for in-depth measurement of children's participation in self-care, the Parent-Child Shared Management of Chronic Illness Scale, was developed by Kieckhefer and Trahms.[1] The results of this study can clarify the concept of parent-child shared management of chronic illness and help experts develop individual health care plans.

II. Material and Methods

This correlational study was a cross-sectional design with convenience sampling was conducted. Data was collected using structured questionnaires.

1. Participants

The participants in this study were from a medical center in Taiwan. The inclusion criteria were as follows: mother or father of a 2-18-year-old child with T1D, T1D diagnosis longer than one year, ability to communicate in Mandarin, and ability to read a questionnaire in traditional Chinese. Data were obtained from questionnaires self-reported by the parents of children with T1D.

2. Research Instruments

(1) Taiwan Version of the Parent-Child Shared Management of Chronic Illness Scale

The Parent-Child Shared Management of Chronic Illness Scale was developed by professors Kieckhefer et al. (2009).[1] Regarding the Taiwan version of this Scale, prior to translation, the authors of the original scale were contacted by email. The scale was translated into traditional Chinese following the translation proposed by Jones et al. (2001).[8] The equivalence in cross-cultural measurement of the translated scale was measured. A teacher of English was asked to perform a backward translation. Two parents were asked to fill in the translated scale and

evaluate the clarity of the questionnaire's writing. The translation was revised in a meeting until the researchers agreed that language and cultural equivalence had been achieved. Five experts were asked to evaluate content usability and word usage clarity for each item, the expert content validity index (CVI) value was 0.95. The Cronbach's α of the total scale was 0.89; the Cronbach's α values of the three subscales were 0.76 (knowledge), 0.82 (desire), and 0.73 (actions).

The internal consistency of the Taiwan version scale conducted in formal testing (N=111). The Cronbach's α of the total scale was 0.90, and according to the internal consistency analysis results for the subscales, the Cronbach's α values were 0.83 (knowledge), 0.73 (desire), and 0.73 (actions).

(2) Chinese Version of the Functional Status II (R)

The Chinese version of functional status scale for chronically ill children (C-FS II (R) is a scale which mainly measures the daily role functions and tasks of children affected by chronic illness. In this study (N=111), the Cronbach's α of the total scale was 0.85. The results indicated good criterion-related validity and psychometric properties of the C-FS II (R), which in turn indicates that it as a suitable tool for the measurement of functional status in chronic illness.[9]

(3) State-Trait Anxiety Inventory (STAI)

The Cronbach's α values of the original state anxiety inventory and trait anxiety inventory developed by Spielberger et al. in 1970.[10] The test-retest reliability of the STAI was 0.74 for the state anxiety inventory and 0.76 for the trait anxiety inventory. The Cronbach α values of the state anxiety inventory and trait anxiety inventory were 0.90 and 0.86, respectively. In this study, the Cronbach's α values (N=111) of the state anxiety inventory and trait anxiety inventory were 0.87 and 0.80, respectively; the Cronbach's α of the total scale was 0.91.

3. Ethical approval

This research project was reviewed by an institutional review board (IRB No.13MMH068).

III. Result

In accordance with the research objectives, the collected data was analyzed for reliability and validity. The statistical analyses used included percentages, means, standard deviations, EFA, Cronbach's α, the independent t-test, ANOVA, Pearson correlation, and multiple regression analysis.

1.Demographic characteristics of children with T1D

Regarding gender, 62 (55.9%) of the children with T1D in this study were male. Most of the patients were the eldest child in their families (n=63; 56.8%). Regarding their studies, 39 patients (35.1%) were in senior high school/vocational school, while the other patients were in elementary school (19.8%) or junior high school (29.7%). The average age of the patients was 14 years. The duration of the disease ranged from 1 year to 16 years. Glycated hemoglobin (HbA1c) was set as the health indicator, and its average value based on the most recent test was 7.5%. Furthermore, 40.5% of the participants had taken leave from school due to diabetes within the past six months; 27.9% of the patients needed emergency care due to diabetes within the past six months; and 23.4% of the patients were hospitalized due to diabetes within the past year, with the average number of hospitalization days being 7.9.

2.Demographic characteristics of parents of children with T1D

Regarding the descriptive statistics of the parents of the children with T1D, the average age of the parents was 47 years. Most of the study participants were mothers (71.2%). As some families switched from the dual-earner family to the single-earner model after the child's diagnosis, the average monthly income of most families was lower than USD$1,750 (68.5%). Half of the parents had a university or college degree (50%). Most of the participants were married (64.0%). Almost half of the participants had two children (49.5%). Most of the parents assessed their health status as satisfactory (57.7%).

3.Reliability and validity of the Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale

(1) Validity Test

The results indicated that the criterion-related validity values of the C-FS II(R) and STAI were significantly positively and negatively correlated with the parent-child shared management of T1D, respectively. A significant correlation was observed between the parent-child shared management of diabetes and the children's functional status (r=.43, p<0.05), meaning that a better functional status led to better parent-child shared management. The Pearson correlation analysis indicated a significant moderate correlation between the two factors (r=-0.53, p<0.05), meaning that higher anxiety levels in parents resulted in poorer parent-child shared management.

The defining features and construct validity in parent-child shared management of chronic illness was examined by EFA. Gorsuch (2014) suggested that the total sample for a factor analysis should include a minimum of 100 participants.[11] Therefore, after a preliminary test, 111 participants were testing to conduct a factor analysis. The Kaiser-Meyer Olkin (KMO) index (0.75) and the chi-square value in Bartlett's sphericity test (1259.11; df=66) reached a significant level (p<0.05), indicating the presence of common factors in the correlation matrix of the population. The values obtained in the two tests indicated the suitability of the factor analysis.

Principal axis factoring was applied to test item homogeneity. The Promax method with the simplest factoring featureswas used to conduct oblique rotation.[12] Common factors with an eigenvalue greater than 1 were left, and the number of factors was retrieved with the reference to the factor scree plot.[13] The factor loading for each factor was obtained from the component matrix after rotation. The convergent validity of each variable was determined based on the factor loadings. Three factors were derived. Repeated analyses were conducted after the deletion of each item, and changes were explored in relation to the previous step. According to Black and Babin (2019), items with factor loadings lower than 0.50 should be removed. Similar factor loadings indicate that items cover several constructs and may be poorly designed, and items with such factor loadings should also be removed. Thus, Item 8, which had a factor loading lower than 0.50, was removed. Higher values of the R^2 variance explained value indicate a better explanatory power.[14] Repeated analysis of the remaining 11 items showed that the total variance explained increased from 76.70% to 80.78% after item removal, indicating improved overall explanatory power **(Table 1).**

Table 1 Comparison of the Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale component matrices after item removal

Rotated component matrix

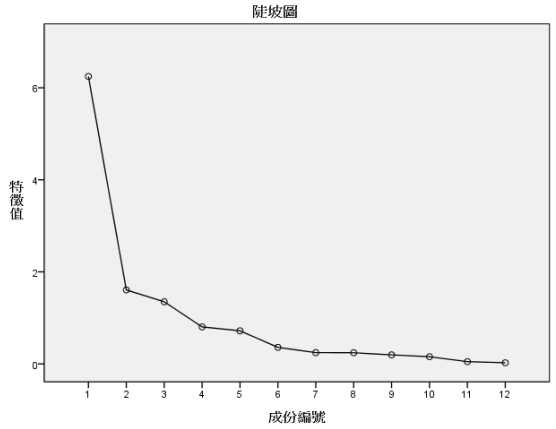
Factor / Item	Factor loading		
	Factor 1	Factor 2	Factor 3
shar1	0.708	0.404	0.150
shar2	0.714	0.524	0.161
shar4	0.937	0.140	0.107
shar5	0.898	0.337	0.145
shar12	0.675	0.178	0.590
shar10	0.528	-0.209	0.495
shar3	-0.038	0.868	0.262
shar6	0.323	0.865	-0.055
shar8	0.304	0.487	0.206
shar9	0.359	0.756	0.274
shar7	-0.017	0.278	0.867
shar11	0.332	0.249	0.790
Explained variance (R^2)	52.06%	13.39%	11.25%

Extraction method: Principal axis factoring
Rotation method: Promax with Kaiser normalization; rotation converged in 6 iterations.

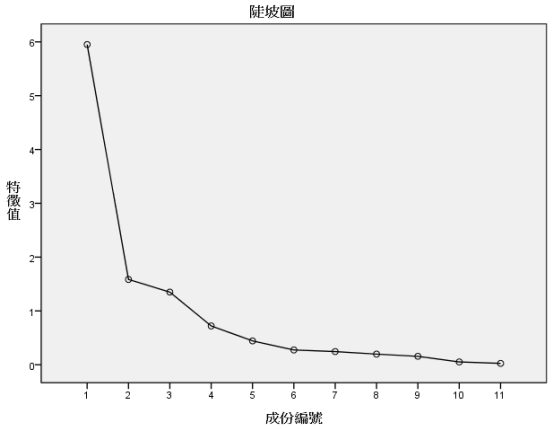
Rotated component matrix (After removing Item 8)

Factor / Item	Factor loading		
	Factor 1	Factor 2	Factor 3
shar4	1.032	-0.100	-0.108
shar5	0.953	0.109	-0.069
shar1	0.716	0.265	-0.022
shar2	0.711	0.355	-0.020
shar12	0.612	-0.065	0.483
shar10	0.520	-0.434	0.436
shar3	-0.226	0.907	0.248
shar6	0.272	0.825	-0.187
shar9	0.246	0.676	0.174
shar7	-0.270	0.208	0.945
shar11	0.157	0.085	0.781
Explained variance (R^2)	54.10%	14.41%	12.27%

Extraction method: Principal axis factoring
Rotation method: Promax with Kaiser normalization; rotation converged in 6 iterations.



【12 items】Total variance explained (**76.70**%)



【11 items】Total variance explained (**80.78**%)

As factor loading of the reverse scoring item, Item 10, covered two constructs (Factor 1 .520; Factor 3 .436), it was removed. Therefore, Item 10 was removed, after which analyses were carried out again. After the removal of Item 8 and Item 10, the principal component analysis of the remaining 10 items indicated the following component matrix: Factor 1 (knowledge, 57.65%), Factor 2 (desire, 14.33%), and Factor 3 (actions, 12.76%). The total variance explained of the 10 items was higher than that of the 12 items in the original scale. After the removal of the two items, it increased by 8.05%, from 76.70% to 84.75%.

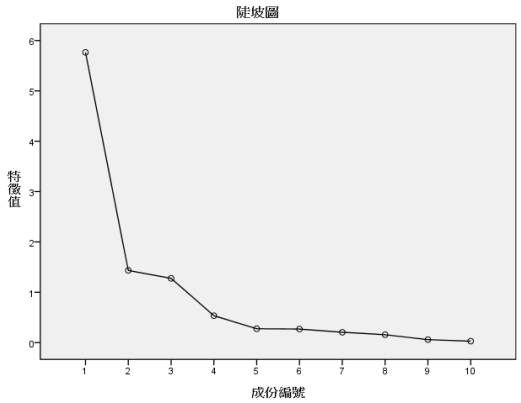
In the component matrix after the removal of items, Factor 1 included most of the items. The factor loading of Item 12 involved two constructs (Factor 1 .66; Factor 3 .55). Item 12 was removed and EFA was conducted. The results of principal axis factoring conducted for the remaining nine items (that is, after the removal of Item 8, Item 10, and Item 12) were as follows: Factor 1 (57.17%), Factor 2 (15.69%), and Factor 3 (11.86%). The total variance explained of the nine items was 84.72%, which was only .03% lower than the 84.75% that was obtained after the removal of two items (leaving ten items) **(Table 2)**.

Table 2 Comparison of the Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale component matrices after item removal

Rotated component matrix [a]
(After removing Items 8 and 10)

Factor / Item	Factor loading		
	Factor 1	Factor 2	Factor 3
shar1	0.719	0.240	-0.020
shar2	0.705	0.349	-0.032
shar4	1.051	-0.171	-0.065
shar5	0.959	0.066	-0.051
shar12	0.657	-0.194	0.550
shar3	-0.248	0.959	0.184
shar6	0.273	0.811	-0.194
shar9	0.244	0.665	0.158
shar7	-0.271	0.210	0.910
shar11	0.218	-0.069	0.856
Explained variance (R^2)	57.65%	14.33%	12.76%

Extraction method: Principal axis factoring
Rotation method: Promax with Kaiser normalization; rotation converged in 7 iterations.

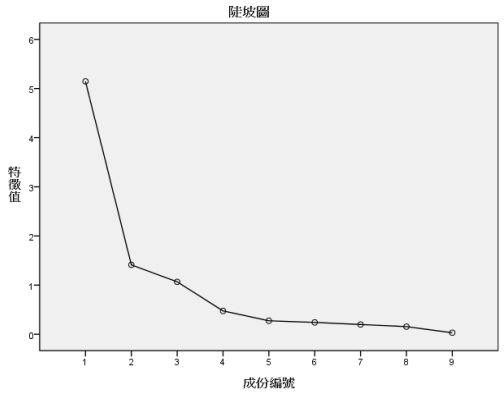


【10 items】Total variance explained (**84.75**%)

Rotated component matrix [a]
(After removing Items 8, 10, and 12)

Factor / Item	Factor loading		
	Factor 1	Factor 2	Factor 3
shar5	0.975	0.515	0.348
shar4	0.943	0.320	0.270
shar2	0.868	0.673	0.392
shar1	0.839	0.569	0.377
shar3	0.294	0.900	0.480
shar6	0.567	0.887	0.201
shar9	0.622	0.854	0.499
shar7	0.226	0.404	0.927
shar11	0.517	0.389	0.869
Explained variance (R^2)	57.17%	15.69%	11.86%

Extraction method: Principal axis factoring
Rotation method: Promax with Kaiser normalization; rotation converged in 5 iterations.



【9 items】Total variance explained (**84.72**%)

After EFA, due to the smaller number of items (nine) and the variance explained being like that in the case of ten items, the final Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale included nine items **(Table 3)**.

Table 3 Rearranged item comparison and variance explained for the Parent-Child Shared Management of Chronic Illness Scale (after removal of items)

	Original scale item	R^2	Items used after principal component analysis and removal of items	R^2
Factor 1. **Current knowledge**	1. I can identify the things which assist in my child's management of his/her chronic disease that he/she is able to do now and in the future. 4. I have a long-term plan in which I will gradually transfer the responsibility for chronic disease self-care to my child. 9. I can be understanding when my child tells me that his/her condition has improved or that the control measures have been unsatisfying. 10. I would feel sad and helpless if my child attempts to manage his/her disease but underperforms. 12. I know my child is well-prepared to take on new responsibilities when he/she is doing well.	52.06 %	1. I can identify the things which assist in my child's management of his/her chronic disease that he/she is able to do now and in the future. 2. I allow (encourage) my child to carry out the routine management of his/her chronic disease on his/her own initiative. 4. I have a long-term plan in which I will gradually transfer the responsibility for chronic disease self-care to my child. 5. I am aware of the need to gradually increase the tasks related to chronic disease self-mangement given to my child.	57.17 %
Factor 2. **Parent's desire**	3. I believe that with support from parents and medical professionals, children are able to self-manage their chronic disease as they become adolescents. 5. I am aware of the need to gradually increase the tasks related to chronic disease self-mangement given to my child. 6. I want my child to take on more responsibilities for chronic disease self-care.	13.39 %	3. I believe that with support from parents and medical professionals, children are able to self-manage their chronic disease as they become adolescents. 6. I want my child to take on more responsibilities for chronic disease self-care. 9. I can be understanding when my child tells me that his/her condition has improved or that the control measures have been unsatisfying.	15.69 %
Factor 3. **Current actions**	2. I allow (encourage) my child to carry out the routine management of his/her chronic disease on his/her own initiative. 7. Over the last four weeks, I took my own initiative to help my child engage in managing his/her chronic disease. 8. I support my child in communicating directly with the medical professionals about the treatment options for and outcomes of his/her chronic disease. 11. My child has gradually increased his/her responsibilities for chronic disease self-care.	11.25 %	7. Over the last four weeks, I took my own initiative to help my child engage in managing his/her chronic disease. 11. My child has gradually increased his/her responsibilities for chronic disease self-care.	11.86 %
Total explained variance		**76.70 %**		**84.72 %**

(2) Reliability Test

In the split-half reliability test, the Guttman's split-half reliability coefficient of this scale was 0.81. According to DeVellis (2021), an α coefficient ranging between 0.70 and 0.80 indicates good reliability.[15]

Based on the EFA results, the items were reallocated to constructs with high homogeneity, and the internal consistency of the scale was then reassessed (N=111). After the removal of items in the scale, the items were rearranged and compared according to EFA principal axis factoring. The Cronbach's α value of the total scale was .89 (F=27.51*, p<0.05). The Cronbach's α values derived from an internal consistency analysis conducted for each subscale were as follows: 0.93 (knowledge), 0.87 (desire), and 0.77 (actions).

4.Relationship between demographic variables and parent-child shared management

The analysis results indicated significant differences in the parent-child shared management of different caregivers based on the F-test and using the mothers of the patients as the reference (F=4.59; p<0.05). Significant differences in parent-child shared management were also observed in relation to average family income, with income lower than USD$1,750 being set as the reference (t=-4.26, p<0.05). About marital status, significant F-test results were observed regarding parent-child shared management in the case of married, non-married (but living together), and divorced parents, with the married parents being set as the reference (F=4.63, p<0.05). Parents' self-reported health status was also found to be significantly correlated with parent-child shared management (F=18.21, p<0.05). Correlation coefficients for other variables did not reach the significance level.

Regarding correlations between the children's demographic data and parent-child shared management, significant F-test results were observed in parent-child shared management in relation to gender, with male gender

set as the reference (F=-3.51, p<0.05). Significant results were also observed for the 'seniority' variable (F=3.10, p<0.05), with the eldest child set as the reference. Regarding 'leave taken due to T1D in the past six months,' differences in parent-child shared management were found to be statistically significant (t=1.67, p<0.05). About 'emergency visits due to T1D in the past six months,' differences in parent-child shared management were found to be statistically significant (t=3.95, p<0.05). About 'hospitalization due to T1D in the past year,' differences in parent-child shared management were found to be statistically significant (t=-2.82, p<0.05). However, no statistically significant differences were observed regarding the health indicator (most recent HbA1c). Hence, the parent-child shared management of chronic illness did not differ significantly between the group with higher HbA1c levels (>7.5) and the control group with better HbA1c levels (≤7.5). This indicated that the control of blood sugar in patients was not significantly correlated with parent-child shared management.

5.Relationships between demographic variables, children's functional status, parents' anxiety levels, and parent-child shared management

Parent-child shared management, parents' anxiety, and children's functional status were found to be significantly correlated, indicating the presence of a linear relationship between the three variables. Afterward, a Kolmogorov-Smirnov test of normality (K-S test) was conducted, with p>0.05, and a normal residual distribution was determined. The variance inflation factor (VIF) tested colinearity between independent variables (predictors). A VIF greater than 10 indicates the presence of colinearity between a given variable and the other variables.[14] The VIF values in this study ranged between 0.16 and 6.38, indicating the absence of colinearity between parent-child shared management, parents' anxiety, and children's functional status. The Durbin-Watson (DW) value was used to test whether the basic assumption of independence was violated and whether there was autocorrelation between residuals. DW values between 1.5 and 2.5 indicate the absence of autocorrelation. The DW value in this study was equal to 2.07, indicating the absence of the autocorrelation phenomenon.

Multiple regression analysis was used to analyze the regression coefficients of the demographic, children's functional status, parents' anxiety levels, and the Scale scores after the removal of items. Variables that reached significant results in the correlation analysis of parent-child shared management and the parents' and children's demographic characteristics, as well as the patients' functional status and parents' anxiety levels, were further analyzed using the hierarchical regression method.

In the hierarchical regression analysis, the children's factors were input in the first phase. The factors included the children's gender, seniority, C-FS II(R), leaves taken due to T1D in the past six months, emergency visits due to T1D in the past six months, and times of hospitalization due to T1D in the past year. The analysis results were as follows: R^2=0.28, F=6.65, p<0.05.

In the second phase, family factors were input in order to explore their additional explanatory power. The input independent factors included caregiver, family income, and marital status. The analysis results were as follows: R^2-change=0.09, F-change=2.90, p<0.05. The addition of the family factors to the child-related factors increased the variance explained by 9%, up to 37%.

In third phase, parent-related variables were input, including parents' self-perceived health and anxiety status. The analysis of the effect of parents' personal factors on parent-child shared management with the exclusion of child- and family-related factors indicated the following results: R^2-change=0.14, F-change=13.91, p<0.05. Thus, parent-related factors explained 14% of the variance in parent-child shared management. The analysis results indicated that the variance explained by the predicting factors, including parent, family, and child-related factors, was 51% (R^2=0.51, F=7.76, p<0.05). R^2 ranged between 0 and 1, indicating good explanatory power of the independent variables in relation to the dependent variables.

Hierarchical regression results showed that the following five independent variables had a significant predictive power with regard to parent-child shared management: functional status of children with chronic illness (β=0.29, t=2.78, p<0.05) and emergency visits due to T1D in the past six months (β=-0.29, t=-2.16, p<0.05) in the first phase, caregiver (β=-0.30, t=-2.88, p<0.05) and marital status (β=0.26, t=2.53, p<0.05) in the second phase, and (parents') self-perceived health status (β=0.52, t=4.27, p<0.05) in the third phase. Hierarchical regression results related to the children's gender, times of hospitalization due to T1D in the past year, family income, and parents' anxiety did not reach the significance level. **Table 4** shows the results of hierarchical regression analysis of factors influencing parent-child shared management of chronic illness.

Table 4 Hierarchical regression analysis of factors influencing parent-child shared management of chronic illness (N=111)

Variable	Item	Number (*n*)	Mean (Total score)	Standard deviation (*SD*)	Statistic *t/r/F*	ost-hoc mpariso n via Scheffé nethod
Main caregiver	(1) Grandmother	7	30.00	3.32	**4.59***	**(3)> (1)**

	(2) Father	25	35.44	2.53	-	
	(3) Mother (benchmark)	79	37.13	7.07	-	
Age (years)		111			-0.05	
Total monthly family income	(1) ≤ USD$1,750 (benchmark)	76	34.58	5.53	**-4.26***	
	(2) > USD$1,750	35	40.03	6.56	-	
Education level	(1) Junior high school	12	33.08	6.44	2.55	
	(2) Senior high school/vocational high school	43	37.66	7.39	-	
	(3) University (benchmark)	50	35.93	4.39	-	
	(4) Graduate institute and above	6	32.00	4.12	-	
Marital status	(1) Divorced	27	33.74	4.49	**4.63***	**(3)> (2)**
	(2) Single	13	40.50	5.79	-	
	(3) Married (benchmark)	71	36.46	6.70	-	
Family type	(1) Nuclear family (benchmark)	93	36.73	6.21	1.38	
	(2) Extended family	6	34.67	4.27	-	
	(3) Multigenerational family	12	33.75	8.06	-	
Number of children raised	(1) One (benchmark)	20	38.55	4.58	2.39	
	(2) Two	55	36.49	7.46	-	
	(3) Three	34	34.38	4.91	-	
	(4) Four	2	41.00	0.000	-	
Self-perceived health status	(1) Poor (benchmark)	17	33.70	2.89	**18.21***	
	(2) Fair	64	34.20	6.04	-	
	(3) Good	28	42.61	4.43	-	
	(4) Excellent	2	37.00	0.00	-	

Note: 1. Items 8, 10, and 12 were removed from the Parent-Child Shared Management of Chronic Illness Scale based on EFA results

2. *p<0.05 (two-tailed), significance level

IV. Discussion

In general, the results of this study indicate that Taiwan version of the Parent-Child Shared Management of Chronic Illness Scale is a tool with reliable, and valid psychometric properties, that can be used among children with T1D and their parents. The caregiver had a significant effect on parent-child shared management, and the scores for family income, marital status, parents' self-perceived health status, and parent-child shared management were found to be significantly correlated.

The socioeconomic status and income were related to disease management in children with T1D. The empirical research on the T1D population has indicated multiple mechanisms through which parent characteristics, parent coping skills, and child characteristics interact to yield a pattern of T1D management behaviors that affect T1D outcomes.[16] Regarding the economic status, our study found that family income was significantly correlated with parent-child shared management. It is assumed that the urban medical center patients who formed the sample in this study had a heavy economic burden. Previous studies on family background and management in children with T1D discovered that a higher family income led to better disease related management.[17] Our study showed that all the parents were educated to some extent and were thus equipped with sufficient knowledge. Therefore, no significant correlations were observed between educational level and parent-child shared management. Relatedly, past studies have proposed a relation between the socioeconomic status of family and disease management in children with T1D.[17]

We found that children's gender, seniority, leaves taken due to T1D in the past six months, emergency visits due to T1D in the past six months, and times of hospitalizations due to T1D in the past year were significantly correlated with parent-child shared management scores. A significant positive correlation was also observed between the functional status of children with T1D and parent-child shared management. The female group significantly outperformed the male group in terms of parent-child shared management scores. Due to the interaction effect of children's growth and developmental tasks and chronic illness, the pressure resulting from parent-child interactions is often even greater than that resulting from the disease. Nonetheless, the English version of the parent-child shared management scale indicated no correlation between parent-child shared management and children's age.[1] One possible reason for this finding is that very young patients with T1D who are not capable of self-care often need parents' help to complete the daily routine of blood glucose control. Relatedly, the transfer of responsibility is a gradual process affected by multiple factors. Thus, changes in the parents' function from providing care to providing guidance, as well as lending a free hand as they encouraged the child's growth, were examined from the perspective of the parents.[18] This could have led to the non-significance of the correlation between children's age and the parent-child shared management of chronic illness.

The C-FS II(R) and the parent-child shared management were found to be positively correlated in the present study. When deciding on whether and when to allow a child with T1D to participate in self-care, in addition to the child's developmental status and current abilities, parents also consider whether the illness influences the child's functional status. This can affect parents' attitude toward children's opinions and actions during the shared management of T1D, which explains the positive correlation between the two aforementioned factors indicated by the results in this study. Lee et al. (2009) investigated the functional status of children with chronic diseases, the number of school days missed and number of hospitalizations in the past six months were used as health indicators that were found to be significantly and negatively correlated with C-FS II(R) scores.[9] Relatedly, better parent-child shared management reduces the absence rate, emergency visits, and hospitalization frequency. If children with T1D can control their blood glucose levels under the guidance and support of family members, it is typically sufficient to conduct outpatient visits and physical examinations only once every three months. Therefore, results indicating significant negative correlations between leave taken, emergency visits, and times of hospitalization and parent-child shared management, corresponding to the findings of the research on the C-FS II(R) scores, were expected. Consistent with those results

Hierarchical regression analysis was used to further examine variances in shared management scores caused by the independent variables. Variables that were found to have a statistically significant effect on the parent-child shared management of chronic illness included the following. First, child-related independent variables were input, and the analysis results indicated that the children's functional status and emergency visits due to T1D in the past six months accounted for 28% of the variance in parent-child shared management.

In the second phase, the child-related factors were controlled, and family-related variables were added. The caregiver and marital status were found to explain 9% of the variance in the shared management scores, indicating that the explanatory power of family factors was almost 10%. In the final phase analysis, the parent-related factor, namely, parents' self-perceived health status, was found to predict (explain) up to 14% of the variance in parent-child management.

Child-related independent variables, such as functional status, were the first to be controlled by the researchers to explore other factors that affected parent-child management. For those who did not need emergency treatment due to T1D in the past half a year, better functional status led to better parent-child management. Regarding family factors, marital status was used as the point of reference in the analysis of the relation between marital status and parent-child shared management. The shared management scores of single caregivers were higher than those of married caregivers, reaching statistical significance. It is inferred that in Taiwanese society, which is characterized by close family relationships, excessive parental concern may sometimes create a burden or cause interference rather than help. Commissariat et al. (2020) conducted research on the transfer of responsibility for diabetes management from mothers to their children and found that factors that influenced the success of such transfer included conflicts between family members and the opinions of other people. Specifically, these factors affected the mothers' willingness to perform the transfer process. Among parent-related factors, parents' self-perceived health status was found to have a greater explanatory power about shared management than family-related factors.[19] Hockenberry and Wilson (2018) found that parents with chronically ill children were caregivers with a long-term responsibility for children's care, which resulted in the accumulation of various burdens of life. Such a vicious circle often led to the deterioration of the caregivers' health.[6] Thus, parents need to maintain their own health to effectively perform shared management of the chronic illness of their children.

V. Conclusion and suggestions

The constructs of the original Parent-Child Shared Management of Chronic Illness Scale included 'current knowledge,' 'parent desire,' and 'current actions.' International cultural differences were compared. Translations of existing reliable and valid scales on their cross-cultural applicability can facilitate comparisons of local research results with those from overseas studies, which is largely beneficial for further research on children with chronic diseases. With regard to factors influencing the parent-child shared management of chronic illness, the influencing mechanism was discussed based on objective scale measurements. The reliability and validity analysis indicated that the Taiwan version possessed a stable principal axis factoring structure that was consistent with past studies. The translated Taiwan version was shown good reliability and validity and easy-to-use measurement tool for the evaluation of parent-child shared management of chronic illness.

Conflict of Interest declaration: The authors declare that we have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Limitations and suggestions

This study had the following limitations. Sample collection was limited to a medical center in an urban city. Future studies could thus conduct research in other areas to determine region- or city-level differences in the investigated phenomena and improve the generalizability of research results.

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