The Utilization of Rasch Model Measurement (RMM) in Investigating the Effect of Pharmacological and Non-pharmacological Treatment on the Quality of Life of Malaysian's Children with Autism Spectrum Disorder (ASD) and Their Family

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Abstract: Autism Spectrum Disorder (ASD) is a developmental disorder that encompasses varieties of disorder with impairments in social relationships, communication and imaginative display. In an attempt to reduce the severity of the said symptoms, these ASD children have been given either pharmacological or non-pharmacological treatment. The treatment given is hope to improve quality of life of the ASD children and their respective family. Thus, by using Rasch Model, this paper attempts to look at the significant effect of pharmacological and non-pharmacological treatment on quality of life of Malaysian's children with Autism and their respective family. A total of 31 questionnaires (with 16 returned and usable questionnaires) were distributed to parents of ASD child at public rehab center located in Eastern and Central Region of Malaysia. By using Bond and Fox Steps of Rasch Measurement Model, reliability analysis of responses were analyzed and research questions were answered. Conclusions and recommendations were discussed at the end of the paper.

Keywords: Autism spectrum disorder (ASD), non-pharmacological treatment, rasch model, children with autism

1. Introduction

Definition of Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (ASD) is a developmental disorder that encompasses varieties of disorder with impairments in social relationships, communication, and imaginative play (Shamsudin et al., 2012) and with the severity and nature of the symptoms varying from one individual to another.

According to Diagnostic and statistical manual of mental disorders by (American Psychiatric Association; 2000), the diagnostic and statistical manual of mental disorders. Diagnosis of Autistic Disorder (AD) typically occurs when a child is approximately 2–4 years of age. Diagnosis is subjective and based on a cluster of behaviours observed

clinically as there is currently no laboratory test to diagnose autism. The Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSMIV) outlines criteria for the diagnosis of AD and related Pervasive Developmental Disorders (PDDs).

Noting that, in an attempt to reduce the severity of the symptoms and indirectly improve quality of life of children with Autism and their respective family, several types of treatment have been introduced. These treatments include pharmacological treatment that use medicine and non-pharmacological treatment (such as speech therapy and visual schedules) have been attempted over the years but to no avail due to nature of disorder and large variations in symptoms. No single approach works best for to improve quality of life of children with Autism. Thus by using Rasch Measurement Model, this paper attempts to look at the effect of pharmacological treatment and non-pharmacological treatment on quality of life of Malaysian's children with Autism and their respective family.

2. Literature review

Types of Available Treatment

In general, there are two types of treatment available for children with Autism in Malaysia i.e. pharmacological (medical consumption) and non-pharmacological (non-medical consumption such as behavioral therapy intervention) treatment.

Looking at the effect of pharmacological treatment towards quality of life of children with Autism, pharmacological treatments may have benefits in a child with autism who has extreme and/or challenging behaviours (LeClerc & Easley, 2015 and Panda & Panda, 2019). Several studies comparing children with ASD with age and intellectual quotient (IQ) matched control groups have demonstrated EF deficits (Happe et al., 2006). The atypical antipsychotic risperidone was the first drug approved by the US Food and Drug Administration (FDA) in 2006 for the treatment of irritability associated with autistic disorder, including symptoms of aggression, deliberate self-injury, temper tantrums, and quickly changing moods, in children and adolescents aged 5 to 16 years. Children treated with pharmacological such as Risperidone showed reductions in stereotype, hyperactivity and aggressive symptoms compared to placebo (Parikh, Kolevzon, and Hollander, 2008).

In particular, (Young et al., 2007) there is a role for psychostimulants in some children with coexisting ADHD, and Selective Serotonin Reuptake Inhibitors (SSRIs) may be helpful in children with obsessions/compulsions. Drug initiation and stabilisation is best undertaken by a developmental paediatrician, child neurologist or child psychiatrist.

However, pharmacological treatments also posed negative effect towards quality of life of children with ASD. The behavioral similarities between patients with frontal lobe lesions and individuals with ASD led to the notion that some of the everyday social and non-social behaviors seen in individuals with ASD may reflect specific executive dysfunction (Robinson et al., 2009).

On the other hand, the non-pharmacological treatment also have improved quality of life of children with ASD (Panda & Panda, 2019). Several researchers have highlighted the effectiveness of such treatment in reducing the symptoms for children with ASD namely (Geraci, 2006; Chen et al., 2019; Gabriels et al., 2012 & Trzmiel, et al., 2019).

The research questions for this paper is as below:

1. Is there any significant correlation between pharmacological treatment and improvement in quality of life of children with ASD?
2. Is there any significant correlation between non-pharmacological treatment and improvement in quality of life of children with ASD?
3. Is there any significant correlation between pharmacological treatment and improvement in quality of life of family having children with ASD?
4. Is there any significant correlation between non-pharmacological treatment and improvement in quality of life of family having children with ASD?

3. Methodology

A total of 31 survey with structured close ended questions were distributed to parents of children with Autism located at rehabilitation center in Eastern and Central Region of Malaysia namely Pahang, Terengganu, Kelantan and Malacca. Parents of children with Autism were selected as they are the person who have direct involvement with children with Autism, know
best what their Autism children needs the most and have directly feel the burden of raising a child with Autism. Samples of questions asked in the survey are as follows:

1. What is the complementary/alternative pharmacological and non-pharmacological treatment do you access to aid your child with Autism Spectrum Disorder (ASD)?
2. Does ASD related intervention improved your child's quality of life?
3. Does your child ASD related intervention improved your family quality of life?

Rehabilitation Center Selected

In Malaysia, the rehab center can be categorized as private rehab center and public (government assisted) rehab center. As such, for this research, the six public rehab center (being called as *Pemulihan Dalam Komuniti*) selected are located in Eastern and Central Region of Malaysia. These rehab center are being assisted and monitored by Department of Social Welfare with each rehab center is being managed by rehab manager. The public rehab center accepts all special needs people in various age with all types of impairment who have registered with Department of Social Welfare and obtain special needs card (*Orang Kelainan Upaya* card).

4. Discussions on Findings

A total of 31 survey with structured close ended questions were distributed to parents of children with Autism located in rehabilitation center in Eastern and Central Region of Malaysia namely Pahang, Terengganu, Kelantan and Malacca. Out of 31 questionnaires distributed, only 16 were completed and usable for the study at hand.

Demographic Profile of Respondents

The demographic profile and identification of respondents are as follows (refer Table 1).

Table 1 - Descriptive analysis

Demographic Profile	Frequency	Percentage (%)	Respondent's Identification
Gender of child diagnosed with ASD: Male			
Female	9	56.25%	T1214P
	7	43.75%	K2213N
Current age (month) of child diagnosed with ASD: <100			
100-200	4	25%	P2113P
200<	8	50%	T1214P
No Answer	2	12.5%	P1315P
	2	25%	P1412P
Your relationship with the ASD child: Biological Mother			
Step parent	14	87.5%	P1412P
Others	1	6.25%	K1254N
	1	6.25%	K1461N
Number of biological children:			K1461N
0	1	6.25%	P1412P
1	2	12.5%	P2113P/T1214P
2-3	10	62.5%	P1315P
4<	3	18.75%	
Types of Treatment			
Pharmacological Treatment	9	56.25%	T1214P
Non-pharmacological Treatment	7	43.75%	K2213N

Reliability of Instrument and Responses

Rasch Measurement Model have been used to analyze the data. The use of Rasch Measurement Model is believed to be the best tools to analyze potential of pharmacological and non-pharmacological treatment for children with ASD. Several past researchers in the area of ASD that have used Rasch Measurement Model are Duku et al (2013), Absoud et al. (2011) and Joosten, Bundy and Einfeld (2012). However, those studies (Duku et al., 2013 & Absoud et al., 2011) only use RMM for ASD scale measurement and (Joosten., Bundy and Einfeld, 2012) use RMM to compare ASD behavior among ASD child with and without intellectual disability. All of those researchers do not use RMM for testing effect of ASD pharmacological and non-pharmacological treatment on ASD children and family with ASD children.

Zooming to the Rasch Model, data has been analyzed using Bond and Fox Steps of Rasch Model. With reference to the result below (as depicted in Table 2), the test is very low reliability with Cronbach Alpha score is 0.34 due to missing data. The reliability of instrument is very high reliable with r=0.95 while respondents' reliability is weak with r=0.24.

Table 2 - Analysis of reliability of instrument and responses using bond and fox steps

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INPUT: 16 Persons  2 Items  MEASURED: 16 Persons  2 Items  6 CATS  Bond&FoxAnalysis
--------------------------------------------------------------------------------

      SUMMARY OF 14 MEASURED (NON-EXTREME) Persons
+-----------------------------------------------------------------------------+
|          RAW                        MODEL        INFIT        OUTFIT         |
|          SCORE    COUNT   MEASURE   ERROR    MNSQ  ZSTD   MNSQ  ZSTD         |
|-----------------------------------------------------------------------------|
| MEAN      4.0      1.8     -3.91     2.97     .40   .8    .41   .7           |
| S.D.      1.4       .4      4.43     2.30    1.13  1.2   1.13  1.2           |
| MAX.      8.0      2.0      6.32    10.35    4.45  3.1   4.46  3.1           |
| MIN.      2.0      1.0    -11.04     1.75     .00  -.6    .00  -.6           |
|-----------------------------------------------------------------------------|
| REAL RMSE  3.86 ADJ.SD  2.17  SEPARATION  .56  Person RELIABILITY  .24      |
|MODEL RMSE  3.75 ADJ.SD  2.35  SEPARATION  .63  Person RELIABILITY  .28      |
| S.E. OF Person MEAN = 1.23                                                   |
+-----------------------------------------------------------------------------+
  MINIMUM EXTREME SCORE:     2 Persons
       VALID RESPONSES:  89.3%

      SUMMARY OF 16 MEASURED (EXTREME AND NON-EXTREME) Persons
+-----------------------------------------------------------------------------+
|          RAW                        MODEL        INFIT        OUTFIT         |
|          SCORE    COUNT   MEASURE   ERROR    MNSQ  ZSTD   MNSQ  ZSTD         |
|-----------------------------------------------------------------------------|
| MEAN      3.7      1.8     -5.38     2.86                                    |
| S.D.      1.4       .4      5.69     2.17                                    |
| MAX.      8.0      2.0      6.32    10.35                                    |
| MIN.      2.0      1.0    -15.70     1.75                                    |
|-----------------------------------------------------------------------------|
| REAL RMSE  3.69 ADJ.SD  4.33  SEPARATION 1.17  Person RELIABILITY  .58      |
|MODEL RMSE  3.59 ADJ.SD  4.41  SEPARATION 1.23  Person RELIABILITY  .60      |
| S.E. OF Person MEAN = 1.47                                                   |
+-----------------------------------------------------------------------------+
Person RAW SCORE-TO-MEASURE CORRELATION = .49 (approximate due to missing data)
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .34 (approximate due to missing data)

      SUMMARY OF 2 MEASURED (NON-EXTREME) Items
+-----------------------------------------------------------------------------+
|          RAW                        MODEL        INFIT        OUTFIT         |
|          SCORE    COUNT   MEASURE   ERROR    MNSQ  ZSTD   MNSQ  ZSTD         |
|-----------------------------------------------------------------------------|
| MEAN     28.0     12.5       .00      .82     .57   .0    .45   .0          |
| S.D.      4.0       .5      3.86      .08     .11   .0    .01   .1          |
| MAX.     32.0     13.0      3.86      .90     .68   .0    .46   .1          |
| MIN.     24.0     12.0     -3.86      .74     .46   .0    .45  -.1          |
|-----------------------------------------------------------------------------|
| REAL RMSE   .82 ADJ.SD  3.77  SEPARATION 4.59  Item RELIABILITY  .95        |
|MODEL RMSE   .82 ADJ.SD  3.77  SEPARATION 4.59  Item RELIABILITY  .95        |
| S.E. OF Item MEAN = 3.86                                                     |
+-----------------------------------------------------------------------------+
UMEAN=.000 USCALE=1.000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00 (approximate due to missing data)
25 DATA POINTS. APPROXIMATE LOG-LIKELIHOOD CHI-SQUARE: 11.90
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Profiling Children Quality of Life

In answering research question 1 and research question 2 above, according to the map below (refer Figure 1), children's quality of life is analyzed and all 8 respondents with pharmacological and 6 respondents with non pharmacological treatment agree with their children's quality of life and one of them (P1412P) responded as non applicable. This shows that pharmacological and non pharmacological treatments are significantly correlated with children's quality of life (LeClerc and Easley, 2015; Chen et al., 2019 & Trzmiel et al., 2019).
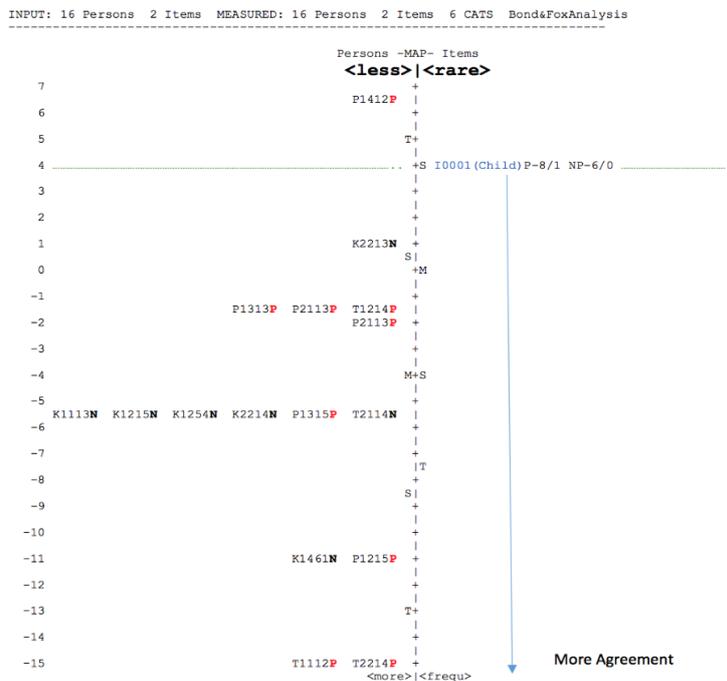
Fig. 1 - Profiling children quality of life

Profiling Family's Quality of Life

In answering research question 3 and research question 4 above, according to the map below (refer Figure 2), family's quality of life is analyzed and all 4 respondents with pharmacological and 6 respondents with non pharmacological treatment agree with their family's quality of life. On the other hand, 5 respondents with pharmacological and 1 with non pharmacological treatment did not agree with their family's quality of life. This shows that pharmacological treatment is not significantly correlated or affected their family's quality of life while non pharmacological treatment is still significantly correlated with children's quality of life. This is in line with the study of Dillenburger et al (2004).
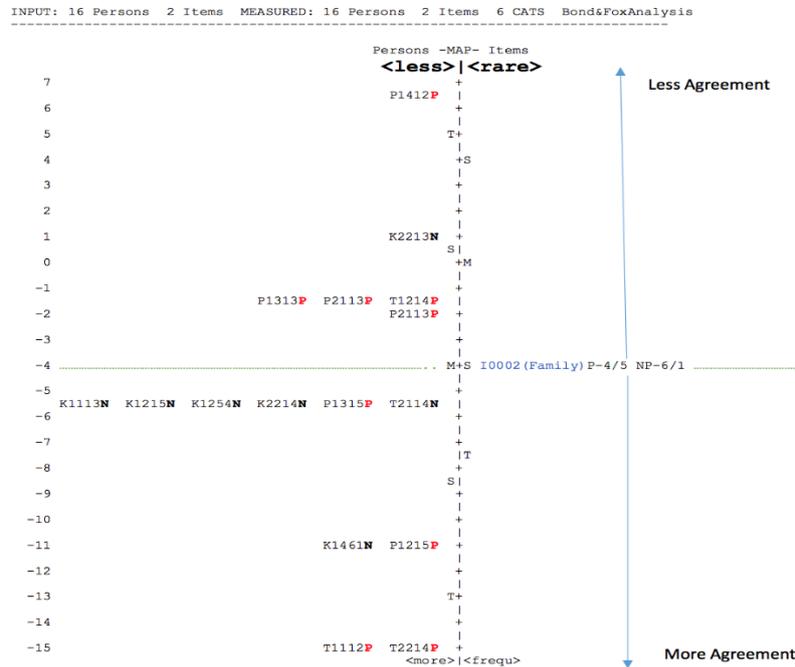

Fig. 2 - Profiling family quality of life

5. Conclusion

Based on the research above, it is further concluded that both pharmacological and non-pharmacological treatment are significantly correlated with ASD children quality of life. However, their family quality of life is only significantly correlated with non-pharmacological treatment, whilst pharmacological treatment does not significantly correlated with ASD children's family quality of life.

Acknowledgement

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