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自閉症障礙類群兒童重複行為的相關因子分析

The Correlates of Restricted and Repetitive Behaviors in  
Children with Autism Spectrum Disorders

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安如 謹致 民國一〇二年七月




# 自閉症障礙類群兒童重複行為的相關因子分析

## 中文摘要

### 研究背景與目的

自閉症障礙類群(Autism Spectrum Disorder, ASD)包括自閉症 (Autism)、亞斯伯格疾患(Asperger's Disorder)及其他未註明之廣泛性發展疾患 (Pervasive Developmental Disorder Not Otherwise Specified, PDD-NOS)。根據精神疾病診斷準則手冊-第四版內文革新版 (American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fourth edition, Text Revision, DSM-IV-TR)，ASD 的三大診斷特徵分別為：社交能力缺損、溝通障礙和重複刻板的興趣。大約有 90%-97%的自閉症障礙類群兒童有侷限與重複行為出現，侷限與重複行為是自閉症障礙類群孩童的主要診斷之一，不僅影響孩童的學習、互動、更影響到各種情境的參與。「國際健康功能與身心障礙分類-兒童及青少年版」(International Classification of Functioning, Disability and Health for Children and Youth, ICF-CY) 包含健康狀況、身體功能與結構、活動、參與、情境因素(個人、環境)，此參考架構整合個人健康狀態在醫學與社會方面的觀點，說明疾病、功能、個人與環境間互動的關係，不只是病理因素影響健康，且強調活動參與、情境因素的重要性。過去有許多研究探討影響自閉症障礙類群兒童侷限與重複行為的因子，但是僅限於 ICF-CY 其中的一、兩個領域。本研究目的，以 ICF-CY 為參考架構，探討學齡前與國小低年級自閉症障礙類群兒童重複行為的相關因子，即依據文獻回顧結果，自 ICF-CY 之身體功能與構造、活動及參與、環境及個人因素面向，各選出一至二個過去研究中有顯著相關的相關因子作為獨立變項。研究假設為：這些選自 ICF-CY 各個面向的因子與自閉症障礙類群兒童的重複行為都有顯著相關。

### 研究方法

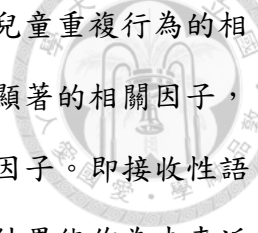


共有八十六位自閉症障礙類群的兒童及其家長參與此研究，參與者轉介自發展中心、職能治療診所、醫學中心的復健部、學校、自閉症家長協會及中華民國自閉症基金會。本研究使用皮爾森(Pearson)相關和逐步多元線性迴歸分析，來探討次領域重複行為以及整體重複行為的相關因子。依變項包含由家長填寫的「重複行為量表」之重複行為總分，以及重複行為之五個次領域的分數：刻板行為、自傷行為、強迫行為、儀式化與同一性行為及侷限興趣。獨立變項為依據文獻回顧結果，以及 ICF-CY 架構，所選出可能之相關因子，包含年齡、自閉症嚴重程度、感覺處理能力、表達性語言、接收性語言、適應行為、焦慮、親子關係及壓力。

## 結果

結果顯示，86 位個案平均月齡為 68.15 個月（標準差：15.60，範圍：37 到 105 個月），有 72 位男生 14 位女生，在重複行為量表的分數中顯示大部分(37.2-60.5%)的填答分數集中在 0 分(從沒出現過此行為)到 1 分(出現過此行為，且是一個輕微程度的問題)。皮爾森相關(Pearson correlation)顯示，整體重複行為量表分數，和嚴重度( $r = 0.415, p < 0.01$ )、表達性語言( $r = -0.419, p < 0.01$ )、接受性語言( $r = -0.433, p < 0.01$ )、適應行為( $r = -0.308, p < 0.01$ )有顯著相關。逐步多元線性迴歸分析的結果顯示，在整體的重複行為中，接收性語言和個案的年齡為顯著的相關因子，共解釋 20.9%的變異量。在刻板行為部分，接收性語言、年齡和適應行為是顯著的相關因子，共解釋 42.2%的變異量。自傷行為與強迫行為，顯著的相關因子只有接收性語言，對於兩個迴歸模型，分別解釋了 26.3%和 5.5%的變異量。儀式化與同一性行為，及侷限興趣部分，則沒有顯著的相關因子。

## 結論



此研究結果可以協助臨床工作者和照護者了解自閉症障礙類群兒童重複行為的相關因子，即孩子的接收性語言、適應行為和年齡都是重複行為顯著的相關因子，並且接受性語言是在不同重複行為次領域中最廣為出現的相關因子。即接收性語言能力差、適應行為不好和年齡大重複行為越嚴重。本研究的結果能作為未來近一步的實驗型研究，發展出有效的介入方式來降低自閉症障礙類群兒童的重複行為。

**關鍵字：**自閉症障礙類群，侷限與重複行為，影響因子

## **Abstract**

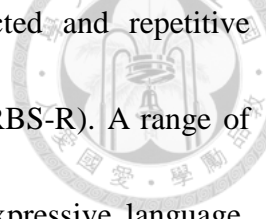


## **Background**

With a prevalence of more than 90% in both autism and PDD-NOS groups, restricted and repetitive behaviors (RRBs) affect their participation and adaptive function. International Classification of Functioning, Disability, and Health- Children and Youth version (ICF-CY) describes functioning from a holistic perspective, including health condition, body functions and structures, activity, participation, and personal and environmental factors. The ICF-CY provides a framework to describe limitations of children's functioning and emphasizes the impact of the environmental factors on functioning from a developmental perspective. Thus, the purpose of the study was to identify correlates of RRBs in preschool and early elementary school children with autistic spectrum disorder from a holistic perspective by considering the variables from all dimensions of the ICF-CY framework.

## **Method**

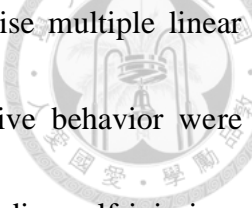
Eighty six children with autistic spectrum disorders were recruited from developmental centers, departments of rehabilitation at medical centers and hospitals, elementary schools. Children with identifiable neurological conditions and patient who



was illiteracy or couldn't read Chinese were excluded. Restricted and repetitive behaviors were measured by Repetitive Behavior Scale-Revised (RBS-R). A range of possible correlates were including severity, sensory processing, expressive language, receptive language, adaptive behavior, age, anxiety, and parent-child relationship quality. Descriptive analysis was conducted for basic information and the observed variables. Pearson correlation investigated the relationships between five subtypes of RRBs and potential correlates. Six separate multiple linear regression models identified the correlates of each subtype of RRBs, including Stereotypy, Self-injurious Behavior, Compulsions, Rituals and Sameness, Restricted Interests, and overall restricted and repetitive behaviors.

## **Results**

A total of 86 children with autism spectrum disorder aged from 37 to 105 months with 72 boys and 14 girls. The findings indicated that almost every subtype of RRBs was centralized in lower score. Pearson correlations showed that overall RRBs were significantly correlate with severity ( $r = 0.415, p < 0.01$ ), expressive language ( $r = -0.419, p < 0.01$ ), receptive language ( $r = -0.433, p < 0.01$ ), and adaptive behavior ( $r = -0.308, p < 0.01$ ). The stepwise multiple linear regression model which explained 20.9% of the variance revealed that receptive language and age of participants were significant



correlates of overall RRBs. As for stereotypic behavior, the stepwise multiple linear regression model showed that receptive language, age, and adaptive behavior were significant correlates and accounted for 42.2% of the variance. Regarding self-injurious behavior and compulsive behavior, the multiple stepwise linear regression model revealed that receptive language was the only significant correlate explaining 26.3% and 5.5% of the variances respectively. As for ritualistic and sameness behavior and restricted interests, no significant correlate was identified.

## **Conclusion**

Knowledge of the correlates may help clinicians, parents, and school teachers develop interventions targeted at the correlates in order to effectively reduce their RRBs. Results of our study can serve as a basis for future experimental studies targeted at the correlates to ameliorate restrictive and repetitive behaviors in children with ASD.

**Keywords:** Autism spectrum disorders, Restricted and repetitive behaviors, Correlates

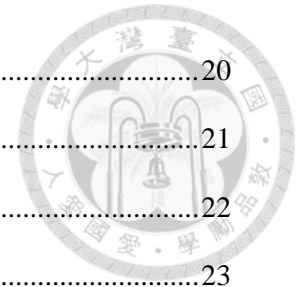


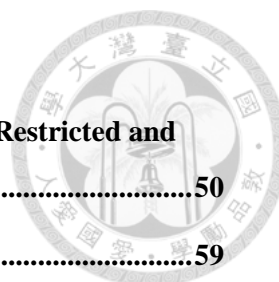


## Table of Contents

<b>Introduction.....</b>	<b>1</b>
<b>Literature review.....</b>	<b>5</b>
Introduction to autism spectrum disorders .....	5
The diagnosis criteria of autism spectrum disorders .....	5
The prevalence of autism spectrum disorders .....	10
Restricted and repetitive behaviors .....	11
International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) as a conceptual framework .....	12
The correlates of restricted and repetitive behaviors in children with autism spectrum disorders .....	13
The relationships between restricted and repetitive behaviors and factors in the dimension of health condition factors.....	14
Severity.....	14
The relationships between restricted and repetitive behaviors and factors in the dimension of body function and structures .....	15
Sensory processing .....	15
The relationships between restricted and repetitive behaviors and activity and participation factors.....	15
Language.....	16
Adaptive behavior.....	16
The relationships between restricted and repetitive behaviors and personal factors.....	17
Age-related differences.....	17
Gender-related differences.....	18
Anxiety .....	18
The relationships between restricted and repetitive behaviors and environmental factors	19
Parent-child relationship quality .....	19

Limitations of previous studies .....	20
Conclusion .....	21
Research purposes.....	22
Hypotheses of the study .....	23
<b>Methods.....</b>	<b>24</b>
Participants.....	24
Measures .....	24
The Measure of Restricted and Repetitive Behaviors.....	24
The Measure Related to Health Condition.....	25
The Measure Related to Body Function and Structures .....	26
The Measures Related to Activity and Participation .....	27
The Measures Related to Personal and Environmental factors.....	29
Procedure .....	31
Statistical analysis .....	32
<b>Results .....</b>	<b>34</b>
<b>Discussion.....</b>	<b>37</b>
<b>Conclusion.....</b>	<b>42</b>
<b>Acknowledgements.....</b>	<b>43</b>
<b>Reference.....</b>	<b>44</b>





## List of Tables

<b>Table 1. Summary of Studies Investigating the Relationships Between Restricted and Repetitive Behaviors and Factors in ICF-CY .....</b>	<b>50</b>
<b>Table 2. Characteristics of Participants (N=86) .....</b>	<b>59</b>
<b>Table 3. The Descriptive Statistics on the Frequency of Occurrence for Each Item of Repetitive Behavior Scale-Revised .....</b>	<b>60</b>
<b>Table 4. Pearson Correlation Matrix of 5 subtypes of RRBs as measured by Repetitive Behavior Scale-Revised and Measures of Potential Correlates .....</b>	<b>63</b>
<b>Table 5. Stepwise Linear Regression Models of Restricted and Repetitive Behaviors Assessed by the Repetitive Behavior Scale-Revised (RBS-R) in Children with ASD .....</b>	<b>64</b>



## List of Figures

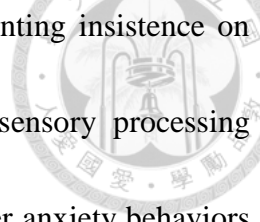
<b>Figure 1. The Possible Correlates of Restricted and Repetitive Behaviors in Children with Autism Spectrum Disorders Basing on Framework of the ICF-CY.....</b>	<b>65</b>
<b>Figure 2. The Flow Chart of The Procedure.....</b>	<b>66</b>
<b>Figure 3. The Correlates of Restricted and Repetitive Behaviors in Children with Autism Spectrum Disorders Basing on The Results of The Study.....</b>	<b>67</b>

## Introduction



Autistic spectrum disorders is a diagnosis group just like a spectrum ranging from mild to severe, including autism, Asperger disorders, and PDD-NOS. According to Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR), individuals with autism spectrum disorder have qualitative impairment in social interaction, qualitative impairments in communication, restricted, repetitive, and stereotyped patterns of behavior, interests, and activities (American Psychiatric Association, 2000). About 1 in 88 children have been identified with an autism spectrum disorder (Centers for Disease Control, 2008; Prevention's Autism and Developmental Disabilities Monitoring (ADDM) Network, 2012).

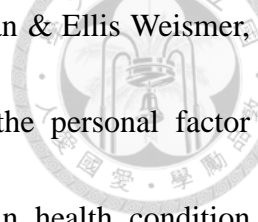
With a prevalence of more than 90% in both autism and PDD-NOS groups (Kim & Lord, 2010), restricted and repetitive behaviors (RRBs) are classified by DSM-IV-TR into four subtypes: (1) preoccupation with restricted interests; (2) nonfunctional routines or rituals; (3) repetitive motor mannerisms; and (4) persistent preoccupation with parts of objects. The two former subtypes are often defined as higher level repetitive behaviors, and the other two as lower level repetitive behaviors (Turner, 1999). Examples of RRBs may include flapping hands, flicking fingers in front of eyes, turning in circles for repetitive motor mannerisms, preoccupation with a part of objects, such as



flicking a rubber band or a paper, and routines and rituals representing insistence on sameness. Children with ASD who manifest RRBs often have sensory processing difficulties, poor language skills, lower adaptive behavior, and higher anxiety behaviors (Gotham et al., 2013). These children with special needs would often cause tension between parents and them (Baker, Seltzer, & Greenberg, 2011). RRBs also affect their participation in daily life and adaptive function (Cuccaro et al., 2003; Leekam, Prior, & Uljarevic, 2011).

International Classification of Functioning, Disability, and Health- Children and Youth version (ICF-CY) is based on the International Classification of Functioning, Disability, and Health (ICF) (WHO, 2001) which describes functioning from a holistic perspective, i.e., health condition, body functions and structures, activity, participation, and personal and environmental factors. The ICF-CY provides a framework to describe limitations of children's functioning and the impact of contextual factors on functioning in addition to health condition from a developmental perspective.

Despite the fact that many studies have investigated the correlates of RRBs in individual with autism spectrum disorders (ASD), these studies only considered variables from only one or two dimensions, for example, sensory processing abnormalities (Boyd et al., 2010; Chen, Rodgers, & McConachie, 2009; Gabriels et al., 2008; Joosten & Bundy, 2010) in the body function and structure domain, adaptive



response (Cuccaro et al., 2003) and language skill (Ray-Subramanian & Ellis Weismer, 2012) in the activity domain, or gender-related differences in the personal factor domain and diagnosis difference (Kozlowski & Matson, 2012) in health condition domain. Furthermore, the age range of participants in the majority of previous studies is wide, for example, from 3 to 21(Cuccaro et al., 2007), or from 8 to 20 years old (South, Ozonoff, & McMahon, 2005). Results of these studies may not be applicable to children at a specific age range.

Based on the ICF-CY model, factors in each dimension may correlate with health condition (Simeonsson et al., 2003). Our study addressed the following research question: Do the possible correlates from each ICF domain significantly contribute to RRBs in children with ASD?

We hypothesized that the significant variables from each ICF domain would correlate with each subtype of RRBs, i.e., stereotypic behavior, self-injurious behavior, compulsive behavior, rituals and sameness behaviors, and restricted interests, respectively and the significant correlates of the five subtypes of RRBs would encompass all dimensions of the ICF-CY model.

Thus, the purpose of the study was to identify correlates of RRBs in preschool and early elementary school children with autistic spectrum disorder from a holistic perspective by considering the variables from all dimensions of the ICF-CY framework.

The knowledge of the factors influencing RRBs will help clinicians to plan effective intervention for children with autistic spectrum disorder.





## Literature review



### Introduction to autism spectrum disorders

Autism spectrum disorders (ASDs) are lifelong disabilities, ranging from mild to severe, consisting of autism, Asperger syndrome, and pervasive developmental disorder not otherwise specified (PDD-NOS). The core symptoms include impairment in social function, communication, resistance to environmental change or change in daily routines, and engagement in repetitive activities and stereotyped movements.

### The diagnosis criteria of autism spectrum disorders

#### 299.00 Autistic Disorder

The American Psychiatric Association's Diagnostic and Statistical Manual-IV, Text Revision (DSM-IV-TR) provides standardized criteria to help diagnose autism spectrum disorders.

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) Qualitative impairment in social interaction, as manifested by at least two of the following:



- (a) Marked impairment in the use of multiple nonverbal behaviors, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
  - (b) Failure to develop peer relationships appropriate to developmental level
  - (c) A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
  - (d) Lack of social or emotional reciprocity
- (2) Qualitative impairments in communication, as manifested by at least one of the following:
- (a) Delay in or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
  - (b) In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
  - (c) Stereotyped and repetitive use of language or idiosyncratic language
  - (d) Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level



(3) Restricted, repetitive, and stereotyped patterns of behavior, interests, and activities

as manifested by at least one of the following:

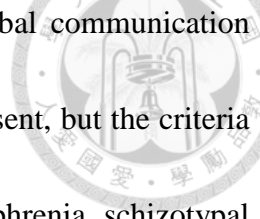
- (a) Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
- (b) Apparently inflexible adherence to specific, nonfunctional routines or rituals
- (c) Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole-body movements)
- (d) Persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

299.80 Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS)

This category should be used when there is a severe and pervasive impairment in the



development of reciprocal social interaction or verbal and nonverbal communication skills, or when stereotyped behavior, interests, and activities are present, but the criteria are not met for a specific pervasive developmental disorder, schizophrenia, schizotypal personality disorder, or avoidant personality disorder. For example, this category includes "atypical autism" -presentations that do not meet the criteria for autistic disorder because of late age of onset, atypical symptomatology, or sub-threshold symptomatology, or all of these.

#### 299.80 Asperger's Disorder (or Asperger Syndrome)

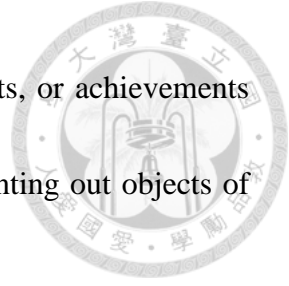
An Asperger/HFA screening tool must meet all six areas defined by the DSM-IV description of Asperger Syndrome (A-F below) to qualify for a positive rating from

First Signs:

A. Qualitative impairment in social interaction, as manifested by at least two of the following:

(1) Marked impairment in the use of multiple nonverbal behaviors, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction

(2) Failure to develop peer relationships appropriate to developmental level



(3) A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)

(4) Lack of social or emotional reciprocity

B. Restricted, repetitive, and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

(1) Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

(2) Apparently inflexible adherence to specific, nonfunctional routines or rituals

(3) Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)

(4) Persistent preoccupation with parts of objects

C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.

D. There is no clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years).




E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.

F. Criteria are not met for another specific pervasive developmental disorder or schizophrenia.

### **The prevalence of autism spectrum disorders**

From 2004 to 2010, among the 7 cities and 18 counties in Taiwan, the prevalence rates for ASDs in the age groups 3–5 years, 6–11 years, 12–14 years, and 15–17 years were 9.1–16.4/10,000, 11.2–25.3/10,000, 6.9–19.6/10,000, and 4.5–14.3/10,000, respectively. The prevalence rates of all age groups generally increased over the years ( $p < 0.01$  for all age groups). From 2004 to 2010, there were more boy cases than girl cases in each year, and the boy-to-girl ratio ranged from 6.14:1 to 6.60:1 (mean = 6.43:1)(Lai, Tseng, Hou, & Guo, 2012).

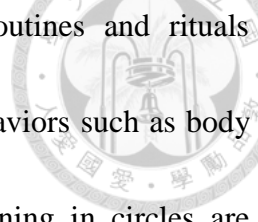
Autism and Developmental Disabilities Monitoring (ADDM) Network (2012), a division of Centers for Disease Control and Prevention (CDC) in the US, released data on the prevalence of ASD, indicating that about one in 88 eight-year old children have



ASDs in multiple areas of the United States. Approximately 18.5 per 1,000 in boys and 3.9 per 1,000 in girls were identified as having ASDs. Comparison of 2008 findings with earlier years indicated that an increase of 78% when the 2008 data were compared with the data for 2002 (from 6.4 per 1,000 children aged 8 years in 2002 to 11.4 per 1,000 in 2008) (Baio, 2012). The reason for the increase in prevalence might be caused by the differences in screening tools and diagnostic criteria (Sun & Allison, 2010).

## **Restricted and repetitive behaviors**

Restricted and repetitive behaviors (RRBs), one of three core features of autism, are classified by DSM-IV-TR into four subtypes: (1) preoccupation with restricted interests; (2) nonfunctional routines or rituals; (3) repetitive motor mannerisms; and (4) persistent preoccupation with parts of objects. Turner (1999) was the first one to classify RRBs into subcategories of “higher-level” and “lower-level” behaviors. The two former subtypes are often defined as higher level repetitive behaviors, and the two others are described together as lower level repetitive behaviors. As for higher-level behaviors, routines and rituals represented insistence on sameness. With regard to lower-level behaviors, they are more often manifested in younger and lower functioning children as well as in children with intellectual disability or other brain-based impairments. (Leekam et al., 2011) Examples of these higher-level RRBs may include preoccupation with a



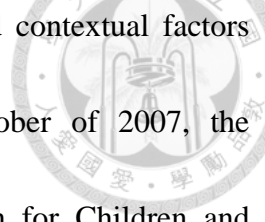
part of objects, such as flicking a rubber band or a paper, routines and rituals representing insistence on sameness. As for lower-level RRBs, behaviors such as body rocking, hands flapping, fingers flicking in front of eyes, or turning in circles are common in ASDs. Prevalence rates of at least one of RRBs ranged from 96–100% and 90–97% by age cohorts (2-6 years old) for autism and PDD-NOS groups, respectively (Kim & Lord, 2010). There are overlaps between each type of RRBs and vary in complexity. RRBs are influenced by the developmental level of cognitive and communicative abilities and may interfere with learning in school (Leekam et al., 2011).

All these behaviors are not always present in the same individual and are often not stable over their life time. In fact, in the same individual with ASD, they may change not only in quantity but also quality and type (Militeri, Bravaccio, Falco, Fico, & Palermo, 2002). Although children with various developmental disorders manifest RRBs, RRBs are more frequently seen in children with ASD.

## **International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) as a conceptual framework**

The World Health Organization's International Classification of Functioning, Disability, and Health (ICF) describes human functioning in terms of body functions and structures (physiological functions and anatomical parts), activity (execution of a





task or action), participation (involvement in a life situation), and contextual factors (including personal factors and environmental factors). In October of 2007, the International Classification of Functioning, Disability, and Health for Children and Youth (ICF-CY) was published by the WHO. International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) is based upon the framework of the ICF and includes developmental aspects for children and youth. The ICF-CY is designed to record the characteristics of developing child and the influence of his or her surrounding environments.

Studies have shown that not only body function and structure but also contextual factors influence child's functioning and development. For instance, the relationship between mother and child is a critical environmental factor, and will influence the child throughout his or her whole life (Simeonsson et al., 2003).

### **The correlates of restricted and repetitive behaviors in children with autism spectrum disorders**

Many studies have investigated the factors associated with restricted and repetitive behaviors. The factors were various including every dimension in the ICF-CY, ranging from health condition factors to contextual factors.

The relationships between restricted and repetitive behaviors and factors in the dimension of health condition factors



## **Severity**

Barrett et al. (2004) recruited 37 children with autism aged 4–7 years, and found that the lower functioning children in their sample showed both the lowest level of pragmatic language skills and the most severe and frequent RRBs. The limitation was the small sample size (N=37)(Barrett, Prior, & Manjiviona, 2004). Hus et al. (2007) collected 983 individuals, ages 4 to 52 years, with diagnoses of autism and ASDs. This study described a complex set of relationships between repetitive sensory and motor actions, verbal IQ, and verbal and nonverbal communication, with the lower functioning group showing greater frequency of these low-level repetitive behaviors(Hus, Pickles, Cook, Risi, & Lord, 2007). Bodfish et al. (2000) compared adults with mental retardation with and without autism. The control group with mental retardation was matched to the autism group in age, gender, and IQ. The autism group had significantly greater severity ratings for compulsions, stereotypy, and self-injury. Repetitive behavior severity was correlated to the severity of autism (Bodfish, Symons, Parker, & Lewis, 2000).

The relationships between restricted and repetitive behaviors and factors in the dimension of body function and structures



### **Sensory processing**

Abundant research indicated abnormal sensory processing in the ASDs population. Significant correlations were found between sensory abnormalities and RRBs(Boyd et al., 2010; Boyd, McBee, Holtzclaw, Baranek, & Bodfish, 2009; Chen et al., 2009; Gabriels et al., 2008; Joosten & Bundy, 2010). Gabriels et al. (2008) indicated children with ASD with higher frequency of RRBs would have a higher rate of abnormal sensory processing as measured by the Sensory Profile. Chen et al. (2009) found that significant relationships were noted between the frequency and intensity of RRBs and both tactile sensitivity and visual/ auditory sensitivity. Boyd et al. (2010) reported that a high level of hyperresponsive behaviors predicted a high level of repetitive behaviors. These findings provide evidence for the correlations between sensory processing difficulties and RRBs in children with ASD.

The relationships between restricted and repetitive behaviors and activity and participation factors



## **Language**

Ray-Subramanian et al. (2012) examined whether language skills and nonverbal cognitive skills were associated with clinician-observed RRBs in a sample of 115 children with ASD at ages 2 and 3. By age 3, RRBs were significantly negatively correlated with receptive and expressive language, as well as nonverbal cognitive skills. Increases in receptive and expressive language from age 2 to 3 significantly predicted decreases in RRBs (Ray-Subramanian & Ellis Weismer, 2012).

## **Adaptive behavior**

Cuccaro et al. (2003) found a negative correlation between level of adaptive behavior and repetitive sensory motor actions when examining the factor structure of the Autism Diagnostic Interview-Revised (ADI-R) and the relationship between identified factors and developmental level. Two factors were identified: Factor 1—repetitive sensory motor actions and Factor 2—resistance to change. Joosten et al. (2010) used the Vineland Adaptive scale and Motivation Assessment Scale (MAS; Durand & Crimmins, 1988) which is assessing the motivation for stereotypical behaviors to investigate the difference in children with intellectual disability (ID) and ASD. The results showed that children with ASD scoring lower in adaptive behavior would have more tendencies to reveal the stereotypical behaviors (Joosten & Bundy,

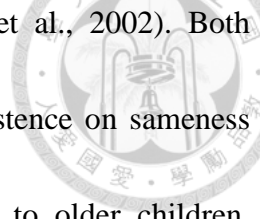
2010).



## The relationships between restricted and repetitive behaviors and personal factors

### **Age-related differences**

Esbensen et al. (2009) investigated age related differences in RRBs in 712 2- to 62-year-old individuals with ASD. The results indicated that older individuals tended to exhibit fewer RRBs than younger individuals. Those individuals with ASD comorbid with diagnosis of intellectual disability would have decreased RRBs with age. Scores of all subscales of the RBS-R, such as restricted interests, stereotyped, ritualistic compulsive, and self-injurious reduced with age (Esbensen, Seltzer, Lam, & Bodfish, 2009). Richler et al. (2010) indicated that repetitive sensory and motor behaviors remained high across the age range of 2 to 9 and only decreased in children with higher nonverbal IQ at age 9. In contrast, insistence on sameness behaviors started with lower severity at age 2 years and high insistence on sameness scores were associated with older ages and with milder social and communication impairments (Richler, Huerta, Bishop, & Lord, 2010). Militerni et al. (2002), in a study with 2- to 4- and 7- to 11-year-old children with ASD, found that younger children displayed more motor and sensory repetitive behaviors and older children had more complex behaviors, such as

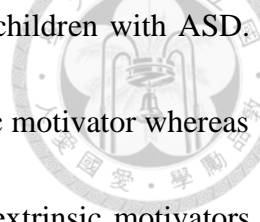


repetitive complex sequences and repetitive language (Militeri et al., 2002). Both Richler et al. (2010) and Militeri et al. (2002) indicated that insistence on sameness behaviors or more complicated repetitive behaviors were related to older children. Richler et al. (2010) indicated that repetitive sensory and motor behaviors remain high from the age of 2 to 9. However, the result of Militeri et al.'s (2002) study showed that motor and sensory repetitive behaviors gradually decreased with age. The discrepancy may be due to different measures used. Richler et al. (2010) used Autism Diagnostic Interview–Revised revealed two RRB factors, i.e. repetitive sensorimotor (RSM) behavior and insistence on sameness (IS) behavior. As for Militeri et al.'s (2002) study, presence of a repetitive behavior was screened for through parental interview by means of a semi-structured, non-standardized questionnaire.

### **Gender-related differences**

Kozlowski et al. (2012) investigated both group and gender differences in the rates of stereotypic behaviors in 322 infants and toddlers who were classified into the autism, PDDNOS, and typically developing groups. Results showed no significant gender differences in the rates of stereotypic behaviors (Kozlowski & Matson, 2012).

### **Anxiety**

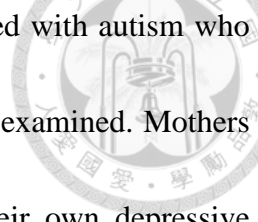


RRBs were triggered by intrinsic and extrinsic motivators in children with ASD. Joosten et al. (2009) showed that anxiety was likely to be an intrinsic motivator whereas escape and gaining a tangible object were the two most common extrinsic motivators (Joosten, Bundy, & Einfeld, 2009). Gotham et al. (2013) explored the association between anxiety and ASD symptoms; particularly the degree to which the relationship was explained by insistence on sameness (IS) behaviors. Child Behavior Checklist Anxiety Problems T-scores was used to measure anxiety. The results indicated that higher anxiety was associated with higher overall RBS-R and sameness subscale scores (Gotham et al., 2013).

#### The relationships between restricted and repetitive behaviors and environmental factors

##### **Parent-child relationship quality**

Positive family atmosphere may have positive effects on the child such as ameliorating the autism symptoms and mitigating behavior problems. Smith et al. (2008) recruited 149 families of adolescents and adults with ASD, and recorded their mother and child relationship quality. The results indicated that high levels of relationship quality was related to subsequent reductions in repetitive behaviors and behavior problems (Smith, Greenberg, Seltzer, & Hong, 2008). Baker et al. (2011) also showed

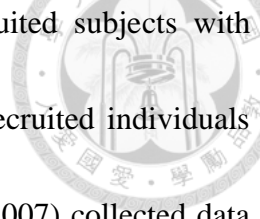


the same result. Participants were 149 families of children diagnosed with autism who were between the ages of 10 and 22 years during the 3-year period examined. Mothers reported on family adaptability, the mother–child relationship, their own depressive symptoms, and the behavior problems of their children. The rating included of hurtful to self, unusual or repetitive, withdrawn or inattentive, socially offensive, uncooperative, hurtful to others, destructive to property, and/or disruptive. Testing of the path model indicated high occurrence of behavior problems and maternal depression over time (Baker et al., 2011).

### **Limitations of previous studies**

The ICF-CY conceptual framework provides a new paradigm of human functioning and disability, and it can be used to guide holistic and interdisciplinary approaches to assessment and intervention (Simeonsson et al., 2003). Although there are many studies investigating the correlates of RRBs in individual with ASD, some studies only considered the domain of body functions and structures (Boyd et al., 2010; Chen et al., 2009; Gabriels et al., 2008) and some studies only investigated contextual factors (Baker et al., 2011; Kozlowski & Matson, 2012). There was no study examining the potential correlates of RRBs considering variables from all domains of the ICF-CY, i.e., body function and structures, activity and participation factors, and environmental





factors, simultaneously. Furthermore, many previous studies recruited subjects with ASD across a large age range. For example, South et al. (2005) recruited individuals with ASD aged 8 to 20 years (South et al., 2005). Cuccaro et al. (2007) collected data from individuals with ASDs aged 3 to 21. It would be difficult to apply the results to children at a specific age (Cuccaro et al., 2007).

## **Conclusion**

Previous studies manifested that restricted and repetitive behaviors negatively related to language and adaptive behavior. Furthermore, RRBs are positively correlated with severity, sensory processing abnormalities and anxiety of individuals with autism spectrum disorder. The relationships between RRBs and age are still inconsistent.

In the domain of activity, receptive and expressive language skills were negatively correlated with RRBs in children with ASD. Ray-Subramanian et al.'s (2012) study recruited toddler only in 2 to 3 years old such that it was difficult to apply the results to children in preschool or early school age for the later would have more challenge in using language to interact with peers.

In the domain of participation, previous studies showed that adaptive behavior was significantly, negatively related to RRBs in children with ASD (Cuccaro et al., 2003; Joosten & Bundy, 2010). However, these studies recruited children with a large age

band, from 3 to 21 years old, and did not consider comorbid situation in participants (Cuccaro et al., 2003).



Regarding the personal factor, the relationship between age and RRBs in children with ASD was still not consistent (Esbensen et al., 2009; Militerni et al., 2002; Richler et al., 2010). Furthermore, RRBs were correlated with severity and anxiety in children with ASD (Goldman et al., 2009; Joosten & Bundy, 2010). The interaction quality between mother and children were negatively correlated with RRBs. Children with ASD had better interaction with their mother would have lower RRBs (Baker et al., 2011; Smith et al., 2008).

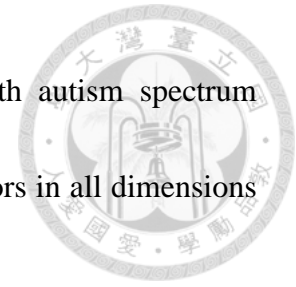
Few studies considered the factors in the environmental domains when examining the correlates of RRBs in children ASD (Cuccaro et al., 2003; Richler et al., 2010; Smith et al., 2008). These studies only considered variables in environmental factor and body function and structures.

Despite the fact that many studies have investigated the correlates of RRBs in individual with ASD, these studies only considered variables from only one or two dimensions of the ICF-CY.

### **Research purpose**

The purpose of the study was to identify the correlates of restricted and repetitive

behaviors in preschool and early elementary school children with autism spectrum disorder adopting the ICF-CY as a conceptual framework. The factors in all dimensions of the ICF-CY were taken into account as potential correlates.



### **Hypotheses of the study**

1. Autistic severity, sensory processing, expressive language, receptive language, adaptive behavior, age, anxiety and patient-child relationship quality would significantly correlate with overall RRBs as measured by Repetitive Behavior Scale-Revised (RBS-R)
2. Autistic severity, sensory processing, expressive language, receptive language, adaptive behavior, age, anxiety and patient-child relationship quality would significantly correlate with five subtypes of RRBs, i.e., stereotypic behavior, self-injurious behavior, compulsive behavior, rituals and sameness behaviors, and restricted interests as measured by Repetitive Behavior Scale-Revised (RBS-R), respectively.
3. The significant correlates of the five subtypes of RRBs (stereotypic behavior, self-injurious behavior, compulsive behavior, rituals and sameness behaviors, and restricted interests) would encompass all dimensions of the ICF-CY model.



## Methods

### Participants

Eighty-six children with autistic spectrum disorders were recruited from developmental centers, departments of rehabilitation at medical centers and hospitals, elementary schools, and Autism Parents Association(自閉症家長協會) in northern Taiwan as well as Autism Foundation of the Republic of China(中華民國自閉症基金會). Children were included if (1) they were diagnosed as autism spectrum disorder by psychiatrists; (2) they were preschoolers or early elementary school children; (3) their primary caregivers gave informed consents. Children with identifiable neurological conditions and parents who were illiterate or couldn't read Chinese were excluded.

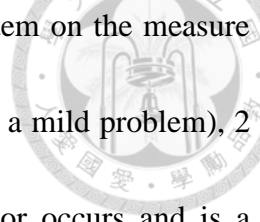
### Measures

The following measures were classified by the ICF-CY dimensions (Figure 1).

#### The Measure of Restricted and Repetitive Behaviors

##### **Repetitive Behavior Scale-Revised (RBS-R):**

The RBS-R is a questionnaire that assesses 43 discrete types of repetitive behaviors across 6 subscales (Stereotypy, Self-injurious Behavior, Compulsions,

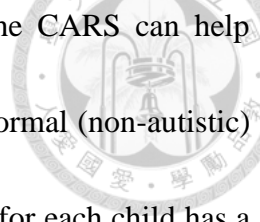


Rituals, Sameness, and Restricted Interests). Scores for each item on the measure range in 0 (behavior does not occur), 1 (behavior occurs and is a mild problem), 2 (behavior occurs and is a moderate problem), and 3 (behavior occurs and is a severe problem). Lam et al. (2007) conducted a factor analysis (based on N = 320 caregivers of individuals with autism) resulting in a five-factor solution that was clinically meaningful and statistically sound. Factor loadings ranged from 0.51 - 0.66, accounting for 47.5% of the variance; internal consistency of the scales ranged from 0.78 - 0.91 and inter-rater reliability ranged from 0.57 - 0.73. The five-factor solution was deemed as most appropriate because they were easily interpretable with good internal consistency, high item-total correlations, and reasonable fit as indicated by the RMSEA statistic. (Lam & Aman, 2007). In this study we used the total score of the RBS-R, and the score of each subtypes based on Lam et al.'s (2007) factor analysis as the dependent variable.

### The Measure Related to Health Condition

#### **Childhood Autism Rating Scale (CARS):**

The CARS (Schopler, Reichler, DeVellis, & Daly, 1980) is a 15-item behavior observational rating scale. The questionnaire is used for individuals 24 months of age and above. In our study we adopted the method of observing children and

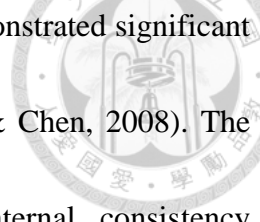


interviewing with parents who are familiar with children. The CARS can help clinicians to identify the severity of autism, total scores from normal (non-autistic) to severely abnormal (severely autistic). The total CARS score for each child has a possible range of from 15 to 60. A higher score (a score > 29.5) indicates more severely autistic. The items in CARS contain social, language, and cognitive skills, with each item having a continuum rating. It has short administration time (10-15 min) and value in screening to quickly identify children with autism. The reliability is good with internal consistency of 0.94 and inter-rater reliability of 0.71 (Schopler et al., 1980).

### The Measure Related to Body Function and Structures

#### **Chinese version of the Short Sensory profile (SSP-C):**

The SSP-C is a 35-item caregiver questionnaire which evaluates children's sensory processing and their response to sensory events in everyday life. The questionnaire is used for children from 3 to 10 years of age. Caregivers give their answers through a 5-point Likert scale (nearly never = 5, seldom = 4, occasionally = 3, frequently = 2, almost always = 1). A higher score indicates better sensory processing abilities (Tseng & Chen, 2008). Psychometric properties are detailed on the user manual. The internal consistency of the SSP total and sections ranged from




0.70 to 0.90. All the section and factor scores of the SP-C demonstrated significant differences between children with and without ASD (Tseng & Chen, 2008). The Chinese version SP demonstrated acceptable to good internal consistency (Cronbach's  $\alpha=.62-.90$ ), good test-retest reliability for total scores (ICC=.79), and poor to good test-retest reliability for each section scores and each factor scores (ICC=.44 - .90). In this study we used the total score of the SSP as a possible correlate of the participation with ASD because it is the most sensitive indicator of sensory dysfunction (Tomchek & Dunn, 2007).

### The Measures Related to Activity and Participation

#### **Psychoeducational Profile-3(PEP-3):**

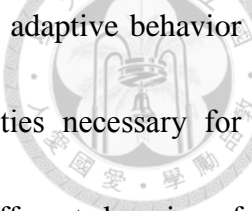
The PEP-3 is a norm-referenced scale measuring development and maladaptive behavior in children with ASD between the developmental ages of 2 to 7.5 years (Schopler, Lansing, Reichler, & Marcus, 2004). The Performance section is made up of 10 subtests: 6 that measure developmental abilities and 4 that measure maladaptive behaviors. These subtests are combined to form 3 Composites: Communication, Motor and Maladaptive Behaviors. The Motor Composite includes Fine Motor, Gross Motor, and Visual-Motor Imitation. The Maladaptive Behavior composite contains Affective Expression, Social Reciprocity,



Characteristic Motor Behaviors, and Characteristic Verbal Behaviors. The Cognitive Verbal/Preverbal, Expressive Language and Receptive Language subtests, which belong to the Communication Composite were used to measure cognitive and language ability. The Expressive Language subtest (25 items) measures naming ability, production of phrases, reading and counting ability, color and letter naming, the ability to produce nouns, pronouns and age appropriate syntax, the ability to express relations such as big and little, as well as some pragmatic information such as the ability to state name and gender when asked and the ability to use words and gestures to request help. The Receptive Language subtest (19 items) measures a child's ability to understand communication through activities such as pointing to body parts upon command, identifying shapes, letters, and objects and demonstrating the ability to follow directions and respond to gestures, understand action words and respond to wh- questions (Fulton & D'Entremont, 2013). Test items on the Performance Scale are scored as Passing (2 points), Emerging (1 point) and Failing (0 points) depending on specific scoring criteria prescribed in the administration guidelines. We used the raw score of subtests of Expressive Language and Receptive Language in our study.

**Vineland Adaptive Behavior Scales (VABS):**



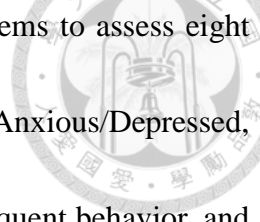


Vineland Adaptive Behavior Scales are designed to assess adaptive behavior defined as ‘the individual’s performance in daily life activities necessary for personal and social independence’. This scale contains four different domains of adaptive behavior, i.e., Communication, Daily Living Skills, Socialization, and Motor Skills. The VABS was administered through a semi-structured interview with parents or caregivers (Sparrow et al., 1984). The VABS is a norm-referenced test measuring adaptive behavior in domains of communication (receptive, expressive, and written), daily living skills (personal, domestic, and community), socialization (interpersonal relations, play and leisure time, and coping skills), and motor skills (gross motor, fine motor). Each item is measured from 0 to 2. The Vineland Adaptive Behavior Scales was translated in Chinese by Wu et al. in 2004 and can be applied to caregivers who have children in three to twelve years old. We used the total score in our study.

#### The Measures Related to Personal and Environmental factors

##### **Child Behavior Checklist Chinese version (CBCL-C):**

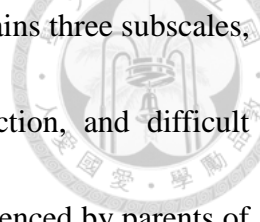
The CBCL is one of the most commonly used parent-report questionnaire that assesses emotional and behavioral problems in children of 4-18 year-olds (Achenbach, 1991). The CBCL was translated to the Chinese version (CBCL-C) by



Huang, Chung, & Wang (1994). The CBCL-C includes 113 items to assess eight narrow-band syndromes (Withdrawn, Somatic complaints, Anxious/Depressed, Social problems, Thought problems, Attention problems, Delinquent behavior, and Aggressive behavior) and two broad-band syndromes (internalizing and externalizing behavior problems). The internalizing problems include Withdrawn, Somatic complaints, and Anxiety/Depression. The externalizing problems include Delinquent behavior and Aggressive behavior (Huang, et al., 1994). The test-retest reliability is 0.51-0.74, and the internal consistency is 0.81-0.92 (Huang, et al., 1994). The CBCL/1<sup>1/2</sup>-5 also assesses emotional and behavioral problems for toddlers and preschoolers ranging from 18 months to 5 years old. The internalizing problems (36 items), consists of four syndrome subscales (Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn). The externalizing problems (24 items), consists of two syndrome subscales (Attention Problems and Aggressive Behavior). In our study, we used the Anxiety/Depression T score to represent the degree of anxiety.

**Parenting Stress Index-Short Form (PSI-SF):**

The PSI-SF (Abidin, 1983; Loyd & Abidin, 1985) was designed to measure the interactions between the parent and the child and assess stress in the



parent-child relationship. It is a 36-item questionnaire that contains three subscales, including parental distress, parent-child dysfunctional interaction, and difficult child. It is a common screening tool used to assess stress experienced by parents of a child with a disability. It identifies dysfunctional parenting and predicts the potential for parental behavior problems and child adjustment difficulties within the family system. While its primary focus is on the preschool child, the PSI can be used with parents whose children are 12 years of age or younger. Each item were rated from 1(strongly disagree) to 5(strongly agree). Thus, the total score ranges from 36 to 180. The PSI-SF shows good reliability and validity (Reitman, Currier, & Stickle, 2002).

## **Procedure**

This study was approved by the Institute Review Board of National Taiwan University Hospital. Children with autism spectrum disorder were recruited from developmental centers, departments of physical medicine and rehabilitation at medical centers and general hospitals, public elementary schools, Autism Foundation of the Republic of China, and Autism Parents Association in Taipei City and New Taipei City. Consent forms and a letter which explained the purpose of study were given to parents with children with ASD. After getting parental consent form, we called the parent to

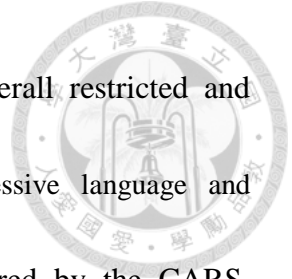
schedule an assessment at School of Occupational Therapy, National Taiwan University.

At the beginning of the assessment, parent filled out the basic information questionnaires and the Vineland Adaptive Behavior Scales (VABS). Researchers gave a package of questionnaires to parents, including Repetitive Behavior Scale-Revised (RBS-R), Chinese version of the Short Sensory profile (SSP-C), Child Behavior Checklist (CBCL), and Parenting Stress Index-Short Form (PSI-SF). While parents were filling out the basic information questionnaire and the VABS, the child was evaluated by trained therapists using Psychoeducational Profile-3(PEP-3). The child was also observed by another trained therapist using Childhood Autism Rating Scale (CARS). Other questionnaires were taken home by parents. Parents would return the completed questionnaires within one month (Figure 2).

### **Statistical analysis**

Statistical analyses were performed using SPSS 17.0 software (Norusis, 2008; Statistics, 2008). Two-sided  $p \leq 0.05$  was considered statistically significant. Descriptive analysis was conducted for basic information and the observed variables. We also used Pearson correlation to investigate the relationships between five subtypes of RRBs and potential correlates. We fitted six separate multiple linear regression models to identify the correlates of each subtype of RRBs, including Stereotypy, Self-injurious Behavior,

Compulsions, Rituals and Sameness, Restricted Interests, and overall restricted and repetitive behaviors. The independent variables included expressive language and receptive language as measured by the PEP-3, severity as measured by the CARS, sensory processing as measured by the SSP-C, anxiety as measured by the CBCL, adaptive behavior as measured by the VABS, and demographic data of children.

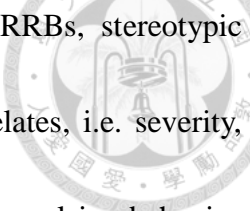


## Results



Descriptive statistics of demographic was shown in Table 2. A total of 86 children with autism spectrum disorder aged from 37 to 105 months (mean: 68.15 months; SD: 15.60 months) with 72 boys and 14 girls. The majority of participants (73.3%) were children with autism. The frequency of occurrence for each subtype of RRBs was shown in Table 3. The findings indicated that almost every subtype of RRBs was centralized in lower scores, except the restricted interests. Namely, the items described RRBs rarely occur in our participants. For instance, the scores of most items (37.2-60.5%) of Stereotypic Behavior were 0 , indicating that the behavior does not occur, and the scores of a much higher percentage of items of Self-injurious Behavior were 0 (41.9-84.9%). The score of overall restricted and repetitive behaviors was 0-129 in this questionnaire. However, our study showed that the score of overall RRBs was just ranging from 2 to 63.

We used Pearson correlations to indicate the relationships between RRBs, including Stereotypy, Self-injurious Behavior, Compulsions, Rituals and Sameness, and Restricted Interests respectively and potential variables (Table 4). The findings showed that overall RRBs were significantly correlated with severity ( $r=0.415$ ,  $p<0.01$ ), expressive language ( $r =-0.419$ ,  $p <0.01$ ), receptive language ( $r =-0.433$ ,  $p <0.01$ ), and



adaptive behavior ( $r = -0.308$ ,  $p < 0.01$ ). As for the subtypes of RRBs, stereotypic behavior and self-injurious behavior had the same significant correlates, i.e. severity, expressive language, receptive language, and adaptive behavior. Compulsive behavior was significantly correlated with expressive language and receptive language. However, no significant independent variables correlated with ritual and sameness behavior and restricted interests respectively.

Stepwise multiple linear regression analysis was conducted to investigate the correlates of overall RRBs, stereotypic behavior, self-injurious behavior, compulsive behavior, rituals and sameness behaviors, and restricted interests. The stepwise multiple linear regression model for RRBs, as measured by the repetitive behavior scale-revised (RBS-R)(Bodfish et al., 2000), revealed that receptive language and age of participants were significant correlates of overall RRBs. The model explained 20.9% of the variance. The score of overall RRBs was higher when the receptive language was poorer and the age of participants with ASD was older. It indicated that children with delayed receptive language skill had a high severity level of RRBs.

As for stereotypic behavior, the stepwise multiple linear regression model showed that receptive language, age, and adaptive behavior were significant correlates and accounted for 42.2% of the variance. The score of stereotypic behavior subscale was higher when the score of receptive language was lower, participants were older, and the

score of adaptive behavior was lower. That is, children with poorer receptive language and worse adaptive behavior had higher stereotypic behavior. Furthermore, stereotypic behavior increased when children with ASD were getting older.



Regarding self-injurious behavior, the multiple stepwise linear regression model revealed that receptive language was the only significant correlate explaining 26.3 % of the variance. The score of self-injurious behavior subscale was higher when the score of receptive language was lower. It indicated that children who have poorer receptive language had a higher level of severity of self-injurious behavior.

As regards compulsive behavior, the multiple stepwise linear regression model indicated that receptive language was the only significant correlate and could explain 5.5% of the variance. The score of compulsive behavior subscale was higher when the score of receptive language was lower. That is, children who have poorer receptive language skill had a higher level of severity of compulsive behavior.

As for ritualistic and sameness behavior and restricted interests, no significant correlate was identified.

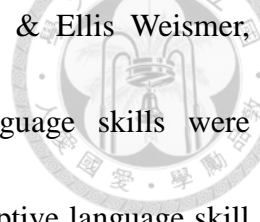


## Discussion



This study considered variables from the entire scope of the ICF-CY when investigating the correlates of RRBs in children with ASD. Our hypothesis was that severity, sensory processing, expressive language, receptive language, adaptive behavior, age, anxiety and patient-child relationship quality would significantly correlate with overall RRBs. Results of this study partially support our hypotheses, i.e., only receptive language, adaptive behavior, and child's age being the significant correlates of RRBs (Table 5 and Figure 3). Furthermore, our finding was consistent with previous studies (Cuccaro et al., 2003; Delincolas & Young, 2007; Kozlowski & Matson, 2012; Ray-Subramanian & Ellis Weismer, 2012). For instance, Cuccaro et al. (2003) and Joosten et al. (2010) indicated that children with ASD scoring lower in adaptive behavior would be more likely to manifest repetitive sensory motor actions and stereotypical behaviors (Cuccaro et al., 2003; Joosten & Bundy, 2010). The correlates of each subtype of RRBs are somewhat similar. First, delayed receptive language skill is the correlate for all the subtypes of repetitive behavior except for ritualistic and sameness behavior and restricted interests. Second, adaptive behavior and age were the significant correlates of stereotypic behavior.

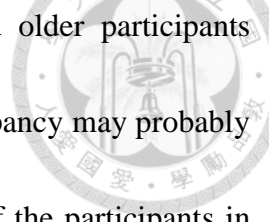
Receptive language skill is in the area of activity in the ICF-CY. Results of our



study lend partially support to previous study (Ray-Subramanian & Ellis Weismer, 2012). Ray-Subramanian et al. (2012) indicated receptive language skills were negatively associated with RRBs at ages 2 and 3. In our study, receptive language skill was the correlates of three subtypes of RRBs, i.e., stereotypic, self-injurious and compulsive behaviors. Among them, receptive language skill was the only correlate of two types of RRBs, i.e., self-injurious and compulsive behaviors. The findings from our study suggest that the poorer the receptive language skill the severer the stereotypic behavior, self-injurious, and compulsive behaviors. The explanation may be that due to difficulty understanding others' commands, children with ASD decreased their anxiety by RRBs (Joosten et al., 2009; Leekam et al., 2011). Another explanation may be that children with ASD indulged in the stereotypic behavior and compulsive behaviors to decrease boringness (Leekam et al., 2011; Zentall & Zentall, 1983) .

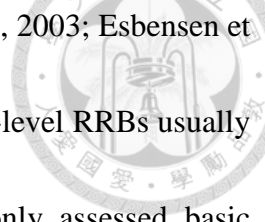
The finding that adaptive behavior is the correlate of stereotypic behavior is consistent with Cuccaro et al.'s study that children with ASD had poorer adaptive behavior would have higher repetitive sensory motor actions(Cuccaro et al., 2003). The reason may be that children with poor adaptive behavior may use repetitive sensory motor actions or stereotypic behaviors as a coping strategy such as body rocking to reduce anxiety (Leekam et al., 2011).

Our study showed that stereotypic behavior increased with age, a finding



inconsistent with Esbensen et al.'s (2009) study which showed older participants tended to exhibit fewer RRBs than younger participants. The discrepancy may probably be due to differences in age range of participants. The age range of the participants in our study is from 3 to 9 but that of Esbensen et al.'s (2009) study is from 2 to 62. In consistent with Militerni et al.'s (2002) and Richler et al.'s study (2010), our study found that overall RRBs and stereotypic behavior increased with age. Militerni et al.'s (2002) study recruited individuals from age 2 to 4 and 7 to 11, and Richler et al.'s (2010) study collected participants with the age range of 2 to 9. Our study also showed that stereotypic behavior increased with age. Perhaps the RRBs gradually decrease in their life span, but its prevalence remains high in preschool children and school children. The stereotypic behavior may be a coping strategy for children with ASD to enable them to either regulate high levels of arousal or to reduce anxiety (Leekam et al., 2011). Another reason might be that the participants with older age in our study were more severe than younger children.

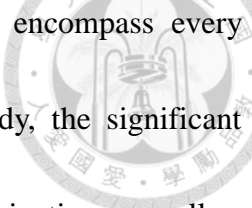
It is interesting to note that no predictors entered into the models of restricted interests, and ritual and sameness behavior respectively and both subtypes are higher-level RRBs. A close examination of the data revealed that no variable was significantly correlated with restricted interests, and ritual and sameness behavior in Pearson correlation matrix. The correlates identified in previous studies such as adaptive



behavior were only correlated with lower-level RRBs (Cuccaro et al., 2003; Esbensen et al., 2009). There might be two reasons for the findings. First, higher-level RRBs usually correlated with cognitive or executive function, but our study only assessed basic language skills using Psychoeducational Profile-3 (PEP-3) . The ceiling effect may exist. Second, restricted interests and ritual and sameness behavior which belong to higher-level RRBs are too complicated to record, so it is hard to find out the definite correlation with other variables.

In our study, some possible correlates did not enter into any stepwise multiple linear regression models such as severity, sensory processing, expressive language, anxiety, and parent-child relationship quality. It is probably because their correlation with the dependent variables was low( $r = 0.001-0.188$ ) (Table 4). Our results showed low correlation between parent-child relationships and RRBs. The finding is similar to Baker's study (2011) that mother child relationship quality did not predict change in child behavior problems.

Even though our study considered all possible correlates based on all dimensions of ICF-CY, there was no correlate belonging to environmental factors. As for the domain of activity and participation, receptive language skills are common in subtypes of RRBs. The reason might be that comparing the domain of activity and participation to environmental factors, the former has more influence to RRBs in children with ASD.



Overall, the hypothesis that the significant correlates would encompass every dimension of ICF-CY model has not been confirmed. In our study, the significant correlates of RRBs only involve the dimensions of activity and participation, as well as personal factors of the ICF-CY model.

Our study has three limitations. First, the majority of participants were high-functioning, so generalization of the results should be cautious. Second, most of our participants were from urban areas in northern Taiwan, so generalization of the results to rural areas should be with caution. Third, our participants were in the age range of 3 to 9, it may not be applicable to children of older age.

## Conclusion



This study took into account the possible correlates of restrictive and repetitive behaviors from all dimensions of the ICF-CY simultaneously. Results of the study showed that children's age, receptive language skill, and adaptive behavior were important correlates of restrictive and repetitive behaviors in children with autism spectrum disorder. Furthermore, receptive language is the common correlate of three subtypes of RRBs. Knowledge of the correlates may help clinicians, parents, and school teachers develop interventions targeted at the correlates in order to effectively reduce their RRBs. Results of our study can serve as a basis for future experimental studies targeted at the correlates to ameliorate restrictive and repetitive behaviors in children with ASD.

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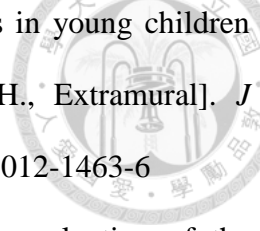
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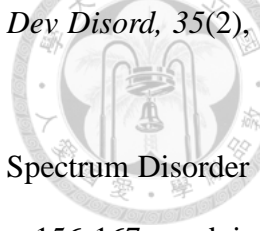
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**Table 1. Summary of Studies Investigating the Relationships Between Restricted and Repetitive Behaviors and Factors in ICF-CY**

<b>Health condition</b>					
<b>Authors</b>	<b>Purpose</b>	<b>Participants</b>	<b>Analysis</b>	<b>Results</b>	<b>Limitations</b>
Suzanne Barrett et al. Autism (2004)	The aim was to identify potentially differentiating features of the two groups using observational ratings and questionnaire measures provided by parents and teachers.	A sample of 37 children aged 4–7 years who all showed some autistic features was investigated	Pearson correlations and multiple regression analyses	The lower functioning children in their sample showed both the lowest level of pragmatic language skills and the most severe and frequent RRBs	The small sample size
Vanessa Hus et al. BIOL PSYCHIATRY (2007)	The present study examines group differences in chronological age, gender, Verbal and Nonverbal IQ, and measures of autism severity, as related to ADI-R items and domains previously used for subsetting or QTL analysis.	983 individuals, ages 4 to 52 years, with diagnoses of autism and ASDs	ANOVA Independent sample t tests Chi-square analyses for categorical variables	Findings suggest that, of several potential grouping variables, only restricted and repetitive behaviors associated with Insistence on Sameness were independent of age, IQ, and autism severity.	more complex multivariate analyses would provide more accurate representations of interactions between both the predictor and criterion variables for this particular dataset
James W. Bodfish et al. Journal of Autism and Developmental Disorders (2000)	Extending previous studies of abnormal repetitive behaviors by determining the rate of occurrence of specific repetitive behaviors in	32 adults (24 male, 8 female) with autism	Pearson correlation	The control group with mental retardation was matched to the autism group in age, gender, and IQ. Autistic group had significantly greater severity ratings for compulsions, stereotypy, and	<ul style="list-style-type: none"> <li>◆ The small sample size</li> <li>◆ Cannot explain to children with ASD</li> </ul>

	individuals with autism compared with a nonautistic-MR group.			self-injury. Repetitive behavior severity was correlated to the severity of autism.
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### Body function and structures

Authors	Purpose	Participants	Analysis	Results	Limitations
Robin L. Gabriels, et al. Research in Autism Spectrum Disorders (2008)	Examining the relation between restricted, repetitive, and stereotyped behaviors and interests (RBs) and sensory responses	N=70, ASD, 3.0-19.7Y(mean 10.8Y), IQ25-138(mean 81.4)	MANCOVA	Controlling for IQ and age, total RBS-R and Sensory Profile scores revealed significant correlations both prior( $r=-0.61$ ) to and after( $r=-0.65$ ) removing overlapping items.	<ul style="list-style-type: none"> <li>based only on caregiver report measures</li> <li>small sample size</li> <li>large age band</li> </ul>
Yu-Han Chen, et al. J Autism Dev Disord (2009)	Examining the potential inter-relationships between sensory processing abnormalities, restricted and repetitive behaviors, and cognitive style.	N=29, Asperger or ASD, 8-16Y (mean 11Y11M), IQ>70	Pearson correlations and multiple regression analyses	Significant correlations were found between degree of sensory abnormalities and amount of restricted and repetitive behaviors reported. There are relationship between an individual's detail-focused cognitive style and their repetitiveness.	<ul style="list-style-type: none"> <li>Almost half of the children and/or parents approached did not reply or declined participation.</li> <li>small sample size</li> <li>there is the issue of change with age</li> </ul>
Brian A. Boyd, et al. Res Autism Spectr Disord(2009)	Examining the relationship between repetitive behaviors and sensory processing issues in school-aged children with high functioning autism and	N=61, ASD, 6-17Y(mean 10.2Y), IQ>70 N=64, TYP(typically developing)	(1) Pearson correlation (2) Regression analysis	Particular types of repetitive behavior (i.e., stereotypy and compulsions) were related to sensory features in autism; however, executive deficits were only correlated with repetitive behavior.	<ul style="list-style-type: none"> <li>only caregiver report measures</li> <li>did not explore the relationship between sensory features and repetitive behaviors in the</li> </ul>

	whether executive dysfunction explained any relationship between the variables.				typical comparison group because they displayed low frequencies of these abnormal behaviors
Brian A. Boyd, et al. Autism Res.(2010)	Examining the association between aberrant sensory features and restricted, repetitive behaviors in children with autism and those with developmental delays.	N=67, ASD, mean 51M N=42, DD, mean 49M	Regression analysis	(1) high levels of hyperresponsive behaviors predicted high levels of repetitive behaviors (2) non-significant associations between hyporesponsiveness or sensory seeking and repetitive behaviors	The study did not directly test for physiological or biological correlates of restricted, repetitive behaviors.

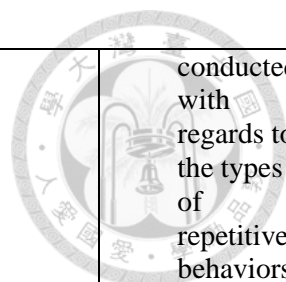
### Activity and participation

Authors	Purpose	Participants	Analysis	Results	Limitations
Corey E. Ray-Subramanian et al. J Autism Dev Disord (2012)	The purpose of the current study was to enhance our understanding of RRBs in young children with ASD from a developmental perspective by examining the presence of RRBs in association with functional skills, such as language and nonverbal cognition, at	N=115, 24–36 months, 106 autism, 9 PDDNOS	Partial correlations	Nonverbal cognitive skills and receptive language skills were negatively associated with RRBs at ages 2 and 3. Expressive language skills were negatively associated with RRBs at age 3 but not at age 2.	<ul style="list-style-type: none"> <li>◆ Not fully capture the range or extent of RRBs that a child with ASD may display in daily life, particularly behaviors characterized by an insistence on sameness.</li> <li>◆ Our standardized language measure captures structural</li> </ul>



	ages two and three and changes in RRBs over this 1-year period.				language skills such as receptive and expressive vocabulary and grammatical abilities, but does not target pragmatic abilities.
Rachel L. Loftin et al. J Autism Dev Disord (2008)	Examining the effect of multi-component social skills intervention on social interactions in children with autism spectrum disorders	N=3, autism, 9-10Y	Descriptive statistics	The outcome showed that social interactions increased during intervention and participants' repetitive behaviors were reduced. The result indicated the children who scored higher in social skills would have lower levels of restricted and repetitive behaviors	<ul style="list-style-type: none"> <li>less applicable to individuals with autism whose communication ability is less developed or those with lower cognitive ability</li> </ul>
Erin K. Delincolas et al. Autism (2007)	Examining the relationships between joint attention behaviors, language, social relating, and stereotypical behavior in autism	N=56, autism, 2Y-5Y6M	Descriptive statistics Spearman's correlations	Expressive language, receptive language, relating to people, stereotypical behaviors all correlations between these symptoms of autism were significant, though they varied in strength from moderate to strong.	<ul style="list-style-type: none"> <li>initiation of, and response to, joint attention should be measured separately</li> </ul>
Michael L. Cuccaro et al. Child Psychiatry and Human Develop	(1) To identify restricted and repetitive behaviors factors based on items from the ADI-R.	N=292, ASD, 3-21Y	Factor analysis	There was a significant negative correlation between an index of level of adaptive functioning and repetitive sensory motor actions	<ul style="list-style-type: none"> <li>This study of RRBs relies solely on parent-report and does not distinguish between</li> </ul>

ment (2003)	(2) To examine the concordance for the derived factors in affected siblings from multiplex families. (3) To determine the relationship between identified factors and developmental level.				current and ever ratings. ♦ The lack of information about RRB in individuals with other developmental disorders.
Annette V. Joosten et al. Australian Occupational Therapy Journal (2010)	Whether children with intellectual disability have more motivation for stereotypical behaviors.	N= 52, (29 ASD+ID, 23 ID), mean age 9.7 years	One-tailed t-tests	The results showed that children with ASD lower of score in adaptive behavior would have more tendency to reveal the stereotypical behaviors	small sample sizes (29 children with comorbid diagnoses and 23 children with ID alone)
Emma Honey, et al. J Autism Dev Disord (2007)	Examining the relationships between repetitive behavior, child's language skills and the level of play skills.	N=79, ASD, 2-4 &6-8Y N=117, TD, 2-4 &6-8Y	t-test, hierarchical regression analyses	(1) Repetitive behaviors were associated with play in ASD but not in typical development. (2) For ASD group, expressive language and repetitive behaviors were revealed as significant predictor of play. (3) Restricted and repetitive behaviors were negatively correlated with overall play behaviors, which are including functional and symbolic play	♦ only caregiver report measures, play lends itself to standardized observational methods ♦ need more accurate measure of language ♦ does not provide information about the severity of ASD ♦ analysis did not



conducted with regards to the types of repetitive behaviors

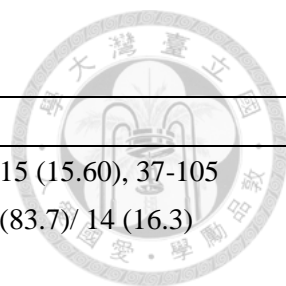
**Personal and environment factors**

<b>Authors</b>	<b>Purpose</b>	<b>Participants</b>	<b>Analysis</b>	<b>Results</b>	<b>Limitations</b>
Anna J. Esbensen , et al.6 J Autism Dev Disord (2009)	Describing age-related patterns of symptom change and association with specific contextual factors, and to examine if the patterns of change are different for the various types of restricted repetitive behaviors	N=712, ASD, participants were selected from six previously conducted studies	Bivariate correlations Multiple regression analyses	Age was significantly correlated with all five of the repetitive behavior subscales, including stereotyped movements, self-injurious behaviors, compulsive behaviors, ritualistic/sameness behaviors, restricted interests, and total score.	The study used modified cross-sectional data, and parents of older individuals with ASD may less likely to report them
Jennifer Richler et al. Dev Psychopathol. (2010)	Examining how restricted and repetitive behaviors and interests developed over time in a sample of children with Autism Spectrum Disorders	N=192, autism, 2Y, followed up at approximately the ages of 3, 5, and 9 years		(1) repetitive sensory and motor behaviors remained high across the age range of 2 to 9 and only decreased in children with higher nonverbal IQ at age 9 (2) insistence on sameness behaviors started at a low level at age 2 years and high insistence on sameness scores were associated with older ages and with milder social and communication impairments	<ul style="list-style-type: none"> <li>◆ Parent's report about behaviors might be subjective and can be problematic.</li> <li>◆ Families with lower socioeconomic status easily dropped out, even though the rate of attrition was relatively low.</li> </ul>
Roberto Militerni et al.	The aim of this clinical and	N= 121. 104 boys and 17 girls, autism	linear regression, frequency	Younger autistic children displayed more motor and	<ul style="list-style-type: none"> <li>◆ This is a single-rater study</li> </ul>

European Child & Adolescent Psychiatry(2002)	observational study is to define subgroups of repetitive behaviors in autism, and to determine their potential significance, as well as usefulness, from a clinical perspective.		distribution and $\chi^2$ testing	sensory repetitive behaviors and older children had more complex behaviors, such as repetitive complex sequences and repetitive language	<ul style="list-style-type: none"> <li>The study is the use of different IQ measures for different subgroups of patients</li> </ul>
Alison M. Kozlowski et al. Research in Autism Spectrum Disorders (2012)	Assessing for significant differences in the endorsement rates of challenging behaviors between infants and toddlers with autism versus PDD-NOS as well as for significant differences between genders	N = 322, including autism PDD-NOS, and typical developing children, 17-36 months	MANOVA ANOVA	<p>(1) No significant differences between genders in endorsement rates of challenging behaviors were found.</p> <p>(2) The result showed that the stereotypic behavior items were significant in each group. The autism group had higher rate in stereotypic behaviors than PDD-NOS group.</p>	<ul style="list-style-type: none"> <li>The current study was the lack of information regarding the communication and social skills of each group.</li> <li>Intellectual disability was not taken into consideration.</li> </ul>
Annette V. Joosten et al. J Autism Dev Disord (2009)	Examining intrinsic and extrinsic motivators for stereotypical and repetitive behavior in children with autism and intellectual disability and children with intellectual disability alone.	N=74, 5-8Y, ID and ID with ASD	Pearson correlation Rasch analysis	<p>(1) Anxiety was a more likely intrinsic motivator than sensory seeking for children with dual diagnoses.</p> <p>(2) The result showed that the new items did assess anxiety and that, when added to the sensory items, formed a construct of intrinsic motivation for stereotypic and</p>	Each child only being rated by one rater and further investigation of inter rater reliability of the adapted MAS is warranted.

				repetitive behaviors.	
Katherine Gotham et al. Autism Research (2013)	The purpose of this study was to explore the association between anxiety and ASD symptoms, particularly the degree to which the relationship is explained by insistence on sameness (IS) behaviors and/or cognitive ability.	1429 individuals aged 5:8–18:0 years who participated in the Simons Simplex Collection, a genetic consortium study of ASD.	ANOVA Tukey post-hoc	The results indicated that higher anxiety was associated with higher RBS-R Overall Total and Sameness subscale scores.	Although the CBCL has shown some promise for use in ASD, it is not yet well validated in this population.
Leann E. Smith et al. American Journal on Mental Retardation (2008)	Assessing for maternal warmth, praise, and relationship quality, levels of behavior problems, and repetitive behaviors. Examining the relationships maternal warmth, praise, and relationship quality and levels of behavior problems and repetitive behaviors.	149 co-residing mothers and their adolescent or adult child with autism was drawn from a large, longitudinal study	Pearson Correlations Unstandardized Path Analysis	(1) A high level of relationship quality was associated with subsequent reductions in internalizing and externalizing problems as well as reductions in impairments in social reciprocity and repetitive behaviors. (2) Maternal warmth and praise were also related to symptom abatement in the repetitive behaviors domain.	<ul style="list-style-type: none"> <li>◆ Mothers reported on their son or daughter's behaviors as well as the quality of the parent-child relationship, resulting in shared method variance between these two measures.</li> <li>◆ Only examined the parent-child relationship with two measurement points over an 18-month</li> </ul>

					window of time
Jason K. Baker et al. Journal of Family Psychology (2011)	The current study used a family systems perspective to examine whether family level adaptability promoted beneficial outcomes for mothers and their adolescents with autism over time.	N=149, autism, 10-22Y	Path analysis	Mothers reported on family adaptability, the mother-child relationship, their own depressive symptoms, and the behavior problems of their children. The rating included of hurtful to self, unusual or repetitive, withdrawn or inattentive, socially offensive, uncooperative, hurtful to others, destructive to property, and/or disruptive. Testing of the path model indicated high stability of behavior problems and maternal depression over time.	Depended heavily on maternal report



**Table 2. Characteristics of Participants (N=86)**

Characteristics	
Chronologic age (months): mean (SD), range	68.15 (15.60), 37-105
Gender (M/F): n (%)	72 (83.7)/ 14 (16.3)
Diagnosis of ASD: n (%)	
Autism	63 (73.3)
Asperger syndrome	20 (23.3)
PDD-NOS	3 (3.5)
Repetitive Behavior Scale-Revised: mean (SD), range	
Overall RRBs	26.19 (15.37), 2-63
Stereotypic Behavior	6.57 (5.49), 0-20
Self-injurious Behavior	2.93 (3.35), 0-17
Compulsive Behavior	3.50 (3.33), 0-14
Ritual and Sameness Behavior	9.36(6,19)0-27
Restricted Interests	3.83 (2.38), 0-9
Childhood Autism Rating Scale: mean (SD), range	27.75 (5.14), 16.5-42
Chinese version of the Short Sensory profile : mean (SD), range	126.51(22.07), 68-176
Psychoeducational Profile-3 : mean (SD), range	
Expressive language	33.02 (17.68), 0-50
Receptive language	29.12 (12.32), 0-38
Vineland Adaptive Behavior Scales : mean (SD), range	220.23 (87.88), 55-388
the Anxiety/Depression T score in CBCL : mean (SD), range	60.80 (16.17), 37.39-106.96
Parenting Stress Index-Short Form : mean (SD), range	111.06 (21.258), 63-171

**Table 3. The Descriptive Statistics on the Frequency of Occurrence for Each Item of Repetitive Behavior Scale-Revised**



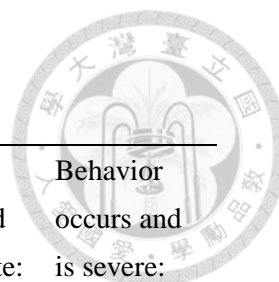
**Stereotypic Behavior**

Items	Behavior does not occur: n (%)	Behavior occurs and is mild: n (%)	Behavior occurs and is moderate: n (%)	Behavior occurs and is severe: n (%)
1. Body movements	44 (51.2)	27 (31.4)	13 (15.1)	2 (2.3)
2. Head movements	49 (57.0)	22 (25.6)	11 (12.8)	4 (4.7)
3. Finger movements	43 (50.0)	28 (32.6)	12 (14.0)	3 (3.5)
4. Locomotion	32 (37.2)	33 (38.4)	16 (18.6)	5 (5.8)
5. Object usage	41 (47.7)	20 (23.3)	12 (14.0)	13 (15.1)
6. Sensory	40 (46.5)	28 (32.6)	15 (17.4)	3 (3.5)
22. Needs to touch/tap	49 (57.0)	26 (30.2)	8 (9.3)	3 (3.5)
42. Preoccupied with part of object	38 (44.2)	39 (45.3)	6 (7.0)	2 (2.3)
43. Preoccupation with movement	52 (60.5)	21 (24.4)	8 (9.3)	4 (4.7)

**Self-injurious Behavior**

Items	Behavior does not occur: n (%)	Behavior occurs and is mild: n (%)	Behavior occurs and is moderate: n (%)	Behavior occurs and is severe: n (%)
7. Hits w/body	36 (41.9)	39 (45.3)	6 (7.0)	5 (5.8)
8. Hits against surface	59 (68.6)	23 (26.7)	3 (3.5)	1 (1.2)
9. Hits w/object	67 (77.9)	13 (15.1)	6 (7.0)	0 (0)
10. Bites self	57 (66.3)	26 (30.2)	0 (0)	3 (3.5)
11. Pulls hair/skin	71 (82.6)	15 (17.4)	0 (0)	0 (0)
12. Rubs/scratches	66 (76.7)	15 (17.4)	5 (5.8)	0 (0)
13. Inserts finger/object	73 (84.9)	10 (11.6)	0 (0)	3 (3.5)
14. Picks skin	62 (72.1)	11 (12.8)	6 (7.0)	7 (8.1)





### Compulsive Behavior

Items	Behavior does not occur: n (%)	Behavior occurs and is mild: n (%)	Behavior occurs and is moderate: n (%)	Behavior occurs and is severe: n (%)
15. Ordering	32 (37.2)	35 (40.7)	14 (16.3)	5 (5.8)
16. Completeness	32 (37.2)	38 (44.2)	9 (10.5)	7 (8.1)
17. Washing	51 (59.3)	17 (19.8)	7 (8.1)	11 (12.8)
18. Checking	68 (79.1)	16 (18.6)	2 (2.3)	0 (0)
19. Counting	67 (77.9)	12 (16.3)	2 (2.3)	3 (3.5)
20. Hoarding	52 (60.5)	25 (29.1)	4 (4.7)	5 (5.8)

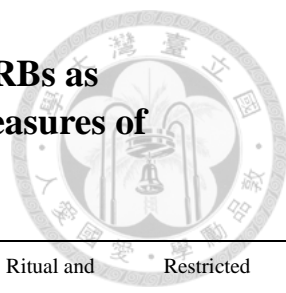
### Ritual and Sameness Behavior

Items	Behavior does not occur: n (%)	Behavior occurs and is mild: n (%)	Behavior occurs and is moderate: n (%)	Behavior occurs and is severe: n (%)
26. Transportation routine	33 (38.4)	30 (34.9)	17 (19.8)	6 (7.0)
27. Play/leisure routine	25 (29.1)	37 (43.0)	21 (24.4)	3 (3.5)
28. Communication	16 (18.6)	40 (46.5)	24 (27.9)	6 (7.0)
30. No new places	46 (53.5)	34 (39.5)	4 (4.7)	2 (2.3)
31. No interruption	25 (29.1)	28 (32.6)	24 (27.9)	9 (10.5)
32. Walks certain way	56 (65.1)	23 (26.7)	1 (1.2)	6 (7.0)
33. Sits certain place	41 (47.7)	38 (44.2)	5 (5.8)	2 (2.3)
34. Appearance/behavior of others	40 (46.5)	38 (44.2)	3 (3.5)	5 (5.8)
35. Uses certain door	70 (81.4)	12 (14.0)	4 (4.7)	0 (0)
37. Difficult transitions	23 (26.7)	35 (40.7)	25 (29.1)	3 (3.5)
38. Insists on routine	33 (38.4)	41 (47.7)	7 (8.1)	5 (5.8)
39. Insists on time	33 (38.4)	39 (45.3)	9 (10.5)	5 (5.8)

## Restricted Interests

Items	Behavior does not occur: n (%)	Behavior occurs and is mild: n (%)	Behavior occurs and is moderate: n (%)	Behavior occurs and is severe: n (%)
36. Videotapes	38 (44.2)	25 (29.1)	8 (9.3)	15 (17.4)
40. Preoccupation with subject	13 (15.1)	35 (40.7)	23 (26.7)	15 (17.4)
41. Attached to object	30 (34.9)	20 (23.3)	24 (27.9)	12 (14.0)

**Table 4. Pearson Correlation Matrix of 5 subtypes of RRBs as measured by Repetitive Behavior Scale-Revised and Measures of Potential Correlates**



Variable/RRBs	Overall RBS-R	Stereotypic behavior	Self-injurious behavior	Compulsive behavior	Ritual and sameness behavior	Restricted interests
Age	-0.016	-0.129	-0.115	0.019	0.076	0.13
Childhood Autism Rating Scale	.415**	.566**	.442**	0.188	0.144	0.116
Chinese version of the Short Sensory profile	-0.108	-0.164	-0.108	-0.04	0.01	-0.135
Expressive Language in PEP-3	-.419**	-.558**	-.505**	-.223*	-0.122	-0.08
Receptive Language in PEP-3	-.433**	-.599**	-.513**	-.235*	-0.091	-0.127
Vineland Adaptive Behavior Scales	-.308**	-.459**	-.374**	-0.11	-0.077	-0.055
Anxiety in CBCL	0.043	-0.042	-0.121	-0.001	0.169	0.108
Parenting Stress Index-Short Form	-0.031	-0.088	-0.018	0.082	-0.028	-0.014

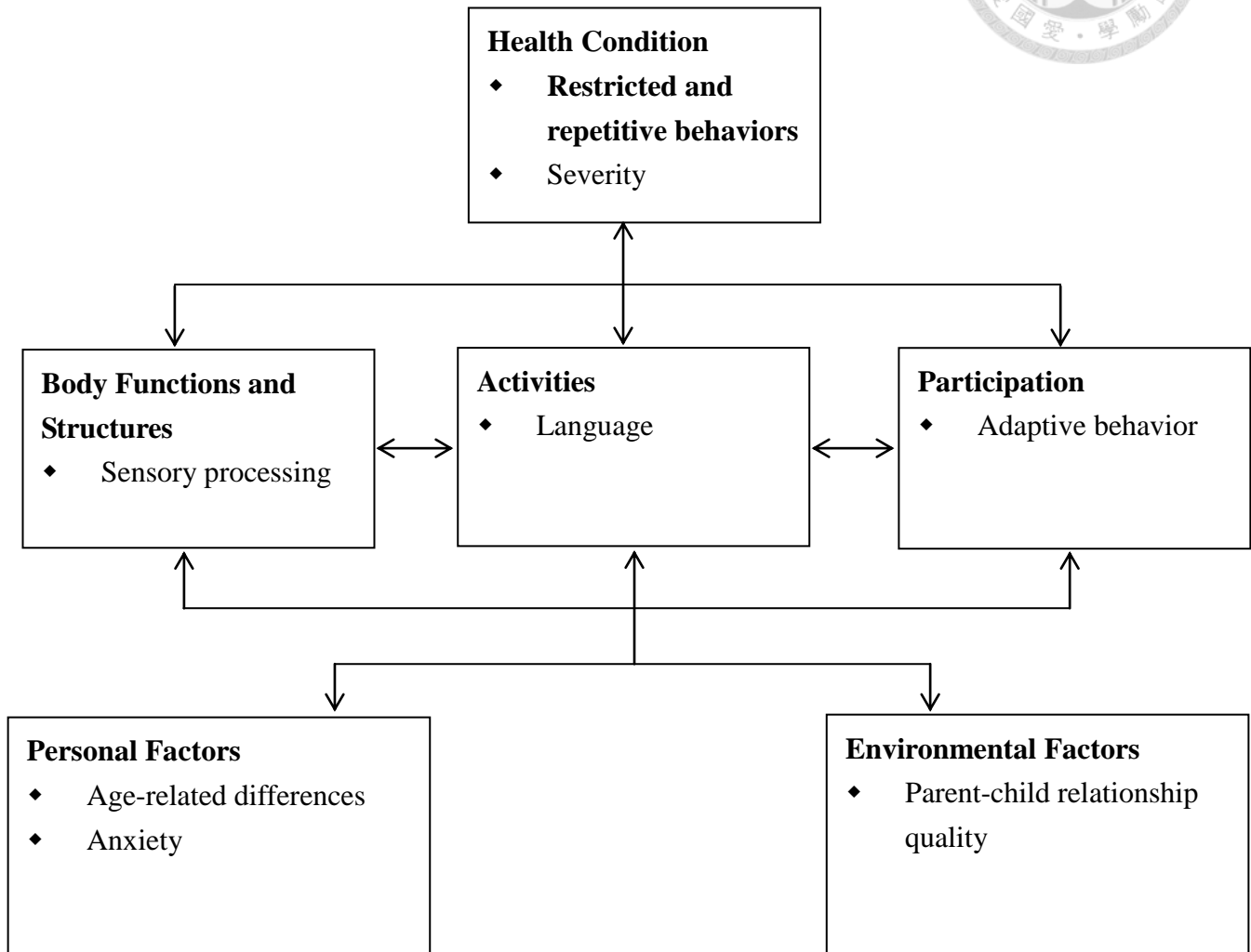
\* p <.05. \*\* p <.01

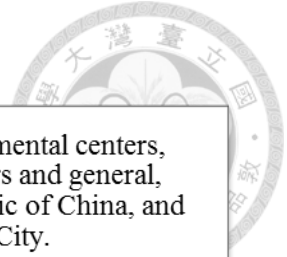
**Table 5. Stepwise Linear Regression Models of Restricted and Repetitive Behaviors Assessed by the Repetitive Behavior Scale-Revised (RBS-R) in Children with ASD**



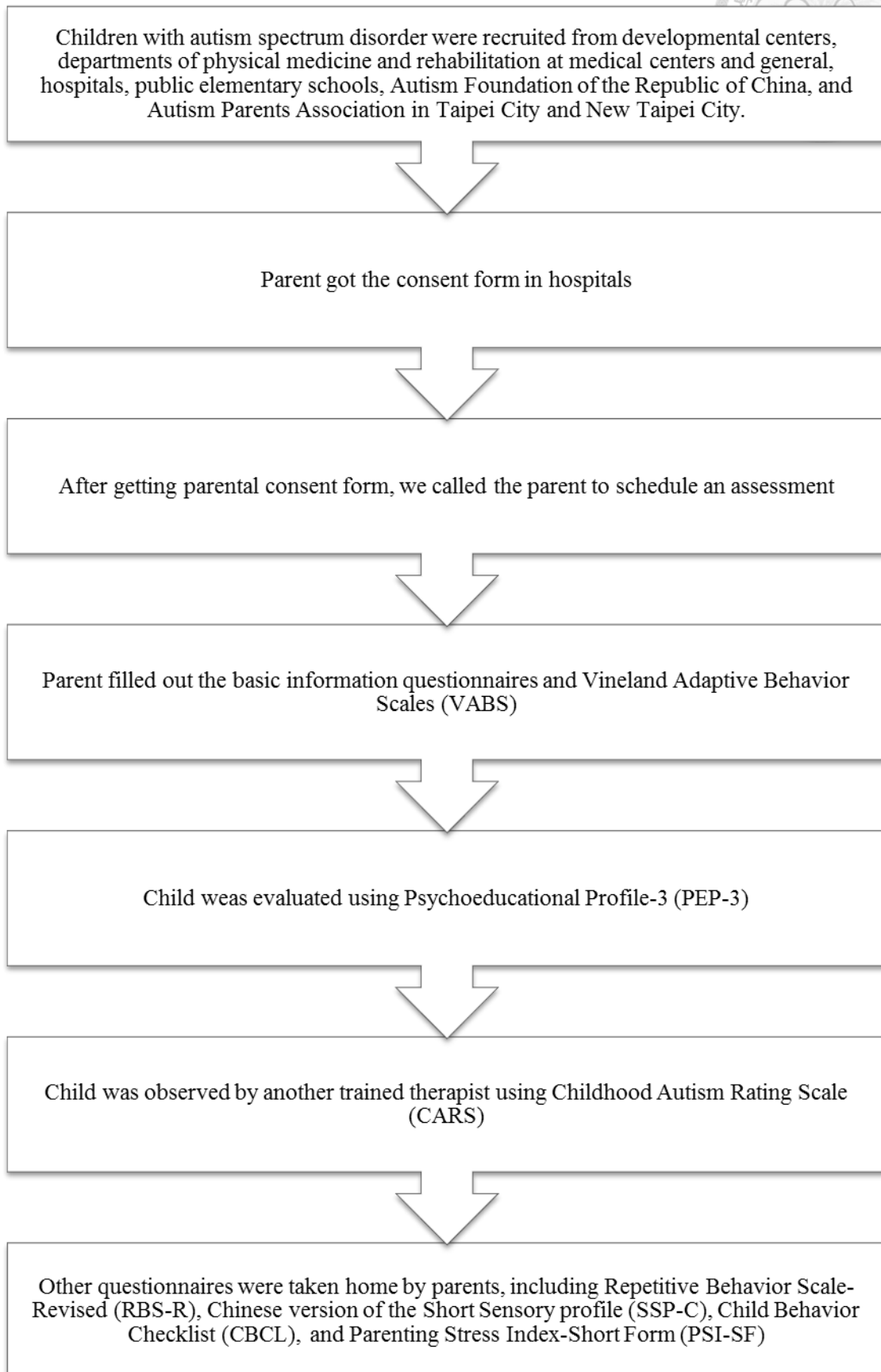
Correlates	Standardized regression		
	coefficient	<i>t</i>	p value
<b>Regression model of overall repetitive behaviors (<math>R^2=0.209</math>)</b>			
Receptive language	-.457	-5.07	<.001
<b>Regression model of stereotypic behavior (<math>R^2=0.422</math>)</b>			
Receptive language	-.556	-4.61	<.001
Age	.339	2.96	.004
Adaptive behavior	-.290	-2.02	.047
<b>Regression model of self-injurious behavior (<math>R^2=0.263</math>)</b>			
Receptive language	-.513	-5.47	<.001
<b>Regression model of compulsive behavior (<math>R^2=0.055</math>)</b>			
Receptive language	-.235	-2.21	.030

**Figure 1. The Possible Correlates of Restricted and Repetitive Behaviors in Children with Autism Spectrum Disorders Basing on Framework of the ICF-CY**





**Figure 2. The Flow Chart of The Procedure**



**Figure 3. The Correlates of Restricted and Repetitive Behaviors in Children with Autism Spectrum Disorders Basing on The Results of The Study**

