Adult Outcome of Children with Autism with Normal Intelligence

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DECLARATION

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ABSTRACT

Introduction This present research was a cross-sectional study examining the outcome and adjustment of 64 individuals at their early adulthood (18 to 28 years old).They all had normal intelligence but were diagnosed as having autism spectrum disorder (ASD) as children.

Method The participants of this study were recruited from a child psychiatric clinic or from the community. All were Chinese living in Hong Kong. All except five were males, aged from 18 to 28, with mean age at 21.7 years (SD=2.5). All had a full IQ score of 75 or above (mean full IQ was 96.4 (SD=13.1, range 75-129), verbal IQ 96.3 (SD=13.7, range 73-128) and performance IQ 97.3 (SD=14.7, range 72-139). They and/or their parents were administered a range of tests or interviews to assess their current outcome and adjustment at early adulthood.

Results and Discussion The participants of this study were under-achieved both in educational attainment and employment when compared to population age peers. 32% (21 out of 64) were found no longer meeting a diagnosis of autism in adulthood, but only seven participants out of the 32% fell below the clinical range in all three domains of autistic deficits. The majority still had impairment in at least one aspect of the triad of autistic deficits. Their intellectual functioning had been stable with a small increase in mean verbal IQ. The overall outcome in terms of a composite score consisting of work, friendship, independence, autistic-type stereotyped repetitive behaviours, and language use was relatively better than those of past studies in Western countries in that 42% had a 'good' outcome. It was argued however that the relatively positive outcome was attributed in part to the results of supportive and facilitative environmental factors such as a large labour market, a buoyant economy, and technological advances, including the mass availability of computers. The participants of this study also experienced more general psychological disturbances other than autism than the general population. Finally, as in previous Western studies, childhood IQ, especially verbal IQ, proved to be a robust predictor of adult outcome in most areas. Results of the present study confirm the findings of Western studies that despite improvement in some individuals at early adulthood, significant impairment still persisted for the majority, reconfirming that ASD as largely a chronic disorder. The need for services tailored to adult problems of autism was called for.

摘要

引言: 這研究是一個探討 64 個青年(年 18 至 28 歲)在成長期的適應的橫斷報告。所有受試者皆在孩童期被診斷爲患有泛自閉症障礙(ASD)，並具正常智能。

方法: 受試者乃居住在香港的中國人，由社區及一間兒童精神科診所招募而來。其中五人爲女性，其餘爲男性，整體年齡介乎 18 至 28 歲，平均年齡爲 21.7 歲(SD=2.5)。全部受試者智商達 75 或以上，平均全量表智商爲 96.4 (SD=13.1, 介於 75 至 129 之間) ，語文智商爲 96.3 (SD=13.7, 介於 73 至 128 之間)，作業智商爲 97.3 (SD=14.7, 介於 72 至 139 之間)。受試者及其父母接受一系列的測試或面談以評估他們的現況及在成長期的適應。

結果及討論：是次研究的受試者的教育水平及就業情況稍遜於一般同齡人士。在 64 位受試者中有 21 人(32%)於成年階段已不再符合自閉症的臨床診斷，而其中只有 7 人在自閉障礙三方面的表現上，能全部低於臨床界別。大部分受試者仍在自閉症的三大範疇中最少有一方面帶有障礙。他們的智能相當穩定而在語文智商平均有輕微增加。由工作、社交、獨立、自閉型的重覆常規動作與及語文運用組成的整體適應函數中，42%受試者有「良好」表現，比以往西方研究的結果稍佳。但是，如此正面的結果部分可能與現今具較多鼓勵及支援的環境因素有關；如龐大勞工市場，蓬勃經濟，科技特別是電腦方面的發展，皆富有影響。此研究的受試者亦比一般同齡人士受到較多心理困擾。最後，與以往西方研究發現類同，兒童智商，尤其爲語文智商，在大部分範疇證實能有效預測成長期的適應。同時，是次研究顯示，雖然有某些自閉症患者在青年時有所進步，但大部分人仍保留相當的障礙，這亦確認了西方研究認爲泛自閉症障礙（ASD）實爲一種長期疾患。故此，探討自閉成人的服務需求乃當前急務。

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CHAPTER ONE

GENERAL INTRODUCTION

1. Introduction

Autism is a developmental disorder which has captivated much attention and research interest over a span of over six decades. Between 1943, when it was first described by Kanner, and 2004, Volkmar and his group reported that nearly 7000 articles had been published on autism (Volkmar, Lord, Bailey, Schultz, & Klin, 2004). Interest is very much maintained because autism is a complex and enduring condition greatly handicapping some of the sufferers even unto adulthood. Despite its diverse manifestations, autism can be understood in terms of three main core categories of symptoms, namely (a) impairments in social interaction, (b) communication and (c) restricted and repetitive behaviours and interests (American Psychiatric Association, 2000). Findings from family studies and genetic research (Bailey et al., 1995; Bolton et al., 1994) suggest clear biogenetic causes. Recent advances in neuroscience research have led to a broad consensus that autism is a neurodevelopmental disorder involving some form of damage or dysfunction of the brain (Volkmar, Paul, Klin & Donald, 2005).

1.1 Changing Constructs of Autism

Previously, autism has been interchangeably considered as a case of ‘childhood schizophrenia’, ‘early childhood psychosis’ and ‘atypical psychosis’. Currently, it is better defined with diagnostic criteria that are intended to be applicable cross-culturally (Volkmar & Klin, 2005). With increasing understanding of the diverse manifestations of social, behavioural and communication deficits, the criteria on the diagnosis of autism are amended in each revision of the major classification systems such as those of DSM (American Psychiatric Association, 2000) and ICD (World Health Organization, 1993). Particularly, Wing (1981) drew attention to Asperger syndrome as part of the autism spectrum. Nonetheless, there are concerns regarding a lack of clear delineation of where the spectrum of autistic disorder begins and ends (Volkmar et al., 2004). Indeed, there are proponents of autism and its phenotypes as being on a continuous spectrum with social, behavioural and cognitive impairments (Wing & Gould, 1979; Prior et al., 1998). This has led to the development of the concept of the Autism Spectrum Disorders (ASD) to cover such existing diagnostic constructs as autism, atypical autism, Asperger syndrome and non-medical pervasive developmental disorders (PDDs). The collective term implies that ASD comprises of a range of clinical entities that may differ in severity or pattern of manifestations but have an underlying unity (Wing, 2005).

1.2 Prevalence of Autism

Parallel to the changing diagnostic constructs of autism, prevalence rates of autism reported in recent epidemiological studies have increased over the years. The rate has changed from the long-accepted figure of 4 per 10,000 to 30 and 60 per 10,000 (Chakrabarti & Fombonne, 2001; Towbin, 1997; Yeargin-Allsopp, et al., 2003), almost a ten fold increase. Over the debate about whether there was a genuine increase of overall prevalence, Wing (1996) held that 'rise could be due to a change in referral patterns, widening of diagnostic criteria for typical autism, and increased awareness of the varied manifestations of disorders in the autism spectrum (especially those associated with higher IQ)'(Wing, 1996). Her view was supported by Fombonne (2007) who did a comprehensive review of epidemiological studies and addressed the question from several approaches. With detailed analysis and discussion, he found no strong evidence to support that the upward change in prevalence rates was directly related to the increase of incidence of autism over time. He thus concluded that 'increase most likely represents changes in the concepts, definitions, service availability and awareness of autism spectrum disorders in both the lay and professional public' (Fombonne, 2007, p 62).

Adopting a conservative analysis of existing data from the epidemiological surveys he reviewed, Fombonne (2007) estimated a prevalence rate of 13 per 10,000 for autism, 20.8 for pervasive developmental disorders-not otherwise stated (PDD-NOS) and 2.6 for Asperger syndrome, totaling to a prevalence rate for all PDD of 38.4 per 10,000. These figures suggest that there is a substantial group of children in the community with symptoms less severe than the core autistic group. They are not formerly detected when strict criteria for autism are used. The proportion of PDD was reported to be even greater in a recent well-designed study conducted in UK by Baird et al. (2006). They estimated the prevalence to be 38.9 per 10,000 for autism and 116.1 per 10,000 for the entire autism spectrum. The increase in prevalence as a result of the broadening of diagnostic constructs calls for more research with those cases with less severe symptoms.

1.3 ASD with Normal Intelligence

It has been well accepted historically that about three-quarters of infantile autism cases has mental retardation (Fombonne, 2003). Baird et al. (2006) found comparable proportion of mental retardation of 73% in a childhood autism group (identified with strict criteria or diagnosed on ICD-10 and meeting cut-offs of both assessment tests, namely the Autism Diagnostic Inventory-Revised (ADI-R) and Autistic Diagnostic Obersvation Schedule (ADOS-G) [Le Couteur et al.,1989]), but only 56% of the ASD group had an IQ below 70. The latter is somewhat expected as the ASD spectrum often includes individuals with intelligence in the average range such as those with Asperger syndrome. Gillberg (1998) even suggested a rate of 15% of mental retardation within the broad autism spectrum. In the Council report of the Royal College of Psyshiatrists (2006), an observation was made on the contrast between the 80% general intellectual disability found in individuals with infantile autism and the 80% normal intellectual ability in ASD individuals. Interestingly, Fombonne (2007) noted in his analysis of recent epidemiological surveys that the rate of mental retardation in infantile autism was much lower than in previous surveys. It had been suggested in one study that the decrease in rate of mental retardation was related to the increased availability of early intervention and special education (Eaves & Ho, 1996). Despite that the factors affecting the decrease in mental retardation cannot be entirely identified currently, it is clear that the pool of individuals with autistic deficits is larger than previously estimated, and among them, the proportion of individuals with normal intelligence is bigger than previously assumed. As the development and outcome of this group of ASD individuals are likely to differ from those with mental retardation, they are gradually attracting more attention in research (Szatmari, Bartolucci, Bremner, Bond & Rich, 1989; Tantam, 1991; Ehlers & Gillberg, 1993; Piven, Harper, Palmer, & Arndt, 1996; Howlin, Mawhood & Rutter, 2000; Gilchrist, Green, Cox, Burton, Rutter, & Le Couteur, 2001; Engstrom, Ekstrom & Emilsson, 2003; Sturm, Fernell & Gillberg, 2004).

2. Outcomes

2.1 Introduction

2.1.1 Autobiographical writings

The lives of adults with autism have become more widely known with the publication of autobiographical accounts of able individuals with autism. In the beginning, short personal accounts of individuals with autism were found appended to books on Autism or Asperger syndrome (Schopler et al., 1998; Frith, 1991). Starting in the early nineties, there was a gradual surge of autobiographies written by able autistic or Asperger individuals who survived difficult developmental periods to adulthood (Donna Williams, 1992, 1994; Temple Grandin, 1995; Sainsbury, 2000; Tammet, 2007). Others were either misdiagnosed or learned of their autistic deficits as adults (Wendy Lawson, 1998 & 2002; Liane Holliday Willey, 1999; Chen, 2007). In the age of internet culture, more stories of individuals with autism can be accessed via websites over the world (e.g. www.nas.org.uk; www.Aspergerssyndrome.org; iautistic.com). Their lucid accounts and touching stories have helped the general public in understanding the world of individuals with autism. Their success has probably brought hope to a lot of families with children with autism. Indeed they provide in-depth qualitative knowledge of individuals but their experiences are inevitably subjective and unique. As Howlin (2007) pointed out, they could be a biased group and could not represent the majority of adults with autism who might not be as eloquent, successful and assertive as they were. To obtain a more objective and comprehensive picture of the adjustment of adults with autism, one should rely on bigger samples, preferably from long-term follow-up studies.

2.1.2 Shortage of adult outcome studies

Adults with autism have attracted much less research interest than children (Shea & Mesibov, 2005). A recent search of published articles on studies of adults with autism from year 2000 to 2008 at the psycINFO database yielded about 200 articles. Outcomes of adults with autism are relatively less investigated than other topics such as classification, etiology, symptoms/deficits, therapeutic interventions or training programmes (Howlin, 2004). Of the 200 recent studies, only 17 are outcome studies. Outcomes with a specific focus on high functioning individuals are even more scarce (Howlin, 2000; Tsatsanis, 2003). Of the 42 studies on adults of HFA or Asperger syndrome, only five are about their outcomes in adulthood (Howlin, 2003; Howlin, Goode, Hutton & Rutter, 2004; Engstrom et al., 2003; Howlin, Alcock, & Burkin, 2005; Cederlund et al., 2008). It is quite apparent that despite growing interest in adults with autism in recent years, outcome studies are still lagging behind, more so regarding the outcomes of high-functioning autistic (HFA) or Asperger children.

2.2 Review of Outcome Studies

2.2.1. Overview

In the early fifties when understanding regarding infantile autism was still in its infancy stage, terms such as 'early childhood psychosis', 'childhood schizophrenia', or 'atypical psychosis' were often found to apply to children with characteristics resembling those of autism. In his review of 25 studies on the development of children classified as psychotic at early ages, Lotter (1978) reported great difficulties in making comparisons across studies because of the heterogeneity in case definitions, sampling sources, methods of study, data presentation, and use of outcome criteria. Even among the 8 studies which used Kanner (1943) or Creak (1961) criteria to classify cases, he commented that there could still be variation in how they applied the criteria. With caution against serious methodological flaws, he concluded his review with the observation that the range of adult outcomes was very wide, with most having poor prospects and only a handful becoming sufficiently independent socially and vocationally.

One of the earliest follow-up studies on children classified as infantile autism according to the Kanner criteria was conducted by Eisenberg (1956) at John Hopkins Medical School. He followed up 63 cases (mean age = 15 years, range = 9-25) over an average range of nine years (range = 4-20). Data was drawn from a mixture of sources. Only ten were actually reexamined and supplemented with detailed reports, 44 were based on institutional reports or abstracts, while nine used information from parents', physicians' or school reports. Based on such diverse data set, he classified their adult outcome in three categories, 'good', 'fair' and 'poor'. Only three were considered to have good adjustment, 14 in the fair range and 46 as markedly poor in functioning. Although his accounts are anecdotal and data collection is unsystematic, his study is the first attempt to classify adult outcomes of individuals with autism in categories which are taken up as the convention of reporting such outcomes in later studies. Results also demonstrate a wide variety of outcomes for individuals with autism. These are replicated by the majority of studies in subsequent years.

Another detailed account of individuals with autism could be found in the reports of Kanner himself (1973) who kept meticulous notes on cases he saw at their young ages and traced their development into adulthood. Though he reported 12 cases who seemed to have adjusted very well in society, the majority of his 96 cases remained highly dependent on parents or institutions and required a lot of support. In contrast, Asperger (1944) in his initial paper showed more optimism about the prognosis of his cases and cited adults who achieved great professional success which he believed would bring about social integration (translation done in Frith, 1991). However, both noted that those with learning disability and poor communication skills had the poorest outcomes in adulthood.

Slightly later in time, outcome of 100 adults with early childhood psychosis in a children hospital was reported by Creak (1963) in United Kingdom. Seventeen were in school or working, 40 attended special schools or training centres, and 43 were institutionized. He reported in detail three case vignettes but gave little information on the characteristics of his cases, such as age, time of follow-up, intellectual ability, or severity of symptoms. As with many of the earlier studies, the lack of information about individual chararcteristics gravely limits the generalizability of the findings.

Later adult outcome studies conducted after 1980 are generally better designed methodologically, using more objective assessment and having clearer definitions of the outcome measures. Even so, as it would be expounded in the course of the review, the methodological diversity in terms of design, sample selection and characteristics, diagnostic definitions and classifications, and operational criteria of outcome indicators, make comparisons across studies a formidable task. Yet, such diversity seems inevitable in research on a topic as multifarious as the adult outcomes of ASD and on a clinical entity as wide-ranging as ASD in terms of symptoms and deficits. It is through the replication of studies with different designs, samples and measurements that random errors or extremes of findings would be filtered out and that cumulative and collective wisdom would be distilled. Through detecting and identifying converging themes and trends among past research, hypotheses can be generated and directions for future investigations can be developed. Hence, as long as due attention is paid to methodological diversity and the limitations thus incurred to the conclusions, effort to review and summarize past studies is still worthwhile and such exercise should throw light on the various adult outcomes of individuals with autism.

Based upon literature search on outcome studies of autistic or Asperger individuals from psycINFO, particularly including those studies quoted in Howlin (2005), 32 studies were selected for detailed review in this present dissertation (Table 1). Broadly, they consist of three main research designs, namely, longitudinal follow-up studies charting changes over time, retrospective cross-sectional studies covering both accounts of past history and current functioning, and cross-sectional studies on adults with autism. Studies with the majority of participants still not reaching adult ages (e.g. Chung et al., 1990; Szatmari et al., 2003; Saulnier & Klin, 2007) or having severe mental retardation (e.g. Beadle-Brown et al., 2006 ; Loveland et al., 1998; Wolf & Goldberg, 1986) were not included. Also excluded were single case studies (e.g. Bolte & Bosch, 2005; Bolman, 2008) and studies with low response rates (e.g. Barnard, 2001).

As mentioned above, research conducted after 1980 are relatively better designed methodologically with hypotheses and outcome variables more clearly defined. The samples also cover individuals of more recent cohorts; thus the results would be more relevant for current and future references. Hence, where appropriate, results from post-1980 studies would be examined separately or in contrast to the pre-1980 studies.

Table 1

Summary of adult outcome studies with demographic data and research designs

Study No	Author	N	Gender (M:F)	Mean age in years (range)	Diagnostic Label and Criteria	Design	Sample Source	Country	Childhood IQ
1	Eisenberg (1956)	63	4:1	15 (9-25)	Infantile autism based on 2 cardinal symptoms: self-isolation, obsessive insistence on sameness	Longitudinal follow-up	Child Psychiatric service	USA	
2	Creak (1963)	100	4:1		Childhood psychosis by nine-point criteria	Longitudinal follow-up	Children Hospital cases	UK	
3	Mittler (1966)	27		15-2 (7-27)	Childhood psychosis by 'nine point' criteria by Creak (1963): Maudsley 'P' scale 4 criteria	Longitudinal follow-up	Discharged patients of Child unit of long-stay hospital	UK	mean=49.7 (Binet IQ)
4[a]	Rutter et al. (1967); Lockyer & Rutter (1969)	63	4.3:1	15.6	Infantile Autism, childhood psychosis, clinic examination	Longitudinal follow-up	Hospital Records	UK	51% IQ <60: 30% un-testable
5	Kanner (1973)	96		(22-29)		Longitudinal follow-up	Hospital Records	USA	
6	DeMyer et al. (1973)	120	2.4:1	12	Hi.middle.low autism by psychiatric interview	Longitudinal follow-up interview in person & by phone	Clinic cases	USA	
7[a]	Lotter (1974a. b)	28	2.1 :1	(16-18)	Autism by behavioural criteria	Longitudinal follow-up	Epidemiological data	UK	31% IQ>55 69% IQ<55
8	Newson et al. (1982)	93	10:1	23	Asperger (Wing & Gould's Definition. 1979)	Cross-sectional	Community :Autistic Society	UK	normal to near normal IQ

Table 1 (continued)

Summary of adult outcome studies with demographic data and research designs

Study No	Author	N	Gender (M:F)	Mean age in years (range)	Diagnostic Label and Criteria	Design	Sample Source	Country	Childhood IQ
9	Rumsey et al. (1985)	14	all male	27 (18-39)	Autism by DSM-III criteria	Longitudinal follow-up	Clinic cases	USA	range=55-129 64% IQ>80
10	Gillberg & Steffenburg (1987)	23	2.8:1	18.4(16-23)	Infantile Autism by DSM-III criteria	Follow-up	Epidemiological data	Sweden	26% IQ>70
11	Szatmari et al. (1989)	16	3.0: 1	26 (17-34)	High functioning autism from clinic data	Longitudinal follow-up	Treatment centre records	Canada	mean=92 (68-110)
12	Mesibov et al. (1989)	59	3.0:1	15.9	Autism. CARS at cut-off = 30	Longitudinal follow-up	TEACCH program	USA	70% IQ <70
13	Tantam (1991)	46	6.0:1	24.4	Asperger (Wing & Gould's Definition. 1979)	Cross-sectional	Known cases	UK	88% IQ>70
14	Venter et al. (1992)	58	3:2	14.7 (10-37)	Autism (ADI, ADOS)	Longitudinal follow-up	Clinical records	Canada	mean IQ=80
15	Kobayashi et al. (1992)	201	5.5:1	21.5 (18-33)	Autistic disorders by DSM-III R criteria	Longitudinal follow-up; part interview in person, part phone interview	Clinic records	Japan	23% >70

Table 1 (continued)

Summary of adult outcome studies with demographic data and research designs

Study No	Author	N	Gender (M:F)	Mean age in years (range)	Diagnostic Label and Criteria	Design	Sample Source	Country	Childhood IQ
16	von Knorring & Hagloff (1993)	34	20:14	18.9 (10-29)	Autistic disorder, DSM-III R criteria	Longitudinal follow-up	Epidemiological survey	Sweden	77% <70
17	Piven et al. (1996)	38	2.5:1	17.6 (13-30)	Autism (ADI). normal IQ	Cross-sectional Retrospective	University clinic records	USA	all non-verbal IQ>65
18	Ballaban-Gil et al. (1996)	99 (54 12-17yrs 45 >18)	3.0:1	18 (12-30)	Autism.DSM-IV clinic exam	Longitudinal follow-up	Clinic records	USA	64% MR
19	Larsen & Mouridsen (1997)	9 AS 9 A	1.3:1	38 (32-43)	AS & A. ICD-10 criteria	Longitudinal follow-up	Child psychiatry department	Denmark	all AS IQ>70 56% A IQ>70
20	Boelte & Poustka (2000)	76	3.2:1	22.3 (15-37)	Autism(ADI-R)	Cross-sectional, retrospective	Community sample for project on genetics	Germany	mean=65 (32-136)
21[a]	Howlin. Mawhood & Rutter (2000); Mawhood et al. (2000)	19	all male	23.8 (21-26)	Autism (ADI. ADOS)	Longitudinal follow-up	Hospital and schools	UK	*mean VIQ=66.6 for 9 only mean PIQ=94.3 for 18
22	Gilchrist et al. (2001)	13 HFA 20 AS	all male	HFA 21 (16-26); AS 14 (11-19)	HFA & AS (ADI, ADOS)	Cross-sectional retrospective	Clinic referrals	UK	mean=79 (69-87) HFA mean=92 (71-141) AS

Table 1 (continued)

Summary of adult outcome studies with demographic data and research designs

Study No	Author	N	Gender (M:F)	Mean age in years (range)	Diagnostic Label and Criteria	Design	Sample Source	Country	Childhood IQ
23	Engstrom et al. (2003)	6 HFA 10 AS	1.3:1	31.4 (23-46)	HFA & AS psychiatric interview	Cross-sectional	Clinic and health service records	Sweden	all IQ>70
24	Seltzer et al. (2003)	251 Adl 154 Adu	2.7:1	Adl: 15.71 (10-21) Adu: 31.57 (22-53)	ASD (ADI-R)	Cross-sectional retrospective	Community sample	USA	59.8% MR
25	Fecteau (2003)	28	6.1:1	13 (7-20.4)	Autism only(ADI-R, ADOS)	Cross-sectional, retrospective.	Known cases	Canada	mean=84(40-108)
26	Howlin et al. (2004)	68	8.7:1	29.3 (21-48)	Autism (ADI)	Longitudinal follow-up	Child psychiatric clinic	UK	range=51-137 mean VIQ=61 mean PIQ=80
27	McGovern & Sigman (2005)	48	7:01	19	Autism (ADI-R & ADOS-G)	Longitudinal follow-up	Clinic samples	USA	mean IQ=51
28 [a]	Billstedt et al. (2005) & (2007)	108	2.3:1	25.5 (17-40)	Autism & Atypical autism, DSM III-R	Longitudinal follow-up	Epidemiological survey	Sweden	5% normal IQ 23% mild MR 72% severe MR
29	Shattuck (2007)	241	3.1:1	21.7 (10-52)	Autism (ADI-R)	Longitudinal follow-up	Community sample	USA	68.5% MR

Table 1 (continued)

Summary of adult outcome studies with demographic data and research designs

Study No	Author	N	Gender (M:F)	Mean age in years (range)	Diagnostic Label and Criteria	Design	Sample Source	Country	Childhood IQ
30	Eaves & Ho (2008)	48	3.4:1	24 (19-31)	ASD. CARS	Longitudinal follow-up (telephone interview)	Clinic cases	Canada	47% VIQ>50 57% PIQ>50 (adolescent measurement)
31	Cederlund et al. (2008)	70 AS 70 A	all male	AS: 21.5 (16.0-33.9) A: 24.5 (16.1-36.1)	Autism & Atypical autism, DSM-III, DSM III-R AS (Gillberg & Gillberg criteria)	Longitudinal follow-up	Clinical cases	Sweden	all AS IQ>70 17% A IQ>70
32	Hutton et al. (2008)	135	3.4:1	35 (21-57)	Autism (ADI and ADOS)	Longitudinal follow-up	Clinic cases	UK	56% PIQ >70 27% VIQ >70

Note. A=Autism; AS=Asperger Syndrome; ASD=Autism Spectrum Disorder; Adl=Adolescent; Adu=Adult; HFA=High Functioning Autism

[a] data of same study reported in 2 publications

2.2.2 Research characteristics

2.2.2.1 Origin of samples

Countries

Studies were carried out in at least six countries. There were 12 studies done in United Kingdom, nine in United States, five each in Sweden and Canada, and one each in Denmark and Germany. One study was a multi-centre research involving participants from Canada and the United States (Venter et al., 1992). Large-scale and well-designed studies are mainly conducted by groups of researchers in major research centres, namely, the Rutter group in London, United Kingdom (Rutter et al., 1967; Howlin et al., 2000; Howlin et al., 2004; Hutton et al., 2008), Gillberg and colleagues in Göteborg, Sweden (Gillberg & Steffenburg, 1987; Billstedt et al., 2005 ,2007; Cederlund et al., 2008), and Seltzer and colleagues in Wisconsin, USA (Seltzer et al., 2003; Shattuck et al., 2007). Their findings are of particular importance as they either have a large pool of participants to start with (Billstedt et al., 2005; Seltzer et al., 2003) or have followed up a well-defined group of patients for a long period (Howlin et al., 2004).

Outcomes are just as variable across countries and no obvious patterns are evident. This to some extent supports the universality of autism and its development into adulthood. However, better general outcomes are reported in two Canadian studies when they are compared to studies of participants of similar functioning in other countries (Szatmari et al., 1989 versus Howlin et al., 2000 and Eaves & Ho, 2008 versus the Autistic group in Cederland et al., 2008). Howlin (2007) commented on the differences in service provisions between Canada on one hand and the USA and United Kingdom on the other hand, suggesting that these differences might partly explain the better Canadian outcomes. It is however not clear whether similar explanation can be applied to comparison between studies in Canada and Sweden, although participants in Eaves & Ho's Canadian study actually received a wide variety of supportive services even if they stayed in group homes. The importance of specific factors in their living environment was also acknowledged by researchers such as Mesibov et al. (1989) and Kobayashi et al. (1992). Seltzer et al. (2003) partly attributed better improvement of functioning in their sample to the relatively enriched service environments in the particular states of USA that their participants resided. Hence, while outcomes are generally similar across countries, specific environmental factors, such as the availability of better services and education systems appear to be able to exert some impact on the outcomes.

Sample Source

Only eight out of the 32 studies drew their samples from the community, three invited volunteers from the community (Seltzer et al., 2003; Shattuck et al., 2007 and Newson et al.,1982), while four followed up children identified in earlier epidemiological surveys (Lotter, 1974a; von Knorring & Häglöff, 1993; Gillberg & Steffenburg ,1987 and Billstedt et al., 2005, 2007). Among these community samples, where overall outcome ratings were available (Lotter,1974; Gillberg & Steffenburg,1987; Billstedt et al., 2005, 2007; Newson et al.,1982), results tended to fall on the poor end, with only a mean percentage of 6.25% (range: 0 – 14%) in the 'good' outcome range. It might be related to the overall poor intellectual functioning of participants as the majority of them, except those participants of the Newson et al. study, had mental retardation (64% to 74%). Billstedt et al. (2005) actually stated that their findings could “reflect the outcome of individuals with low IQ rather than of autism per se”. In studies with clinic samples whose IQs were also largely in the range of intellectual impairment, the mean percentage falling in the good outcome range was only 9.4% (range: 0-27%) (Eigenberg, 1956; Creak, 1963; Mittler, 1966; Rutter et al., 1967; DeMyer et al., 1973; Kobayashi et al., 1992 ;Tantam, 1991). It appears that in terms of percentages of individuals having a good outcome, samples from either the community or clinical settings do not differ to a great extent.

In studies where symptom or diagnosis changes were examined, a high proportion of the community participants was also found to remain in the impaired range (88% in Seltzer et al., 2003; 97% in von Knorring & Häglöff, 1993 ; 99% in Billstedt et al., 2007). Again, a great proportion of the samples was in the MR range in terms of IQ (60%, 77%, 95% of the above studies). Despite that Shattuck et al. (2007) reported a varied but largely positive pattern of symptom changes over a period of 4.5 years, there was no mention that their community participants were ‘free’ of their diagnosis. Among those clinic samples largely in the MR range in terms of IQ (Rutter et al., 1967; Boelte & Poustka, 2000; Mesibov et al.,1989; McGovern & Sigman, 2005; Cederlund et al., 2008), the proportions of individuals retaining an ASD diagnosis was between 81% to 99%, again quite similar to those of the community samples. In summary, it appears that the group of studies with samples from the community shares similar patterns of adult outcomes in terms of outcome ratings and symptom changes as the clinical samples.

Poor intellectual functioning seems to be a more salient factor affecting the adult outcomes regardless of the source of the samples.

2.2.2.2 Research Design

Of the 32 studies under review, 24 are follow-up and eight cross-sectional studies. Although half of the follow-up studies have sample sizes over 60, four of them are conducted in early days with diagnosis not well defined and measures of outcome criteria not well specified (Eisenberg, 1956; Creak, 1963; Kanner, 1973; DeMyer et al., 1973). More systematic and methodical follow-up study began with Rutter and colleagues (1967) who examined in detail the development of their autistic participants on a number of behavioural, cognitive, family and other characteristics. Other subsequent studies however had relatively small sample sizes (14 in Rumsey et al., 1985; 23 in Gillberg & Steffenburg, 1987; 16 in Szatmari et al., 1989; 34 in von Knorring & Häglöff, 1993; 18 in Larsen & Mouridsen, 1997) which somewhat limited the generalizability of their results. Recent times witnessed larger scale prospective studies with better defined diagnostic criteria, outcome measures and predictors of outcomes (Venter et al., 1992; Howlin et al., 2004; McGovern & Sigman, 2005; Billstedt et al., 2007; Shattuck et al., 2007; Eaves & Ho, 2008; Cederlund et al., 2008).

Among the eight cross-sectional studies, five collected both current and restropective data through the use of the semi-structured interview schedules (Piven et al.,1996; Boelte & Poustka, 2000; Gilchrist et al., 2001;Seltzer et al., 2003; Fecteau et al., 2003). Inaccuracy resulting from memory bias can be a concern (Pearson et al., 1992). However, both Boelte

& Poustka (2000) and Seltzer et al. (2003) argued that the ADI had excellent psychometric properties, had been extensively used, and recall bias could be minimized with training in the use of investigator-based technique in triggering memories. Notwithstanding the limitation of memory bias, the availability of 'lifetime' and 'current' information from the ADI of the above studies made it possible to examine the improvement in terms of diagnosis and symptom changes over time. One area of interest is about diagnostic continuity. Except in Seltzer et al. (2003) and Billstedt et al. (2005, 2007), results on the percentages of individuals who are still diagnosable as having an ASD diagnosis at adulthood are strikingly similar among restrospective and follow-up studies (84% reported by Boelte & Pouska, 2000, and 87% by Piven et al., 1996 versus 81%, 84%, 86% and 88% by Mesibov et al., 1989, Cederlund et al., 2008, Rutter et al., 1967 and von Knorring & Häglöff, 1993 respectively). Although Seltzer et al. (2003) reported that only 55% of their adult participants met cut-offs in all three symptom domains, there were actually another 33% who met cut-offs in two out of the three criteria. The latter group, though not meeting the rather strict criteria of ADI-R, could have been diagnosed by other diagnostic criteria as atypical autism or PDDNOS. Furthermore, in two reports, Billstedt et al. (2005, 2007) found that all their adult participants continued to be diagnosable as ASD. Thus, follow-up and retrospective studies yield similar findings regarding the continuity of ASD diagnosis.

2.2.3 Sample characteristics

2.2.3.1 Age

The majority of the studies involve individuals with a wide range in age. Only twelve studies have all participants above 18 years of age. Children as young as seven years of age are included in Mittler et al.'s (1966) study. The mean age of some samples is in early adolescence (12-15 years, in DeMyer et al., 1973 and Fecteau et al., 2003). Others may include older adolescents, e.g. 16-18 years in Lotter (1974a), 16-23 years in Gillberg & Steffenburg (1987), 16-26 years in Gilchrist et al. (2001). We should be cautious in generalizing findings from these studies to older adults. In the two studies in which both adolescents and adults behaviours are examined separately (Seltzer et al., 2003 & Shattuck et al., 2007), differences are found in the manifestation of symptoms. Specifically, Seltzer et al. (2003) suggested that adults appeared to be asymptomatic in areas of complex mannerisms and unusual preoccupations, but adolescents were less impaired in communication and social interactions. Shattuck et al. (2007) found that over a short span of 4.5 years, verbal communication, social reciprocity, repetitive behaviours and stereotyped interests improved with age but non-verbal communication did not. The authors thus suggested that different sets of symptoms might perhaps develop differently over the life-course of an individual, with some improving in adolescence and others not as much. Thus, the applicability of outcomes of younger (i.e., adolescent) age groups to older adults should be cautioned.

2.2.3.2 Cohort differences

Not only may symptoms of autism change with age, the environments in which individuals develop are also changing over time such that outcomes of a certain generation cohort may not be readily generalizable to cohorts that follow or those yet to come. It is evident that individuals with autism being followed up in early studies have limited educational opportunities (e.g., Rutter et al.,1967) compared to those of more modern times (e.g., Eaves & Ho, 2008). The conveniences and amenities brought about by technological advances in computers and others in recent years are not available to people born prior to the computer age. The outcomes from cohorts of different generations can hence have different meanings and implications. Thus, the era to which a sample belongs should always be taken into account when outcome findings are interpreted.

2.2.3.3 Intellectual Functioning

Just as age, there is a wide spread of intellectual functioning in individuals with autism within studies and across studies. The widest range was over 100 points (32-136 in Boelte & Poustka, 2000). In at least 11 of the 32 studies, the majority of individuals were found in the mental retardation range (e.g. 69% with IQ under 55 in Lotter, 1974b; 77% under 70 in von Knorring & Häglöff, 1993; 68% being MR in Shattuck et al., 2007). It is well-established that cognitive ability is one of the strongest predictors of outcomes (Rutter et al., 1967; DeMyer et al., 1973; Ballaban-Gil et al., 1996; Billstedt et al., 2005; Shattuck et al., 2007 and Eaves & Ho, 2008). Individuals whose IQs are untestable or who have non-verbal IQ below 50 are found to be incapable of independent living (Gillberg & Steffenburg, 1987;

Lotter,1974b). Ballaban-Gil et al. (1996) reported that individuals with autism with normal to near-normal intelligence had the best behavioural, social and language outcomes relative to their counterparts with mild or severe mental retardation. Hence, group results from samples with mixed levels of IQs from MR to normal intelligence can be misleading and difficult to interpret. Lotter (1974b) once suggested that degree of mental retardation could be considered as a criterion in subdividing groups of children with autism. Szatmari et al. (1989) argued for separate study of individuals with autism of normal intelligence and those in the range of intellectual impairment. So, it is considered appropriate to study individuals with autism with and without mental retardation separately or to make comparisons between them.

2.2.3.4 Gender

Although the majority of the studies provide information on the proportion of males and females in the samples, not all studies address gender differences. Four studies (Rumsey et al., 1985; Howlin et al., 2000; Gilchrist et al.,2001; Cederlund et al., 2008) exclusively examine the outcomes of males only. There is a belief that females with autism may have poorer outcomes compared to those of males (Lotter, 1974b; Billstedt et al., 2005). There are some empirical support to this notion found in a few studies with small samples. Among the 12 individuals with autism with the best outcomes in DeMyer et al.'s study (1973), nine were males. All nine girls in Lotter's (1974b) study had poor outcomes, and none in the good or fair category. Similarly, those female participants in Engstrom et al.'s (2003) study, seven in all, fell in the fair outcome range. None of the Rutter et al.'s (1967) nine good outcome cases was female. Comparing 17 males with six females, Gillberg & Steffenburg (1987) found that females were more prone to pubertal aggravation and deterioration.

Yet, in some other studies with bigger sample sizes, no gender differences are found in a variety of outcome indicators. Venter et al. (1992) found no significant gender effects on social-adaptive outcomes and academic attainments in their autistic group. Problematic and stereotyped behaviours did not differ significantly between male and female individuals with autism in Ballaban-Gil et al.'s study (1996). Shattuck et al. (2007) observed similar degrees of changes in autistic symptoms and maladaptive behaviours in females and males over a period of 4.5 years. Piven et al. (1996) also detected no significant sex differences in the pattern of behaviour changes in the three autistic domains. However, they were somewhat surprised by the absence of deterioration in symptoms in females in contrast to worsening in 20% of males. Though Billstedt et al. (2005) found no statistically significant association between gender and overall outcome, GAF-scores, rate of epilepsy and deterioration, they noticed a tendency for the females to have better GAF at follow up than the males. Furthermore, based on DISCO (the Diagnostic Interview for Social and Communication disorders) in another report in 2007, they observed that females tended to have greater abnormality in social interaction. Discrepant observations were also reported in the study by Howlin et al. (2004). Though women did not differ from men in measures of IQ and language, and on scores in reading and spelling tests, none of them was rated as having a good outcome and five of them were in the poor/very poor range. Collectively, findings from research on gender differences have so far been equivocal. Because of the small sample sizes in most studies and an inevitable difficulty with a dominance of males in the autistic population, any conclusion is at best to be considered as tentative. Though studies of bigger samples seem largely not to support poorer outcomes in women, a few studies reviewed above do hint at such tendency. Knowledge on the adjustment of female adults with autism would come about only through the effort of collecting a large enough sample to be assessed across a well-defined set of outcome variables. Until such data is available, many researchers take the position of incorporating female data into the larger bulk of male data in analysis and interpretation. So, the exact outcomes of female versus male individuals with autism remain unclear at this current stage.

2.2.3.5 Initial Diagnosis

With increasing knowledge and understanding from research, the definition of autism has evolved and changed over time. From childhood psychosis and infantile autism to the much more broadly defined Autism Spectrum Disorder, the perception of autism as a disorder falling within a discrete and narrow category has changed to one comprising of different subtypes or phenotypes, the boundaries amongst which have yet to be well demarcated, unfortunately for the time being (Royal College of Psychiatrists, 2006). Samples first assessed in the early period of 1950 to 1970 could be biased toward the more seriously handicapped as the diagnostic criteria then were stricter and the most problematic tended to be identified. In those earlier studies, criteria by which diagnosis was made could be varied and sometimes imprecise (Eisenberg, 1956; Creak, 1963; DeMyer et al., 1973; Lotter, 1974). Even when clear criteria were stated, some relied on clinical judgment by experienced clinicians in which subjectivity was inevitable, especially when reliability check was not conducted (von Knorring & Häglöff, 1993; Ballaban-Gil et al., 1996). Diagnostic diversity is especially prevalent among high functioning individuals. Sweden researchers had used the Gillberg and Gillberg criteria (Gillberg, 1991) for Asperger Syndrome in their clinic since 1985 (Cederlund et al., 2008) which required the fulfilment of nine symptoms instead of three in DSM-IV. Those adults with AS, diagnosed with reference to the Wing and Gould criteria (Wing & Gould, 1979) in Tantam's study (1991), could have symptoms severe enough to lead to a diagnosis of infantile autism.

Time has witnessed increasing sophistication in research designs and case identification. The availability of well standardized diagnostic instruments such as the ADI/ADI-R (Le Couteur et al., 1989) and the DISCO (Wing et al., 2002) has standardized the diagnostic process and the resultant more standardized diagnosis would facilitate more valid and credible comparisons of studies. However, participants of studies covered by the present review are mostly born before 1990 when standardized diagnostic instruments are not commonly available. Some studies, nonetheless, reassess their participants at the time of follow-up, using standardized instruments, in order to arrive at a clearer diagnostic description (Venter et al., 1992; Howlin et al., 2000 & 2004; Fecteau et al., 2003; Shattuck et al., 2007). The trend towards more uniform assessment via standardized instruments is encouraging and results of such recent research hence deserve more attention.

2.2.4 Outcome characteristics

2.2.4.1 Education

Seventeen studies report on the education of their participants (Table 2). Best education outcome is indicated in the proportion of individuals who can enter college or universities. In 11 studies (Kanner, 1973; Newson et al., 1982; Rumsey et al., 1985; Venter et al., 1992; Szatmari et al.,1989; Tantam, 1991; Kobayashi et al., 1992; Howlin et al., 2000; Howlin et al., 2004; Eaves & Ho, 2008; Cederlund et al., 2008) , a range of 2% to 50% was reported for individuals with college and above qualifications. Individuals who could stay in ordinary schools with minimal support ranged from 3% to 90%, as reported in seven studies (Rutter et al., 1967; Venter et al., 1992; Ballaban-Gil et al., 1996; Larsen & Mouridsen, 1997; Howlin et al., 2000; Howlin et al., 2004; Cederlund et al., 2008). Four studies reported 11% to 43% of participants studying in normal schools with various forms of support (Ballaban-Gil et al., 1996; Howlin et al., 2004; Eaves & Ho, 2008; Cederlund et al., 2008). Those requiring special education ranged from 5% to 100% (Szatmari et al., 1989; Venter et al., 1992; Larsen & Mouridsen, 1997; Howlin et al., 2000; Gilchrist et al., 2001; Howlin et al., 2004; Eaves & Ho, 2008; Cederlund et al., 2008).

The vast difference in percentages is expected since education placement and attainment can be affected by a number of factors. Individual's ability, diagnosis, the availability of support services, and differences in education systems and provisions are likely contributors to the types of education an autistic individual can endure and to his/her eventual level of eduational attainment.

In studies before the 70s, the majority of the children had no more than five years of education (Rutter et al., 1973; Mittler et al., 1966; DeMyer et al., 1973). In later studies, almost all children could stay in some form of schooling until the end of high school. This is very likely to be related to the improvement in educational systems in most developed countries which offer compulsory education until high school. Furthermore, a large proportion can stay in ordinary schools rather than being placed in special schools because of the greater amount of supportive services available in ordinany schools, arising out the ideology of inclusive education. For example, 47% of Asperger syndrome individuals were in or finished high school in Cederlund et al.'s study (2008), out of which 36 % were provided with special classes, individually tailored programs or some regular special education lessons. None of the participants in the study of Eaves & Ho (2008) studied in special schools. About 70% received various forms of support in their high schools, including special classes, personal aides, training from speech pathologists, and counseling from school counselors. It seems that inclusive education policy has helped to allow more children with autism to benefit from mainstream education.

Outcomes of individuals with AS and infantile autism were compared in two studies (Larsen & Mouridsen, 1997; Cederlund et al., 2008). Respectively, 89% and 30% of the AS group studied in ordinary schools without special provisions while 100% and 91% of the autism group were in special schools. Such results seem to support the commonly held notion that individuals with Asperger Syndrome generally do better than autistic people in education. However, the effect of diagnosis may be confounded by the concurrent better intelligence in those individuals with AS who all have an IQ above 70. Except one, studies with a high percentage of their samples entering college or university are those with high functioning individuals (50% in Szatmari et al., 1989; 32% in Howlin et al., 2000; 14% in Rumsey et al., 1985; 14% Cederlund et al., 2008). So, it seems that good cognitive ability, rather than a diagnosis of Asperger syndrome, can better account for the academic attainment.

Yet, intelligence alone is not enough to keep some individuals with autism in normal schools (Howlin et al., 2000). 73%, 69%, 50% and 48% respectively of the normal intelligence samples of Howlin et al. (2000), Gilchrist et al. (2001), Szatmari et al. (1989) and Venter et al. (1992) were placed in special education. Clearly, other factors such as difficulties in emotional control or disruptive behaviours may impede successful inclusion into normal schools. For instance, some of the individuals with autism in Howlin et al.'s (2004) study had their education in schools for emotional and behavioural problems.

In summary, only a small portion of individuals with autism are able to study in mainstream schools and reach college or university level. High functioning individuals tend to do better than others. Being able to study in normal schools may not be entirely determined by one's cognitive ability. Rather, the degree of supportive services may be crucial to the inclusion of individuals with autism in mainstream education. Their social and communication difficulties leading to emotional or behavioural problems are other possible obstacles to higher educational attainment.

Table 2

Summary of outcome studies on education and employment

Study No.	Author	N	N at employable age	Initial diagnosis	Education*				Employment*			
					College/ University	Ordinary school with minimal support	Ordinary school with support	Special education	Paid jobs	Training program or Daily Activity Centre	Sheltered workshop	Unemployed
4	Rutter et al. (1967)	63	38>16 years	Infantile autism, childhood psychosis		3%			5%			
5	Kanner (1973)	96	all		7%				11%			
6	DeMyer et al. (1973)	120	24>15 years	Hi,middle,low autism		10%			0%			
7	Lotter (1974)	28	all	Autism					4.6%			
8	Newson et al. (1982)	93	all	Asperger	11%				22%			
9[a]	Rumsey et al. (1985)	14	all	Autism	14%	36%			29%	64%		4.5%
11[a]	Szatmari et al. (1989)	16	all	High functioning autism	50%			50%	44%		25%	12.5%
13[a]	Tantam (1991)	46	all	Asperger	4%				9%			
14[a]	Venter et al. (1992)	58	22>18years	Autism	3%	22%		48%	27%		59%	14%

Table 2 (continued)

Summary of outcome studies on education and employment

Study No.	Author	N	N at employable age	Initial diagnosis	Education*				Employment*			
					College/ University	Ordinary school with minimal support	Ordinary school with support	Special education	Paid jobs	Training program or Daily Activity Centre	Sheltered workshop	Unemployed
15	Kobayashi et al. (1992)	201	all	Autistic disorders	2%				22%		14%	
18	Ballaban-Gil et al. (1996)	99 (54 12-17yrs 45 >18)	45>18years	Autism		2% [b]	11%		11%		16%	
19 [a]	Larsen & Mouridsen (1997)	9 AS 9 A	all	AS & A		89% of AS [c], 0% of A		100% of A	11%AS, 22%A	55%A	22%AS, 11%A	55%AS
21 [a]	Howlin, Mawhood & Rutter (2000)	19	all	Autism	32%	11%	16%	73%	16%	63%		5%
22	Gilchrist et al. (2001)	13 HFA 20 AS	all	HFA & AS				5% of AS, 69% of HFA				
23 [a]	Engstrom et al. (2003)	16	all	10 AS; 6 HFA					6%	31%	19%	37%
26	Howlin et al. (2004)	68	all	Autism	5%	15%	24%	56%	13%		21%	

Table 2 (continued)

Summary of outcome studies on education and employment

Study No.	Author	N	N at employable age	Initial diagnosis	Education*				Employment*			
					College/ University	Ordinary school with minimal support	Ordinary school with support	Special education	Paid jobs	Training program or Daily Activity Centre	Sheltered workshop	Unemployed
30	Eaves & Ho (2008)	48	all	ASD	30%	~30%	70%		6%		50%	41%
31[a]	Cederlund et al. (2008)	70 AS 70 A	all	Autism & Atypical autism	14% of AS, 0% A	30% of AS, 9% of A	20% of AS	16% of AS, 91% of A	10%AS, 1.4%A	8.6%AS, 53%A		17%AS, 19%A
32	Hutton et al. (2008)	135	All	Autism					16%			

Note. A=Autism: AS=Asperger Syndrome: ASD=Autism Spectrum Disorder

*only reported figures were put in, hence might not add up to 100%

[a] Study with all or a group of participants > 70 in IQ

[b] Adolescents only

[c] One had home school (=11%)

2.2.4.2 Employment

Eighteen studies trace the employment status of their samples. Two studies (Larsen & Mouridsen, 1997; Cederlund et al., 2008) gave separate figures on Asperger and autistic groups. The number of individuals having a paid job for most of the time ranges from 0% to 44%. The percentages of individuals with autism having paid jobs were smaller in early studies (0%, 4.6%, 5% and 11% respectively in DeMyer et al., 1973, Lotter, 1974, Rutter et al., 1967; Kanner, 1973). Beginning in the 1980s, the employment figures seem to have improved across time. Among the post-1980 studies, the mean proportion of individuals with a regular job is 17%. There seems to be a slight tendency for more high functioning individuals to get a job as four out of six studies with employment rates above the mean of 17% have participants with IQs over 70 (44%, 29%, 27% and 22% respectively in Szatmari et al., 1989, Rumsey et al., 1985;Venter et al., 1992; Newson et al., 1982).

However, a sizable portion of these able individuals with autism are also found to stay in Daily Activity Centre or Training programs without a job. 64%, 63% and 31% of the cases in studies of Rumsey et al. (1985), Howlin et al. (2000) and Engstrom et al. (2003) respectively were participating in some form of day or training centres. Furthermore, 37%, 17%, 14% and 12.5% of the high functioning individuals in the respective studies of Engstrom et al. (2003), Cederlund et al. (2008), Venter et al. (1992) and Szatmari et al. (1989) were unemployed or never had a regular job. Actually, Venter et al. (1992) found no association between employment and non-verbal IQ in their adult group. Rumsey et al. (1985) noted that inappropriate behaviours could have influenced occupational stability, while Howlin (2005) suggested that social deficits could be a factor leading to premature termination of employment for the intellectually able individuals.

Social benefits and economical factors can have an impact on employment of individuals with autism as well. Kobayashi et al. (1992) and Howlin et al. (2004) partly attributed the relatively satisfactory rate of employment to good economy at the time of their study. Seventeen percent of the AS group and 19% of the autistic group in the study of Cederlund et al. (2008) had "no organized daily activity at all and were dependent on social services and/or the Swedish insurance system for their welfare" (page 80). Though five Asperger individuals (55%) had worked before, they stopped work for various reasons and eventually lived on disability pension. Perhaps, the good welfare system in Northern European countries makes life less difficult for those who find it hard to engage in gainful employment.

In terms of job nature, although some report individuals having well-paid, high-level or professional jobs such as librarian, physics tutor, salemen with semi-managerial positions (Szatmari et al., 1989), physiotherapist, or a civil servant (Kobayashi et al., 1992), most are engaged in menial jobs such as janitor, cab driver, gardener, or kitchen hands. Even high functioning adults with autism are mainly employed in low-level jobs. A university graduate in the study of Venter et al. (1992) started off in his chosen profession, but ended up as a bartender after being laid off in a company retrenchment exercise.

Finally, 11% to 59% of the samples in seven studies were reported to find work in sheltered settings, under supervised support or as part of some supported employment scheme. As discussed in detail in Howlin (2005), the supported employment model had been very effective in meeting the occupational needs of the adults with autism. But so far, the success was limited to low-level unskilled jobs.

A project trying to match high functioning adults with autism with more skilled and high-level jobs was launched by Howlin and colleagues and very encouraging results were reported (Howlin et al., 2005).

In summary, the employment rate of adults with autism is generally low. Even among the more intellectually able, it is lower than what can be expected of people functioning in the normal range of intelligence. Work nature is mainly in the low-level, unskilled sector. Specialized supportive employment scheme appears to be a viable solution in helping the socially inept adults with autism to find jobs that are more compatible to their abilities.

2.2.4.3. Diagnostic Continuity

On the question of whether individuals with autism can outgrow their diagnosis, studies report various degrees of improvement. In many studies, not having a diagnosis of autism may merely refer to a score below the cut-off on a standardized measure (e.g., Boelte & Poustka, 2000; Seltzer et al., 2003). However, when the conditions of the individuals no longer having a diagnosis are examined in detail, it is quite apparent that residual symptoms are found in quite a number of them (Table 3).

In earlier studies, for example, Rutter et al. (1967) considered that 14% of their sample whose 'autism' was much less marked at follow-up as having lost their 'autism'. In the DeMyer etal (1973) study, 75% of the 'high autistic' group and 20% of the rest of the sample of poorer functioning were no longer autistically withdrawn.

Post-1980 studies examine the diagnosis at follow-up using clearer criteria either according to diagnostic manuals like DSM-IIIR/DSM IV or assessment instruments such as ADI-R or CARS. The reported rates of individuals no longer having their original diagnosis range from 8% (4 out of 48 in McGovern & Sigman, 2005) to 71% (10 out of 14 in Rumsey et al., 1985) (Table 3). Of interest are the unusual results of Billstedt et al. (2005), where 86% of individuals (30 out of 35) with atypical autism 'lost' their diagnosis for worse, i.e., to the more serious diagnosis of autism, while the rest retained their atypical autism diagnosis. Notwithstanding the exceptional findings above, the average rate of 'improvement' across the studies is 20%.

At closer scrutiny, improvement in terms of 'loss of the original diagnosis' actually requires qualification. Of the four (12%) individuals not retaining the original diagnosis in the study of von Knorring & Häglöff (1993), three (9%) was diagnosed as PDD and only one (3%) did not meet any diagnosis. The 12 (16%) individuals, mostly high functioning (IQ > 85), who did not meet a full autism diagnosis in the study of Boelte & Poustka (2000) because of their sub-threshold ADI-R scores on repetitive and restrictive behaviours, they were still impaired in the social and communication domains. Similar results were found by Seltzer et al. (2003). Out of the 48 (12%)

individuals not meeting full autism criteria, 40 (10%) still met cut-off in one of the three domains of ADI-R. Among the ten cases (71%) in Rumsey et al.'s group who were no longer considered as infantile autism, nine (64%) were given a DSM-III diagnosis of autism, residual state. In Mesibov et al.'s study (1989), the proportion of individuals not meeting an 'autism' diagnosis dropped from 19% (11 out of 59) to 8% (5 out of 59) when the cut-off of CARS was lowered from 30 to 27.

There are in fact very few individuals who have scores below cut-off on all domains and subsequently not assigned any Autism Spectrum Disorder diagnosis. Only one such individual was found in the studies of von Knorring & Häglöff (1993) and Billstedt et al. (2005). Only eight out of the 48 (2% of the whole sample, n = 405) individuals without autism diagnosis in Seltzer et al. study (2003) fell below cut-off in all three domains of ADI-R. Whereas eight (12%) of the Asperger individuals no longer met criteria for any ASD diagnosis, only one (1%) in the autistic group was considered so in the study of Cederlund et al. (2008). Only two of the four cases in McGovern & Sigman's sample (2005) who did not bear an ASD diagnosis were really free of symptoms as two of them still manifested overt social-communicative impairments under direct observation. It seems clear that the 'loss of autism', in terms of a nil diagnosis, does not entail a loss of all autistic features. Rutter et al. (1967) had cautioned this observation a long time ago. It would be fair hence to say that autism is indeed a life-long illness that most individuals still bear it unto adulthood.

Table 3

Outcome studies reporting diagnostic continuity

Study No.	Author	N	Initial Diagnosis	Diagnosis at F/U or judged in "current" state of Interview Schedule		
				% Not Autistic	Detail on not-autistic subjects	% No ASD Diagnosis
4	Rutter et al. (1967)	63	Infantile Autism, Childhood psychosis, clinic examination	14%		---
6	DeMyer et al. (1973)	120	Hi,middle,low autism by psychiatric interview	75% of hi autism 20% of the rest		---
9	Rumsey et al. (1985)[a]	14	Autism (DSM-III)	71%	90%(9/10) Autism, residual state (DSM-III)	---
12	Mesibov et al. (1989)	59	Autism (CARS)	19%	Lowering cut-off from 30-27, only 8% not autistic	---
16	von Knorring & Hagloff (1993)	34	Childhood psychosis (Rutter's criteria)	12%	9% (3/34) PDD (DSM-III-R)	3% (1/34)
17	Piven et al. (1996)	38	Autism (DSM-III)	13%	3 not meeting social criteria (ADI) 2 not meeting ritualistic/ repetitive criteria (ADI)	0%
20	Boelte & Poustka (2000)	76	Autism (ADI-R)	16%	Diagnosis by current behaviors All not meeting ritualistic/ repetitive criteria (ADI-R)	0%
24	Seltzer et al. (2003)	405	ASD (ADI-R)	12%	10% meeting diagnostic cut-off in one domain (ADI-R)	2%
27	McGovern & Sigman (2005)	48	Autism (DSM-III)	8%	Judged by ADOS-G cut-off criteria 2 observed to experience general social difficulties	4%
28	Billstedt et al. (2005) & (2007)	108	73 Autism (DSM-III-R) 35 Atypical autism	15% of A *	* 86% AA->A 14% same AA->AA	1% of A 0% of AA
31	Cederlund et al. (2008)	140	70 Asperger Syndrome (Gillberg & Gillberg criteria)	16% AS	8 AS not meeting ASD criteria (Gillberg & Gillberg criteria) , 6 AA, 1 AS, 1 no ASD according to DISCO-10 algorithm	12% of AS
			70 Autism (DSM-III or III-R)	19% A	The only one A without clinical diagnosis had an AA diagnosis according to DISCO-10 algorithm	1% of A

Note. --- = not reported; (   ) = Diagnostic Criteria [a] all/mostly HFA Dx=diagnosis

2.2.4.4 IQ Stability

Intellectually assessment done before age five inevitably relies on a variety of tests such as the Stanford-Binet, Ravens, Merrill-Palmer or Leiter International Scale. Differences in scores from these tests when compared to later Wechsler IQ scores at follow-up could merely reflect on test differences rather than real changes in intellectual functioning, cautioned Lockyer & Rutter (1969). For instance, Mittler et al. (1966) reported on an increase of 24 points in IQ by comparing Stanford-Binet scores with Wechsler scores. The difference can be spuriously inflated as the Binet test contains a larger amount of verbal items which pose greater difficulty than the Wechsler test to the verbally impaired, resulting in underestimation of the childhood IQ. Also, as Wechsler test usually has a higher floor than the Binet, some children who are testable on admission by the Binet are not testable by the Wechsler test at follow-up and they are not included in the results. Consequently, findings of Mittler et al.'s study are only based on ten of the 27 individuals so that results may not be representative.

In a larger scale study by the Rutter group of researchers, comparison between childhood and follow-up full scale, verbal and performance IQs of subgroups of children (probably those who could be reliably tested initially) found trivial differences (Lockyer & Rutter, 1969) (80.5: 76.7, 80.2: 76.4 and 79.2 : 73.7 being mean childhood versus follow up FIQ, VIQ, and PIQ respectively) (Table 4). They concluded that there was no tendency of a systematic change in IQ in children over a mean period of follow up of 15 years. Similar results suggesting stability of IQ over time are reported in later studies. Follow up assessment conducted after an average of eight years yielded little changes with the mean childhood IQ of 80.2 and follow up Wechsler FIQ of 79.2 in a study by Venter et al. (1992). The estimated mean IQ of the 16 high functioning individuals in the study of Szatmari et al. (1989) remained almost unchanged, being 89.3 initially and 92.4 at follow-up.

The pattern of change appears to be different between VIQ and PIQ in a group of 19 high functioning individuals with autism in the study of Mawhood et al. (2000). Mean Verbal IQ was found to increase by 15 points among a subgroup of nine individuals whose childhood VIQ was available (childhood = 66.6 and follow-up = 82.3) but the mean Performance IQ dropped by 11 points in 18 individuals (from 94.3 to 82.8). Similar though less striking pattern was reported in another study of 68 adults with childhood IQ in the range of 51 - 137 (Howlin et al., 2004). They reported an overall rise of verbal IQ from 61.4 to 69.6 and a slight drop of performance IQ from 80.2 to 75.0 over time though the differences were not statistically significant. There was also a drop of about five points in PIQ in the group of Lockyer & Rutter (1969) though again the difference was not statistically significant.

In a recent follow-up study by Cedelund et al. (2008) of 70 Asperger individuals, the mean FIQ and VIQ were very similar (101.4 vs 103.0, 107.2 vs 104.0 in childhood vs follow up respectively). There was however an increase of about seven points in PIQ from 94.6 initially to 101.3 at follow up. The authors attributed the increase to the change in perceptual organizational subtests between childhood Wechsler test and the WAIS-III. An increase of five points in PIQ (from 81.8 to 86.8) was also found among a group of individuals who were tested on Wechsler scales in childhood and adulthood, but statistically the difference was not significant (Howlin et al., 2004).

It seems that in terms of group mean, there are both increase and decrease in verbal and performance IQs. However, because of the differences in test instruments even among the child and adult Wechsler tests, mean score changes should be interpreted with care. Also, as pointed out by Dietz, Swinkels, Buitelaar, van Daalen and van Engeland (2007), differences in IQ scores should be at least one standard deviation in order to be considered clinically relevant. Thus, in order to look at changes with a real impact on functioning, it may be more appropriate to compare changes in terms of broad bands of IQ levels (Eaves & Ho, 1996). In a follow-up study of children entering adolescence (follow-up ages ranging between 11 to 17 years), Eaves & Ho (1996) found only seven out of 76 adolescents (9%) showing changes over 15 points that could be considered as having an impact on their functioning. In a subgroup of high functioning children (IQ>70), their IQs showed substantial stability as 88% to 95% stayed in the same IQ band. In a group of autistic participants with childhood IQ above 50, Howlin et al. (2004) reported that 31 out of 63 of them (49%) remained in the same IQ band at follow-up. Stability was even greater in participants who had a childhood verbal or performance IQs of 70 or above, 85.7% and 77.8% of them respectively remained in the same IQ band.

Table 4

Mean childhood and follow-up IQs in outcome studies

	Lockyer & Rutter (1969)			Szatmari et al. (1989)			Venter et al. (1992)			Mawhood et al. (2000)			Howlin et al. (2004)			Cederlund et al. (2008) (Asperger Group)		
	Child-hood	Follow-up	N	Child-hood	Follow-up	N	Child-hood	Follow-up	N	Child-hood	Follow-up	N	Child-hood	Follow-up	N	Child-hood	Follow-up	N
FIQ	80.5	76.7	17	89.3^a	92.4^a	16	80.2^b	79.2 89.0^c	58		-		-	-		101.4	103.0	66
VIQ	76.4	80.2	18	-	-		-	79.9	58	66.6 *	82.3*	9	61.5^{a*} 70.6^{d**}	69.6^{a*} 82.4^{d**}	39 22	107.2	104.0	66
PIQ	73. 7	79.2	24	-	-		-	83.3	58	94.3**	82.7**	18	80.2^{a*} 81.8^d	75.0^{a*} 86.8^d	68 30	94.6	101.3	66

Note. All IQ scores are Wechsler scores unless stated otherwise

^{a} estimated score from mixture of tests

^{b} derived mainly from non-verbal tests

^{c} Raven score

^{d} subset with childhood & f/u Wechsler result

* p< .05 ** p<.01

Generally speaking, recent findings converge to suggest a fair degree of stability between childhood and follow-up IQs. Some inconsistency is also reported. Some studies indicate improvement in verbal and performance IQ at follow up, while some report deterioration in performance IQ. Interpretation of these changes was cautioned, given uses of different tests. When we define IQ change across wider bands in order to consider it clinically significant, substantial stability was noted, particularly among those high functioning individuals. However, these group findings do not rule out fluctuation at individual level.

2.2.4.5 Overall Outcome Rating

In 19 studies under the present review, attempts were made to arrive at an overall outcome rating of their participants by assigning grades such as 'good', 'fair' and 'poor' according to multiple criteria. Findings are expectedly diverse in magnitude, considering the heterogeneity of sample characteristics such as age, intellectual functioning and initial diagnosis, as well as the diversity in the sets of multiple criteria used and their varying operational definitions. Comparison across studies also needs to take into account the inevitable subjectivity in making judgment over those multiple criteria.

Table 5

Summary of outcome studies with an overall outcome rating

Study No.	Author	N	Mean age in years (range)	Diagnostic Label and Criteria	Outcome rating in %*		
					Good	Fair	Poor/ very poor
1	Eisenberg (1956)	63	15 (9-25) [13 aged 9-12years]	Infantile autism	5[a]	21[a]	73[a]
2	Creak (1963)	100		Childhood psychosis	17[b]	40[b]	43[b]
3	Mittler (1966)	27	15-2 (7-27)	Childhood psychosis	0[c]	26[c]	74[c]
4	Rutter et al. (1967)	63	15.6 (38 aged 16 yrs and over)	Infantile Autism, childhood psychosis	14	25	61
6	DeMyer et al. (1973)	120	12	High, middle, low autism	10	16	74
7	Lotter (1974a)	29	(16-18)	Autism	14	24	62
8	Newson et al. (1982)	93	23	Asperger	***7***[d]	***77***[d]	***16***[d]
9	Rumsey et al. (1985)	14	27 (18-39)	Autism (64% IQ >80)	***35***	***35***	***28***
10	Gillberg & Steffenburg (1987)	23	(16-23)	Infantile autism	4	48	48
11	Szatmari et al. (1989)	16	26 (17-34)	High functioning autism	***38***	***31***	***31***
13	Tantam (1991)	46	24.4	Asperger	***3***[d]	***44***[d]	***53***[d]
15	Kobayashi et al. (1992)	201	21.5 (18-33)	Autistic disorders 46 IQ>70	all:27 ***HFA:48***	all:27 ***HFA:30***	all:46 ***HFA:22***
19	Larsen & Mouridsen (1997)	18	38 (32-43)	9 Asperger 9 Autism	A:21 ***AS:33***	A:11 ***AS:45***	A:67 ***AS:22***
21	Howlin, Mawhood & Rutter (2000)	19	23.8 (21-26)	HFA	***16***	***10***	***74***
23	Engstrom et al. (2003)	16	31.4 (23-46)	10 AS 6 HFA	***12***	***75***	***12***
26	Howlin et al. (2004)	68	29.3 (21-48)	Autism	all:22 ***HFA:32***	all:19 ***HFA:23***	all:57 ***HFA:45***
28	Billstedt et al. (2005) & (2007)	108	25.5 (17-40)	Autism, atypical autism	0[e]	22[e]	78[e]
30	Eaves & Ho (2008)	48	24 (19-31)	Autism spectrum disorders	21	32	47
31	Cederlund et al. (2008)	70 A 70 AS	A:24.5(16 -36) AS:21.5(16-34)	Autism & atypical autism Asperger	A:0[e] ***AS:27***[e]	A:7[e] ***AS:47***[e]	A:93[e] ***AS:26***[e]

Note. bold & italic numbers are ratings of HFA/AS samples

[a] Good: functioning well at academic, social and community level ; Fair: regular class /some meaningful contact with people/ some impairment in function; Poor/very poor: still autistic/grossly disturbed

[b]. Good: attending ordinary schools or working; Fair: attending special school/ training centres; Poor/very poor: permanently institutionalized

[c] Fair: discharged to school within the educational system and staying for at least a year; Poor: remaining in psychiatric hospital at follow-up

[d] Good: high level of independence in living or having a job; Fair: needing support in work and/or daily living; Poor/very poor : living in residential home or hospital or requiring close parental supervision

[e] Good: a) being employed or in higher education or vocational training; and b) living independently; having > 2 friends or a steady relationships ; Fair: either a) or b) under good outcome; Restrictive but acceptable: neither a) nor b) under good outcome but accepted by group of peers and personnel so that handicap not obvious; Poor/very poor: severe handicap (fair & restrictive but acceptable outcome combined into 'fair'))

Definitions of the overall outcome rating in earlier studies tend to be crude. For instance, according to Creak (1963), good outcome was complete recovery, and fair outcome was staying at home with attendance at training centres, while poor outcome was institutionalized. Similarly, in Mittler et al. (1966), there were only two levels of outcome: ‘improvement’, defined as discharge from institutions, and ‘no improvement’, defined as remaining in institutions. When Eisenberg (1956) accepted that some odd behaviours could still be present in the ‘good’ outcome group, Kobayashi et al. (1992) would assign only a ‘fair’ rating to those who behaved inappropriately. Someone ‘who exhibits schizoid peculiarities of personality, sufficient to single him out as a deviant and to cause interference with function’ would be given a ‘fair’ ranking from Eisenberg (1956), but this person would probably be rated as ‘poor’ according to Kobayashi et al.’s (1992) definition as someone who ‘behaves very oddly, cannot adapt socially and needs some aid’. Thus, those outcome definitions are somewhat crude and vary across studies.

Many studies referred to the criteria recommended by Lotter (1974a): ‘good’ outcome = normal or near normal social life and satisfactory functioning at school or work; ‘fair’ outcome = some social and educational progress despite significant or even marked abnormalities in behaviour or interpersonal relationships; ‘poor’ outcome = severe handicap, no independent life, some potential for social progress; ‘very poor outcome’ = unable to lead any kind of independent existence. It seems that Lotter assessed outcome on two dimensions, namely social competence and level of functioning relevant to developmental stage. However, when the Sweden researchers adopted Lotter’s criteria, they seemed to loosen the criteria so that meeting one among the two dimensions of social competence and level of functioning was sufficient (Gillberg & Steffenburg, 1987; Billstedt et al., 2005; Cederlund et al., 2008). For example, 'being employed' and 'living independently after 23 years old' were sufficient to rate someone as having a 'good' outcome, regardless of his/her social competence. For those under 22 years old, demonstrating social competence was enough to be considered as being 'good' in outcome.

Subtle differences also exist among studies in the requirements of behavioural indices illustrative of a certain outcome. For instance, 'independence' was defined differently in two separate studies by Howlin et al. (2000, 2004). In the 2000 study, independence was judged in terms of self-care, mobility and money management. But in the 2004 study, the emphasis was on living arrangement and degree of autonomy. Similarly, whereas Howlin and colleagues attempted to define friendship in terms of both frequency and quality, others (Billstedt et al., 2005) considered 'having two or more friends' as a sufficient criterion for 'good' outcome. On the other hand, a closer examination at the various definitions of 'good', 'fair' and 'poor' outcomes finds fewer disputes over what is meant by 'poor' outcome.

Despite the differences, the overall outcome rating often examines similar areas of everyday living for evidence of adjustment, namely, education or employment, independent living, social competence or friendship. This allows some degree of comparison across studies.

Studies reporting outcome ratings are identified from the group of studies under review of this dissertation (Table 1) and summarized in Table 5. As expected, ratings vary greatly across studies. 'Good' rating ranges from

0% to 38%, 'fair' rating from 7% to 77%, and ' poor' rating from 12% to 93%. The mean percentage of individuals having a 'good' outcome rating is 15.0%, 'fair' rating 32.7%, and 'poor' rating 48.2%.

Howlin (2005) observed that overall outcomes seemed to have improved over the years. Following her procedure, outcome ratings of studies before 1980 are compared with those conducted after 1980 in Table 6 with our current review including more studies. In both reviews, the mean rates are very similar in the period before 1980 with 10% to 11% 'good' outcome, 25% 'fair' outcome and 65% 'poor' outcome. However, regarding outcome ratings in studies after 1980, our and Howlin et al.'s reviews have both found improved outcomes respectively; 17% and 20% 'good' rating, 36% and 30% 'fair' rating, as well as 41% and 50% 'poor' rating.

Table 6
Comparison of outcome ratings of studies before and after 1980

		Pre 1980 studies		Post 1980 studies		
Outcome criteria	All current studies n=19	Current review n=6	Howlin's studies n=7	Current review n=13	Howlin's studies n=10	Current studies of Asperger or high functioning ASD n=10
	%	%	%	%	%	%
Good	15.0	10.0	10.0	17.1	20.0	25.0
Fair	32.7	25.3	25.0	35.8	30.0	42.0
Poor	48.2	64.7	65.0	41.0	46.0	33.0

As discussed above, outcomes are likely to be associated with intellectual functioning. On top of the seven studies which aimed at examining Asperger or high functioning individuals with autism (Newson et al., 1982; Rumsey et al.,1985; Szatmari et al., 1989; Tantam, 1991; Howlin et al., 2000; Engstrom et al., 2003; Cederlund et al., 2008), there were three other studies which also reported on the outcome ratings of a subgroup of participants with normal intellectual functioning (Kobayashi et al., 1992; Larsen & Mouridsen, 1997; Howlin et al., 2004). The mean percentage of able adults with autism with 'good' outcome is 25% (range: 3% to 48%), 'fair' outcome 42% (range: 10% to 77%) and 'poor' outcome 33% (range: 12% to 74%). On the other hand, the poorest outcome ratings are found among groups of people with severe mental handicap. In the MR sub-group of the autistic sample of Cederlund et al. (2008), 93% had 'poor' outcome, and none was rated as 'good'. Similarly, in studies where the majority of the participants had an IQ below 55 (Mittler et al., 1966; Rutter et al.,1967; Lotter, 1974b; Billstedt et al., 2005), more than 60% of their samples was rated to function in the 'poor' category. However, it must be noted above that among individuals with autism with normal intelligence, the mean 'poor' rating is amounted to 33%. One therefore cannot be sure that normal intelligence guarantees a good adult outcome.

2.2.4.6 Psychiatric problems

Epilepsy

Epilepsy is often found to associate with autism (Kanner, 1971). Among the 13 out of 32 studies in our present review which reported on epilepsy, rates ranged from 2.6% to 42.6%, resulting in a mean rate of 17.4%. Other reviews reported invariably different rates - around 20% to 33% (Shea & Mesibov, 2005), 0% to 26.4% with a median of 16.8% (Fombonne, 2003), and 21.5% for individuals with autism with mental retardation and 8.0% for those without retardation (Amiet, Gourfinkel-An, Bouzamondo, Tordjman, Baulac, Lechat, Mottron & Cohen, 2008). The last review suggests that the rate of association between autism and epilepsy may be mediated by the presence of mental retardation in individuals with autism. Similarly low rates of 2.6% and 7% were reported in the two studies with participants with near to normal IQ (Piven et al., 1996; Venter et al., 1992). Compared with the prevalence rates in normal population ranging from 0.15% to 1.4% ,as reported in the factsheet of WHO (2001) and by Mac et al. (2007), epilepsy has a high rate of occurrence amongst individuals with autism, both in the retarded and non-retarded group. The strong association between epilepsy and autism lends support to the neurobiologic origin of both disorders but whether it is a causative or comorbid relationship is still uncertain (Levisohn, 2007).

Psychiatric disturbances

Psychiatric problems were reported in nine out of 32 studies in our present review. Based upon detailed psychiatric interview and observation, Rumsey and colleagues (1985) reported that half (50%) of 14 high functioning individuals with autism showed various anxiety symptoms. None was classified as having schizophrenia, however. Tantam (1991) found 30 of a sample of 85 individuals with autism (35%) having a psychiatric disorder other than autism. Eighteen (21% of the whole group) were given a diagnosis of psychosis, three (3.5%) schizophrenia and eight (9%) mania. Depression was noted as the most common disorder, with seven (8%) in the affective disorder category and six (7%) in psychotic category, totaling 15%. Anxiety disorder and OCD constituted another 7% (six of the total group). Drug treatment is sometimes used as an indicator of psychiatric disturbance in some studies. In one study (Larsen & Mouridsen, 1997), 44% of the Asperger individuals and all (100%) with infantile autism were prescribed neuroleptics, while in another study (Billstedt et al., 2005), 32% of the sample had the same prescription. Larsen & Mouridsen (1997) also reported that 33% of Asperger individuals and 89% of those with infantile autism had been admitted to psychiatric hospitals. Howlin et al. (2000) also found one of their 19 high functioning adults to have undergone inpatient treatment and another outpatient treatment, making up 10% of their sample having psychiatric disturbance. Two other studies relied on parents or the adults with autism as informants of psychiatric disorders (Szatmari et al., 1989; Eaves & Ho, 2008). In a group of 16 high functioning adults with autism, one chronic schizophrenia (6%) was identified and convergent reports by parents and adults with autism suggested that 25% had 'overanxious' disorder and 19% had OCD (Szatmari et al., 1989). In the study by Eaves & Ho (2008), parents reported via telephone interview that 77% of a sample of 48 adults with autism had psychiatric disturbances, with 'emotional difficulty' as the most common problem (62.5%). Half (50%) was thought to have OCD while half (50%) reported anxiety, followed by 21% depression and 6% bipolar. Yet, Cederlund et al. (2008) reported that only 6% and 4% respectively of the autistic and Asperger individuals were diagnosed by psychiatrists as having psychosis, though no exact information on the exact disorder was available. Among the nine studies reviewed, the study by Hutton and colleagues (Hutton, Goode, Murphy, Le Couteur and Rutter, 2008) was most methodic, involving a relatively larger sample (135) and using an investigator-based interview. Twenty individuals (16%) were identified as definitely having a new-onset psychiatric diagnosis, comprising of two main groups, those with OCD and others of affective disorders. Another eight individuals (6%) were considered to have dubious or uncertain new psychiatric diagnosis. Heterogeneity of the findings is self-evident, with the rates of psychiatric disturbances ranging between 6% to 100% in different studies (Cederlund et al., 2008; Larsen & Mouridsen, 1997)

Table 7 lists the types of psychiatric problems reported by various studies. Depression or depressive symptoms were reported in five studies with a range from 0.09% to 50%. Anxiety disorder or symptoms were found with a range from 4.7% to 50% in four studies. Rates from .07% to 9% were reported in four studies for mania or bipolar disorder. Four studies found OCD with rates from 2.3% to 50%. While schizophrenia was said to occur rarely, ranging from 0% to 6% among five studies, three studies noted rates of 5% to 8.2% for psychosis. Affective disorder was found in 8% of the participants in Hutton et al.'s study. Once again, the wide variation in rates is note-worthy.

Table 7

Outcome studies reporting psychiatric disturbances

	Depression depressive symptoms	Anxiety/ anxiety symptoms	Mania bipolar disorder	Affective disorder	OCD	Schizophrenia	Psychosis
Rumsey et al. (1985) N=14	50.0% affect flattening	50.0% generalized anxiety	---	---	---	0%	---
Szatmari et al. (1989) N=16	---	25.0%	---	---	19.0%	6.0%	---
Tantam (1991) N=85	15.0%	4.7%	9.0%	---	2.3%	3.5%	8.2%
Billstedt et al. (2005) N=108	.1%	---	---	---	---	.1%	7.4%
Eaves & Ho (2008) N=48	21.0%	50.0%	6.2%	---	50.0%	---	---
Cederlund et al. (2008) N=140	—	---	.1%	---	---	0%	5.0%
Hutton et al. (2008) N=135	3.0%	---	1.5%	8.0%	3.0%	---	---

Note. --- = not reported

There are other studies not included in our 32 reviewed studies that set out to study comorbidity to autism. According to Ghaziuddin et al. (1992) and Green et al. (2000), mood disorders were the most commonly reported disorders among individuals with autism. Lainhart (1999) reported in her review of 30 studies from 1967 to 1999 that rates of depression ranged from 4.4% to 57.6% and those of anxiety disorders from 7% to 84%. Bipolar disorder or mania was less frequently reported and the rates ranged from 0% to 21%. The range of rates of OCD reported in Lainhart (1999) was 1.5% to 29%. However, Lainhart (1999) found a much higher rate in the range of 16% to 81% for obsessive thinking and ritualized-compulsive behaviours, in addition to a full OCD diagnosis. In a more recent study conducted in Denmark (Mouridsen, Rich, Isager & Nedergaard, 2008), relatively low rates of affective disorders (3.4%) and mood disorders (1.7%) were reported, indistinguishable from controls in the general population.

Autism has been regarded as having much overlap with schizophrenia in the early days. Currently, the construct of autism has been firmly separated from the latter as a distinct disorder. Volkmar and Cohen (1991) found from their sample a rate of schizophrenia of 0.6% which roughly equaled to that in the general population. Mouridsen et al. (2008) reported no significant difference in the percentage of schizophrenia between the autism group and the control group. Thus, there is no strong evidence to support that the rate of schizophrenia in autism is greater than that in the general population.

The above rates from Lainhart's review (1999) share the same vast ranges as those of the 32 studies being reviewed in this dissertation. It is believed that the same issues pertaining to heterogeneity in terms of sampling, methods of inquiry, assessment instruments and diagnostic criteria account for the wide ranges in rates of psychiatric disorders across studies. Furthermore, Hutton and colleagues (2008) delineated some of the intrinsic difficulties involved in the assessment of psychiatric problems in individuals with autism. Their inherent deficits in comprehending and describing abstract and emotional concepts, as well as communicating feelings and mood states might result in under-diagnosis of mood disorders (Leyfer et al., 2006; Stewart et al., 2006). The difficulty was even greater in detecting depression or anxiety in non-verbal adults with autism. Over-diagnosis of psychosis could also occur due to their unusual speech and mannerisms, flattened affect, concrete thinking and literal interpretation of language. They could be misunderstood as symptoms of psychosis (Volkmar & Cohen, 1991; Wing, 1986; Howlin, 2004). Differentiating obsessive compulsive symptoms and the repetitive and stereotyped behaviours of autism was no easy task either. This led Szatmari et al. (1989) to remark that it was ‘very difficult…to distinguish between obsessive ideation and the bizarre preoccupations so commonly seen in individuals with autism.’

In conclusion, although it is likely that comorbid psychiatric disturbances are present in adults with autism, studies so far report a wide range and there are inherent difficulties in assessing comorbid psychiatric disorders as noted above. Yet, some general pictures do emerge. Mood disorders such as anxiety and depression are commonly reported. Particularly, anxiety and depressive problems at sub-clinical level seem most prevalent. Rates of more severe mental illnesses such as schizophrenia have not been found to be greater than those found in the general population. OCD is often reported but the overlap between obsessive symptoms of OCD and the autistic type obsessions and ritualistic compulsions has created issues of differential diagnosis.

Psychopathology measured with personality inventory

A recent research by Ozonoff and colleagues (2005) explored psychopathology in adults of normal intelligence and diagnosed with autistic disorder or Asperger syndrome by asking them to fill out the Minnesota Multiphasic Personality Inventory-Second Edition(MMPI-2) and comparing their results with matched community controls. The autistic sample consisted of 20 participants of mean age of 23.0 and with mean FIQ of 104.7. Compared to the control group of university students, significantly large group differences were found on Scale 2 (Depression) and Scale 0 (social introversion), as well as medium group differences on scale 8 (Schizophrenia) and Scale 9 (Hypomania) on the Clinical Scales of the MMPI-2. With reference to the content scales, large group differences were found on the Social discomfort (SOD), while medium group differences on the Low Self-esteem (LSE) , work interference (WRK) and Negative treatment indicators (TRT). In all scales, the autistic group displayed higher scores than the control group. High scorers on clinical scale 2 (depression) was described by Greene (1993) as introverted, reclusive, aloof and maintaining psychological distance from other people and might have a restricted range of interests. A constellation of behaviours including discomfort in social situations, social reservation and social anxiety was ascribed to high scorers on the scales of social introversion and social discomfort. These behavioral characteristics were found to bear great similarities to the clinical picture of ASD. These findings as a whole suggested that the group of adults with autism had greater general psychopathology in terms of social isolation, interpersonal difficulties, depressed mood and coping deficits. Ozonoff and colleagues hence argued that MMPI-2 could be validly used for assessing personality and psychopathology in the autistic population. A small sample size (20) of adults with autism is the main limitation of the study.

2.2.5 IQ as an early indicator of outcome

As noted above, IQ has been found to be one of the best predictors of later outcome, besides early language development. Eleven out of the 32 studies under current review in this dissertation examine the contribution of childhood IQ to outcome (Rutter et al., 1967; Lockyer & Rutter, 1969; DeMyer et al., 1973; Lotter, 1974b; Gillberg & Steffenberg, 1987; Venter et al.,1992; Ballaban-Gil et al., 1996; Howlin et al., 2004; McGovern & Sigman, 2005; Billstedt et al., 2007; Shattuck et al., 2007; Eaves & Ho, 2008). Different studies address different aspects of outcome adjustment. For instance, Venter et al. (1992) found a strong association between early non-verbal IQ and achievement scores at follow-up. Some examined to what extent childhood IQ predicted changes in diagnosis or symptom manifestation (Howlin et al., 2004; McGovern & Sigman, 2005; Billstedt et al., 2007; Shattuck et al., 2007). McGovern & Sigman (2005) reported that participants with IQ ≥ 70 showed larger reduction in all areas of autistic deficits, namely social impairment, communicative impairment and repetitive behaviours and stereotyped interests when compared to those with IQ < 70. Similarly, in the study of Shattuck et al. (2007), the presence or absence of MR was found to be the most robust predictor of changes in autism symptoms and maladaptive behaviours. Significant correlations were found between childhood IQ scores and DISCO-ASD algorithm items, namely, social interaction, reciprocal communication and limited pattern of self-chosen activities (Billstedt et al., 2007). Childhood performance IQ was, however, found by Howlin and colleagues (2004) to associate only with social use of language but not with social communication and ritualistic behaviours.

In some studies, childhood IQs of individuals with good outcomes were compared to those with poor outcomes (Lockyer & Rutter, 1969; Lotter, 1974b; Gillberg & Steffenberg, 1987; Howlin et al., 2004). Individuals in the MR range were much more likely to stay in the 'poor' outcome range and those with IQ at least over 50 were more likely to be found with 'good' outcome. The value of IQ as a predictor seems to lie in differentiating the MR from the non-MR groups.

There are fewer data on the predictive value of IQ for individuals within the normal range of intelligence. A study by Howlin et al. (2004) is the rare exception. They examined the outcome of individuals with a childhood IQ above 70. Those adults with autism with an IQ over 100 did not have a better outcome than those in the IQ range of 70 to 99 in terms of overall outcome rating and the ADI ratings of social language use, communicative language and ritualistic behaviours.This led Howlin et al. (2004) to conclude that "it proved easier to identify correlates of 'poor' outcome than the variables predictive of good prognosis". In other words, higher IQ within the normal range might not be more predictive of a ‘good’ outcome, on top of a normal intelligence.

2.3 Outcome Studies in the Chinese Population

Research on autism in the Chinese population is scarce. A search on psycINFO up till November 2008 found only 30 articles, ten done in the Republic of China, ten in Taiwan and ten in Hong Kong. None is about adults with autism. Only two are follow-up studies, one about the application of the TEACCH program over a period of 12 months (Tsang et al., 2007) to a group of pre-school children. The other is a follow-up study on 66 children over a period from two to ten years (Chung et al., 1990). However, 86% of the children with autism is below 12 years of age at the follow-up. Their findings are still of interest since it is the only follow-up study available in Chinese population for an extended period of time. Of the 66 children in Chung et al.’s study, 58 were boys and eight were girls, and most were having IQs of MR range. On follow-up, 57% were at special schools, 12% at home with no education, 4.5% in training centers, while only 21% at normal schools. Common problems reported were poor attention, poor self-care, overactivity, inappropriate affect, irritability and temper tantrums. 45% were put on medication for their overactivity. 10.6% developed epilepsy. Over 80% of the children were in the mental retarded range and only 7% had an IQ over 100. With reference to Lotter’s criteria, 30% of the children was rated as having ‘good’ outcome, 47% ‘fair’, 18% ‘poor’, and 3% ‘very poor’. Even though Chung and colleagues concluded that the characteristics of their Chinese sample were strikingly similar to those of other countries, this sample had in fact very good outcome when compared to outcomes of older samples in the

32 studies under review in this dissertation. This Chinese study also provided evidence for IQ and language before five years as good predictors of outcomes.

2.4 Purpose of the Present Study

1. Previously, when the narrow definition of autism, i.e., infantile autism, was used, three quarters of children such diagnosed were intellectually impaired. In recent times when the construct of autism has been expanded to autism spectrum disorder (ASD) with corresponding increase of prevalence estimates (as discussed in section 1.3), three quarters of children such diagnosed are of normal intelligence (Skuse et al., 2004). Given the majority of individuals with autism currently diagnosed will be of normal intelligence, research efforts should be more devoted to them. As noted above, there is so far no study on the early adult outcomes of Chinese individuals with autism, not to mention those of normal intelligence. Little is known about whether their autistic diagnosis persists and how they are coping in their adulthood. The primary aim of this present research is to study a cohort of Chinese individuals with autism born in the 80s in Hong Kong who are currently at their early adulthood. Such information has both academic values in understanding the progress of a disorder since childhood as well as clinical values in considering service planning to the afflicted. This study will also fill the missing gap in the world literature regarding knowledge on Chinese adults with autism.
2. Chung and colleagues (1990) suggested in their discussion that the relatively good outcome might partly be explained by the relative young

ages of their sample, as there were views in some studies that significant deterioration would take place after adolescence (Gillberg & Shaumann, 1981; Rutter, 1970). This study, examining a group of Chinese adults with autism who come from around the same generation in Hong Kong as those in Chung et al.'s study, will test the above hypothesis, whether the good adolescent outcome may not be found again in early adulthood.

3. Previous literature has indicated the predictive power of intelligence on outcomes. However, as noted above, this predictive power lies between MR versus non-MR. There are few researches investigating the predictive power of intelligence within the normal range. Only one study by Howlin et al. (2004) attempted to look at this issue, but the findings had been negative. Given three quarters of currently diagnosed ASD children will be of normal intelligence, this issue deserves a re-visit and hence a replication test.
4. Finally, although autism has been established as a universal developmental disorder with children from every country and culture meeting the major triad of impairments, variation in outcomes can still be influenced by cultural factors. Outcome studies in the Chinese population in the East should provide valuable data for comparison with those collected in Western countries.

3. Objective of the Study

The present research is a cross-sectional study aiming at finding out about the outcomes and adjustment of a sample of Chinese high functioning individuals with autism in Hong Kong at early adulthood. Specifically, the following areas will be studied:

1. educational attainment and employment status as outcome measures;
2. diagnostic continuity ;
3. overall outcome rating comprising work, friendship, independence, autistic stereotyped behaviours and language;
4. IQ stability;
5. comorbid psychiatric disturbances;
6. relationship between diagnostic status and outcome measures;
7. childhood IQ as a predictor of outcome measures;
8. associations among outcome measures.

CHAPTER TWO

METHOD

1. Recruitment

An initial research proposal was first sent to the Clinical Research Ethics Committee of both the Chinese University of Hong Kong and the Kowloon West Cluster of the Hospital Authority. Ethical approval was granted in 2007 and data collection was completed in 2008 (Appendix 1).

Participants were recruited from 2 major sources. The majority was identified by the investigator who checked through all case files available at the Child and Adolescent Psychiatric Centre where she worked. Others were recruited through publicity to other centers and organizations having contacts with individuals with autism with normal intelligence and by word of mouth via parents (Appendix 2 & 3).

Participants to this study were selected according to the following criteria:

a) That they had been formally assessed as children (i.e. before 16 years of age) in the early 80s by a clinician, who could be a psychiatrist, a paediatrician or a clinical psychologist, and were given a diagnosis of any one of the followings: childhood autism, PDDNOS, atypical autism, Asperger syndrome or high functioning autism. During those times when child psychiatry was still under-developed, no standard manual on diagnostic criteria was agreed for use among local clinicians. It was only in the 90s that ICD-10 was adopted as the official diagnostic manual in the mental health services of the Hospital Authority. Also, there was a lack of standardized assessment instruments, and records understandably varied in terms of details and hence rendered verification on the accuracy of diagnosis almost impossible. Hence, no attempt was made to verify the diagnoses and classify the cases into subtypes. All participants with any of the above diagnoses would be regarded as having an Autism Spectrum Disorder (ASD);

b) that they were over 18 years old at the time of recruitment into the present study;

c) that they had studied in mainstream education;

d) that there was sufficient information to indicate that their childhood intelligence fell in the non-retarded range;

e) that recruited cases would be first assessed to ascertain that they had a current Full IQ equal or more than 75. Allowing for some margin of error in measurement, a cut-off score of 75 with the 95% confidence interval from 71 to 80 was adopted (Manual of WAIS-III, Taiwanese Version). So, it was very likely that the true score would lie within the normal range. This selection criterion ensured that the sample truly represented a group of individuals with normal intelligence.

Once cases meeting criteria a) to d) were identified from clinic case notes and other sources noted above, parents and their children with autism were contacted to invite them to participate in the study. Informed written consent was obtained from them.

2. Sample Characteristics

A total of 73 cases were identified from the computer records of the Child and Adolescent Psychiatric Clinic where the investigator worked from January to July 2007. Five files were destroyed because they were not used for over ten years. Four cases could not be traced because of incorrect contact phones and addresses. Two parents refused to participate. Consequently, 62 adults with autism who were cases of the Child and Adolescent Psychiatric Centre were recruited. Eight more families volunteered to join the project in response to publicity and by words of mouth but one case was dropped because the mother was very busy and eventually declined to be interviewed. So, there were seven more participants from sources other than the clinic, making up an initial sample of 69 individuals with autism. After assessment of their current intellectual functioning, four were found to have a FIQ score between 70 to 74 and one below 70. They were hence excluded from the study resulting in a final sample of 64 individuals

Of the 64 participants, 54 were first diagnosed before age 6 (84.4%), out of which 45 (70.3%) at age 3 or under. All but two had speech delay and received a mixture of diagnoses including autism, atypical autism and PDDNOS. The two without speech delay were diagnosed as Asperger Syndrome at age 9 and 13 respectively. Individuals were born between 1979 and 1988, with a mean age of 21.72 years (range 18 - 28; SD = 2.51). Fifty-nine were males and five were females. Only two lived away from home, one for work reason as she needed a place to teach children piano individually and the other because of severe conflicts with his mother.

Records of IQs at childhood, in terms of results of the Hong Kong Wechsler Intelligence Scale for Children (HK-WISC), were found in fifty participants. A full IQ score was available in 45 individuals. Thirty-nine out of these 45 participants had separate records of verbal and performance IQ scores. In the rest of the group, a full IQ range was known in two participants and another four had verbal and performance IQ range. The mean full IQ of the participants at childhood was 91.3 (n= 45; SD= 15.4; range 69 to 140), mean verbal IQ 85.8 (n= 39; SD = 16.2 ; range 51-121), and mean performance IQ 97.2 (n=39; SD = 14.7; range 69-126). The earliest assessment was conducted at 5 years 3 months and the latest at 15 years 3 months. The mean age at assessment was 9 years 9 months.

3. Measures

3.1 Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Taiwanese Version)

The WAIS-III (Wechsler, 1981) is an individually administered test of intellectual abilities for adults. It comprises of 14 separate subtests and measures verbal and non-verbal abilities. The score would range from 40-160, with a median of 100. The Chinese version of the WAIS-III was standardized in Taiwan in 2002 (Wechsler, 2002) and shared very similar properties in terms of its validity and reliability as the original test. The internal consistency reliability coefficients for individual subtests fell in the range of .65

to .92, being lowest for Picture Arrangement and Object Assembly and extremely high (>.90) for vocabulary, digit span, information and matrix reasoning subtests. The internal consistency reliability coefficients for IQ scales and indexes were very high, ranging from .89 to .98. The average test-retest stability coefficients for four pooled age groups ranged from .71 to .92. Interscorer reliability study for the Taiwanese version was not examined, and the coefficients of the original WAIS-III were quoted as being very high, averaging in the range over .90. Concurrent validity from the comparison with WAIS-R was excellent with correlation coefficients being .94, .86 and .93 respectively for VIQ, PIQ, and FIQ. Similarly, there were significant correlations with coefficients from .49 to .79 between VIQ, PIQ and FIQ and scores of Standard Progressive Matrices. In the present study, testing was performed by four testers who were well-trained in the administration of the WAIS-III (Taiwanese Version).

3.2 The Developmental, Dimensional and Diagnostic Interview (3Di)

The Developmental, Dimensional and Diagnostic Interview (3Di) is a standardized interview schedule for making diagnosis of ASD (Skuse, Warrington, Bishop, Chowdhury, Lau, Mandy, & Place, 2004). In its computerized format, it is an efficient tool for assessing autistic symptoms both for research and clinical practice. Test-retest and inter-rater reliabilities were reported to be excellent with most intra-class correlation coefficients greater than 0.9. Concurrent validity in terms its agreement with independent clinician formulation was very good with mean $\kappa = 0.74$. Criterion validity, obtained by comparing with the Autism Diagnostic Interview-Revised (ADI-R), was excellent. The agreement on scores above threshold for the three subscales from both 3Di and ADI-R ranged from 76% to 100%, and correlations between the subscales of the two instruments ranged from .53 to .64, ($p < .01$) . Discrimination between autism spectrum and non-individuals with autism was almost perfect (sensitivity=1.0; specificity > ,97).

The interview comprises of 183 items concerning demography, family background, developmental history, and motor skills. There are 266 questions directly or indirectly concerned with disorders on the autism spectrum and 291 questions that relate to current mental states, or information relevant to other diagnoses. Regarding the autism spectrum, a report with quantitative data on five subscales, namely reciprocal social interaction, social expressiveness, use of language and other communication skills, use of non-verbal gestures, and repetitive/stereotyped behaviors and routines can be generated. Areas assessed under each subscale are summarized in (Table 8). For diagnosis, only three subscales which depict the three main domains of autistic symptomatology are computed. They are reciprocal social interaction (Social), use of language and other communication skills (Communication) and repetitive/stereotyped behaviors and routines (Stereotyped Behaviours).

An ASD diagnosis is assigned to an individual only if the criterion of reciprocal social interaction is met. Algorithms in adherence to the ICD-10 conditions are used to determine subtypes of ASD such that individuals meeting cutoffs of all three subscales would be classified as having Autism (A), those meeting all three cut-offs but without language delay would be Asperger Syndrome (AS) and those meeting cutoffs of reciprocal social interaction and either of use of language and other communication skills or repetitive/ stereotyped behaviours and routines would be Atypical Autism (AA) (Table 9)

Table 8

Areas assessed in the ASD subscales of 3Di (Skuse et al., 2004).

ASD Subscale	Areas Assessed	Question count
1. Reciprocal social interaction skills	1. Use of non-verbal social cues 2. Peer and sibling relationships 3. Shared enjoyment 4. Emotional Reciprocity	59
2. Social Expressiveness	1. Peer and sibling relationships 2. Shared enjoyment	23
3. Use of language and other social communication skills	1. Use of conventional gestures 2. Conversational Interchange 3. Stereotyped, repetitive or idiosyncratic speech 4. Imaginative play	43
4. Use of gesture and non-verbal play	1. Use of conventional gestures 2. Imaginative play	21
5. Repetitive/stereotyped behaviours and routines	1. Circumscribed interests 2. Ritualistic Behavior 3. Simple and complex mannerisms 4. Non-functional use of objects	15

Table 9

Diagnosis according to 3Di algorithms (Skuse et al., 2004)

Subscales/ Variables	Diagnosis (above cutoff=yes; below cutoff=no)				
	Cutoff /maximum score	Autism	Asperger Syndrome	Atypical Autism	
Reciprocal social interaction skills	10/30	yes	yes	yes	yes
Use of language & other social communication skills	8/26	yes	yes	yes	no
Repetitive/stereotyped behaviours and routines	3/12	yes	yes	no	yes
Language Delay		yes	no	yes or no	yes or no

The 3Di has been translated into Chinese by a team of researchers and clinicians, the investigator being one of them. It is the beginning step of an on-going psychometric research with the aim of eventually producing a validated Chinese version of 3Di. The Short Interview module, comprising of 230 questions which cover information about first concerns, developmental milestones and all the 117 questions of the three main subscales for diagnosis, was used in the present study.

Three clinical psychologists, the investigator being one, who had received formal training in the administration of the 3Di conducted the interviews. Inter-rater reliability was computed with two interviewers interviewing ten participants together and rated responses independently. Intra-class correlations (ICC) were excellent being .99 (95% CI 0.97-1.00, $p < .001$), .99 (95% CI 0.95-1.00, $p < .001$) and 1.00 (95% CI 0.98-1.00, $p < .001$) for the three main subscales, Social, Communication and Stereotyped Behaviours, respectively.

3.3 The Chinese Minnesota Multiphasic Personality Inventory-2 (Chinese MMPI-2)

The original Minnesota Multiphasic Personality Inventory, or *MMPI*, was first published in 1943 by Hathaway and Mckinley who intended to design a test to aid clinicians in assigning psychodiagnostic labels to individuals. After extensive application to clinical work and the development of more validity scales, it transpired that although MMPI was able to separate normals from psychiatric patients (Morrison et al.,1994), it was not adequate to provide valid psychodiagnosis to patients or confidently differentiate among clinical groups (Graham, 2006). Over time, through the aggregation of data from numerous empirical research and clinical experience, the MMPI developed correlates for its scales so that scores were interpreted as a measure of the likelihood that the individual possessed the characteristics and behaviours known to be associated with that scale.

In late 1980's, a revision of the original MMPI had become necessary to re-standardize it with a more representative sample, to provide more updated normative data, and to realign some of its language and reference to more contemporary standards. The revised version, the MMPI-2, was published in 1989. Research into the comparability of MMPI and MMPI-2 had found that the same interpretation of MMPI scores could be applied to those of MMPI-2. The MMPI-2 has since replaced MMPI (Graham, 2006) and become the most widely used tool in assessment of personality and general psychopathology.

The MMPI and MMPI-2 are the most widely translated and adapted clinical tests of personality and psychopathology (Butcher, 1996). The Chinese MMPI–2 was developed and re-normed in Hong Kong and mainland China so that Chinese local norms were available for reference for this study (Cheung, Song, & Zhang, 1996). Test-retest reliability coefficients for both the clinical and content scales were very high in Hong Kong subjects, being .74 to .94 and .70 to .95 respectively. Internal consistency reliability was satisfactory, with a Cronbach's alpha coefficient of .63 for males and .64 for females for clinical scales and .76 for males and .77 for females for content scales. As for convergent validity, significant correlations were found between the overall score of General Health Questionnaire and seven out of the ten clinical scales (r= .21 to .35 , significant at .05 level). Similarly, significant correlations were found between the overall score of GHQ and ten out of the 15 content scales (r= .23 to .34 at .05 level).

The MMPI-2 contains 567 test items and takes approximately 60 to 90 minutes to complete. It can be administered to an individual or a group. Persons aged 16 and over and having completed at least 6 years of education can be expected to understand the Chinese MMPI-2. It has ten clinical scales and three validity scales plus a host of supplementary scales. The clinical scales are groups of items selected on the basis of their ability to discriminate empirically between a well-defined clinical group and non-clinical group. Given the shifts in diagnostic practices and criteria which had taken place since the development of MMPI, the diagnostic constructs attached to the scale names are no longer current (Helmes & Reddon, 1993) and the clinical scales are now referred by number rather than by name (Nichols, 2001, p287). Scores are interpreted as a measure of the likelihood that the individual possesses the characteristics known to be associated with that scale. The basic scales consist of Hypochondriasis (Scale 1), Depression (Scale 2), Hysteria (Scale 3), Psychopathic Deviate (Scale 4), Masculinity-Femininity (Scale 5), Paranoia (Scale 6), Psychasthenia (Scale 7), Schizophrenia (Scale 8), Mania (Scale 9), Social Introversion-Extraversion (Scale 0). The Content Scales, as the commonest supplementary scales, aim at tapping the problem themes of individuals which are organized psychometrically for meaningful interpretations. Items are selected on the basis of their rationally judged relationship to a clinical construct. Scores are then interpreted as measures of the extent individuals endorse the characteristics and problems summarized by the content scales. The Content Scales are: Anxiety, Fears, Obsessiveness, Depression, Health Concerns, Bizarre Mentation, Anger, Cynicism, Antisocial Practices, Type A, Low Self-Esteem, Social Discomfort, Family Problems, Work Interference, Negative Treatment Indicators. Raw scores are converted to T scores (M= 50, SD = 10) relative to normative data (Butcher et al., 2001). Scores of 65 or above are considered to be in the clinically significant range.

Taking cultural factors into consideration, Cheung et al. (2003) recommended some changes to the rules for interpreting score elevations. On top of the original validity scales, a Chinese Infrequency Scale (ICH) was developed and had been found to differentiate among normal respondents, individuals faking bad, and clinical groups. The ICH consisted of 15 items which were endorsed by less than 15% of both the Hong Kong and People of Republic China (PRC) normal respondents. The cut off score was set at ten. For the Variable Response Inconsistency (VRIN) scale, a raw score cut-off of 15 was suggested, while scores below 5 and above 14 were suggested as the cut-off for True Response Inconsistency (TRIN) scale in the screening of invalid protocols. Although research findings suggested the use of T-score of 60 as the cut-off in Chinese MMPI-2, Cheung et al. (2003) noted the greater probability of false positive classification of normal respondents with the use of T-score at 60 as the cut-off (which corresponded to the 84th percentile). With respect to US norms, the cut-off was set at 65, i.e., 92nd percentile. To be more conservative in order to avoid Type 1 error, and upon consultation with the original author of the Chinese MMPI-2 (Cheung, personal communication), a T-score of 65, which is the cut-off used with the US population, would be used in this study.

3.4 The Obsessive Compulsive Inventory-Revised (OCI-R)

The Obsessive Compulsive Inventory (OCI-R) is used in this study to obtain supplementary information on obsessive-compulsive symptoms, since the ‘obsessiveness’ subscale in the MMPI-2 does not tap adequately into them. The OCI-R (Foa, Kozak, & Salkovskis, 1998) is a 18-item self-report measure of obsessive- compulsive symptoms comprising of six symptom categories commonly found in OCD : washing, checking, ordering, obsessing, hoarding, and neutralizing. Items are rated on 5-point (0-4) Likert scales for severity of the associated distress. Foa et al. (2002) described the psychometric properties of the OCI-R in a sample of 118 individuals with OCD, 75 with generalized social phobia, 71 with posttraumatic stress disorder, and 74 with no mental health condition. The internal consistency was excellent for the total scores, with alpha coefficients ranging from .81 to .93 for the four groups. Test-retest reliability for the total scores was found to be excellent across a two-week time period for OCD patients (.74–.91) and good to excellent across a one-week period for non-anxiety controls (.57 –.87). The OCI-R was also positively correlated with other self-report measures of obsessive features (.66 with Global Obsessive-compulsive Scale and .85 with Maudsley Obsessive-Compulsive Inventory). Excellent discriminant validity was demonstrated in ROC analyses. The AUC for total score is .70 (95% CI=.66 -.74) between OCD patients and non-anxiety controls, and .81 (95% CI=.78 -.85) between OCD patients and anxiety control patients. A translated Chinese version of OCI-R is available for research purpose. The cutoff of 21, which is the optimal total score for differentiating OC patients and non-anxiety controls (sensitivity:65.6%; specificity:63.9%) (Foa et al., 2002), was used in this study.

3.5 Interview Schedule on Education, Employment, and Overall Outcome

An interview schedule that covered six areas of adjustment (Appendix 4 & 5), namely, educational attainment, employment history, friendship, independence, autistic-type stereotyped /repetitive behaviours and language, was designed. Based upon information gathered, an overall outcome rating was made according to the general criteria of Lotter (1974a). Among studies adopting the Lotter criteria, Howlin and colleagues (Howlin et al., 2000 & 2004) had so far provided the most detailed and specific explanations on the rating system. The present rating system was an adaptation of the criteria used in Howlin et al.'s studies. One deliberate deviation from the Howlin et al.'s criteria was leaving out living arrangement as a measure of independence for reasons unique to Hong Kong. It is common in Hong Kong that most unmarried adult children would live with their parents unless they earn enough money to find a separate lodging, but this is a huge financial burden in Hong Kong, given that housing is so expensive in a small city with more than seven million people. Also, the relatively scarce supply of hostels for special needs people implicates that one has to be very poor in functioning before a hostel place can be granted. Hence, living arrangement reflects more a financial consideration than an indication of someone's ability to live independently. Argument against the use of independent living as a parameter for measuring psychosocial functioning was also made by

Engstrom et al. (2003) who considered that public policy in support of independent housing for disabled people could have resulted in a higher figure for independent living.

The overall outcome rating is made on the basis of the following criteria:

1. work: (please note separate conditions if the participant is still studying)

   0: employed or self-employed. (*If still studying, in tertiary education or in high forms preparing for advanced level examination which was the entry qualification to colleges and universities in Hong Kong.)*

   1: low pay scheme or voluntary work/job training, where no supervision by a case worker is required. (*If still studying, in post-secondary training such as Institute of Vocational Education (IVE))*

   2: supported employment (working under the supervision of a case worker) *(If still studying, in skill training centres.)*

   3: no occupation or in sheltered workshops/special centres.

2. friendship:

   Normal interpersonal relationship was defined in Howlin et al. (2000) as "being with a person of approximately their own age and sharing activities with that person outside a formal group setting". The relationship also needs to involve "definite reciprocity and mutual responsiveness" to qualify as a "normal friendship".

   Frequency of friendships (Howlin 2004) was rated according to the numbers of friends/acquaintances the individual had, and *quality* according to the degree of sharing and mutual participation that the relationship involved.

0: normal relationship as defined above and more than1 close friend involving sharing and exchange of confidences and range of different activities together.

1: some limited friendship

2: no friends, but has acquaintances who are met in a group situation such as work or a club or in arranged settings

3: no friendships involving selectivity and sharing.

3. Independence:

    0: full independence, being able to cope with all self-care activities travel independently, and manage their own finances without help

    1: moderate independence, requiring some help in the above areas

    2: little independence, requiring significant help

    3: no independence.

4. Autistic-type stereotyped and repetitive behaviours: including a) unusual preoccupations; b) rituals/compulsions; c) resistance to change; and d) unusual attachment to objects.

    0: scoring on none of the above

    1: scoring on one

    2: scoring on two

    3: scoring on more than three

5. Language: a) able to use sentences with mature grammar; b) understands 2 or 3-step instructions, talks to others so that conversation flows; and c) able to build on other person's dialogue.

    0: scoring positively on all of the above

    1: scoring positively on two of the above

    2: scoring on only one

    3: scoring on none

The overall score can range from 0 to 15. The final categobrization of the overall outcome is performed in the following manner:

0-1: 'Near normal functioning'

2-4: 'Good'

5-9: 'Fair'

10 and over: 'Poor'

Two raters, the investigator being one and the other also a clinical psychologist, interviewed the individuals with autism and/or their parents either in person or by telephone, depending on their availability and preference. Inter-rater reliability was assessed on the ratings by each cross-scoring ten interview protocols blind. Intra-class correlations (ICC) were mostly good to excellent, being .97 (95% CI .93 - .99) for overall outcome rating, 1.0 for work, .94 (95% CI .85 - .97) for friendship, .77 (95% CI .52 - .90) for independence , .71 (95% CI .41 - .87) for language, and .87 (95% CI .69 -.95) for stereotype (Table 10).

Table 10
Inter-rater reliability on outcome ratings

	ICC	95% Lower Bound	95% Upper Bound
Work-	1		
Friendship	0.94	0.85	0.97
Independence	0.77	0.52	0.90
Language	0.71	0.41	0.87
Stereotype	0.87	0.69	0.95
Outcome Total	0.97	0.93	0.99

4. Procedure

1. The Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Taiwanese Version) was first administered to all individuals with autism who fulfilled the first four inclusion criteria (a-d) and consented to participate in the research. However, those who scored below 75 on the FIQ scale were excluded subsequently.

2. Those with a FIQ scored equal or above 75 were then asked to do two sets of self-rated questionnaires, the Chinese MMPI-2 and the translated Chinese version of the Obsessive Compulsive Inventory – Revised (OCI-R). As far as possible, participants filled out the questionnaires by themselves after test instructions were explained to them verbally. A student helper or the investigator would be available during this period so that the participants could seek clarification or assistance in case of difficulty in comprehending the questionnaire items.

3. Relatives who knew the participants well since childhood were invited for interview using the Developmental, Dimensional and Diagnostic Interview Schedule (3Di). In almost all cases, it was the mother who attended the interview. In a couple of cases, both parents came and in a particular

case, an aunt who took care of the autistic individual when young joined the parents in the interview.

4. Another interview was conducted either in person or over the phone with parents and/or individuals with autism to collect information on education, employment, independence, friendship and use of language, etc. As far as possible, information was gathered from both parties. However, a few individuals were found to be too poor in communication, and thus their parents became the main source of information.

5. Data Analysis

Descriptive statistics, such as frequencies, percentages and means, were used to report on the various indices of outcomes, namely, educational attainment, occupation, IQ, outcome ratings, and psychopathology, etc. Pearson's chi-square statistic was used for categorical data and one-way ANOVA, independent t-test or regression analysis were used for continuous data to explore the relationships between outcome indices and potential correlates.

CHAPTER THREE

RESULTS

1. Education

The educational level of the participants is defined according to the definitions used in the report of 2006 Population By-census (Census and Statistics Department, 2006) of the Department of Census and Statistics, HKSAR (2007) (Appendix 6). In Hong Kong, all children are entitled to nine years of compulsory education. Most would continue to study until upper secondary (Form 5) and take the public examination, Hong Kong Certificate of Education Examination (HKCEE). After secondary education, students in fact can have two main paths to further their study in Hong Kong. Those who do well in the HKCEE can obtain a place in sixth form which will prepare them for the Advanced Level Examination (ALE) which is the gateway to university education. Those who fail to meet the basic requirements for Form 6 entry can go through other channels such as the Institute of Vocational Education (IVE) to pursue diplomas, high diplomas or associate-degrees. Given the availability of such different pathways after secondary education, educational attainment in this study is classified in terms of three levels: secondary education which includes both lower and upper secondary schools, post-secondary vocational education which is made up diplomas, higher diplomas and associate-degrees, and post–secondary academic education which includes sixth form and degree courses. The latter is considered the highest level of educational attainment in this study.

In this study, all individuals had studied up to lower secondary school (From 3 level) as all children in Hong Kong did due to the educational policy of compulsory education up to that level. Five (7.8%) stopped at Lower Secondary education and twenty-two (34.4 %) reached upper secondary (Form 5 level), some without taking the public examination at the end of the high school curriculum. After leaving the secondary school, 20 out of 27 (74%) of these individuals left the educational system and sought various training which did not lead to any formal academic qualification but aimed at acquisition of some basic job skills. Of these 20 people, 16 (80%) studied in Skill Training Centres, two (10%) joined the Youth Pre-employment Training Programme offered by the Labour Department, while two (10%) went to the Hong Chi Pinehill Advanced Training Centre for Mentally Handicapped Persons.

For those who went on studying beyond Form 5, three (4.7%) were studying in Form 7 which prepared them for the Advanced Level Examination for university entry. Fifteen (23.4%) were either studying or having completed certificate or diploma courses in the Vocational Training Council and thirteen (20.3%) were able to enter into programs leading to Higher Diplomas or Associate Degrees. One lady was talented in music and she had successfully acquired the Licentiate and also the Fellowship from Trinity College of London (LTCL and FTCL) in Performance (Solo Piano) after she studied in a Diploma program in music composition in the Hong Kong International Institute of Music. Only six (9.4%) had reached a university education. Four were studying in a local university and two had acquired a degree by distance learning.

Compared to the educational attainment of individuals with matching ages to the current autistic sample (i.e., between 18 to 28), drawn from the 2006 Population By-census (see Table 11) (Census and Statistics Department, HKSAR, 2006) , the proportions of individuals attaining upper secondary education, from either the general population or the present sample, were similar at 33% and 34%. After leaving high school, the pathway of education of the autistic group became quite different from that of the general population. A much smaller percentage was able to enter into Form 6 to prepare for Advanced Level Examination (4.7% versus 10.3%), but the percentage engaging in study at the diploma or sub-degree level (43.7% versus 17.0%) was instead greater. Individuals taking diploma or sub-degree courses probably did not do well enough to enter Form 6 or they did not get good enough grades in the ALE to be admitted into universities. The proportion entering university was far smaller compared to the general population, being 9.4% versus 26.6%. It was thus fair to say that when compared to the population of similar ages, individuals in this study were underachieving in their educational attainment.

Table 11

Educational attainment[a]: Comparison with population aged 18-28[b]

	No. of participants (N= 64)	% in total no. of participants	% in total population (N= 1042018)
No schooling / Pre-primary	0	0.0	0.3
Primary	0	0.0	1.7
Lower Secondary	5	7.8	11.3
Upper Secondary (including Craft level)	22	34.4	33.1
Sixth form	3	4.7	10.3
Post-secondary - Diploma / Certificate	15	23.4	6.7
Post-secondary - Sub-degree course	13	20.3	10.0
Post-secondary - Degree course	6	9.4	26.6

[a] Definitions in Appendix 6

[b] Figures drawn from 2006 Population By-census Data, Demographic Statistics Section, Department of Census and Statistics

2. Employment

Twenty nine individuals (45.3%) were still studying or undergoing skill training. Two were never employed. Of all the 33 people having some kind of employment, 19 (57%) were engaged in full time open employment. Four (12%) worked in a family- or relative-run business. Four (12%) were in a Youth Work Experience & Training Scheme (YWET), which is a 12-month training program of the Labour Department that subsidizes half of the wage of the employed person while the employer pays the other half. The monthly wage is set at HK$4000 – a very low salary level in Hong Kong. Two (6%) worked under supervision in a supported employment scheme run by social service agencies. Two (6%) worked part-time, one in a printing company while another staying at home waiting passively for occasional calls from social agencies to distribute flyers on the street. Two (6%) were in sheltered workshops. Of the 19 in full time open employment, only five (15% of all with some kind of employment) were able to hold a full time paid job for over a year at the time of interview.

Nature of the jobs individuals took was classified according to the specifications in the Quarterly Report on General Household Survey, Census and Statistics Department, 2007 (Census and Statistics Department, 2007) (Appendix 7). Seventeen of all those in employment (51.5%) were doing elementary occupations such as cleaners, messengers, security guards or labourers. Two (6.1%) worked as technicians and seven were (21.2%) in service sectors working as waiters, shop assistants and programme assistants. Four (12.1.%) engaged in clerical jobs. One lady who acquired a high diploma in music was self-employed as a piano teacher while continuing her pursuit for higher qualifications in music performance. All part-time workers held unskilled jobs. The five stable full time workers consisted of a piano teacher, two programme assistants in a social service agency, an electrical technician, and a security guard.

Compared to individuals in the general population of matching ages to our autistic sample (i.e., between 18 to 28) (Table 12) (statistics from the Quarterly Report on General Household Survey, Census and Statistics Department, 2007), there were far fewer individuals in the autistic group who could secure high-level occupations. Only one individual, namely, the piano teacher (3.0%) could be classified as an associate professional whereas 29% in the matched general population were engaged in professional or managerial jobs. The percentage of people working as clerks was less than half of that in the general population (12.1% versus 25.0%). The proportions working as service workers and craft workers were comparable, being 21.2% versus 22.1% and 6.1% versus 5.0%, respectively. However, over half of the autistic group (51.5%) held unskilled jobs compared to 16.6% of their peers in the population. It appeared that as a group, the individuals with autism were engaged in more low-level jobs than the population of similar ages.

Table 12

Occupation[a]: Comparison with population aged 18-28[b]

	No. of participants (n= 33)	% in total no. of participants	% in total population (N= 1042018)
Managers and administrators	0	0.0	1.7
Professionals	0	0.0	6.7
Associate professionals	1	3.0	20.6
Clerks	4	12.1	25.0
Service workers and shop sales workers	7	21.2	22.1
Craft and related workers	2	6.1	5.0
Plant and machine operators and assemblers	0	0.0	2.1
Elementary occupations	17	51.5	16.6
Others	2	6.1	-

[a] Refer to Appendix 7 for definitions

[b] Figures drawn from General Household Survey, Q4 2007, of Census and Statistics Department

Out of 35 people who were not studying, two (5.7%) had never found a job. It was similar to the population statistics where the unemployment figure of persons aged between 18 to 28 was 4.8%. This finding suggested that the adults with autism did not have a higher rate of unemployment than their contemporaries.

2.1 Employment and Education

Chi-square test was run to examine the relationship between employment status and educational attainment. Results were significant ($\chi^2(2,N=33)=6.35$, $p=.04$), indicating that those better educated had higher level, skilled jobs (Table 13). However, with 50% of cells having observed counts less than five, the test results might not be validly interpreted. Chi-square test was re-run after collapsing education attainment to two levels, i.e., secondary and post-secondary, and results were also significant (χ^2(1,N=33)=4.53, *p*=.03). The same trend as in the former analysis was confirmed, i.e., the more highly educated would be more likely to find higher level, skilled jobs (Table 13). For example, 66.7% of those with post-secondary education were in skilled jobs.

Table 13
Education by 2 & 3 levels in skilled and unskilled workers

		Occupation				
		Skilled work (n=14)		Unskilled work (n=19)		
		n	%	n	%	χ^2
Education by 3 levels	Secondary	6	28.6	15	71.4	6.35*
	Post-secondary vocational	5	55.6	4	44.4	
	Post-secondary academic	3	100	0	0	
Education by 2 levels	Secondary	6	28.6	15	71.4	4.53*
	Post-secondary	8	66.7	4	33.3	

*$p < .05$

3. Diagnostic Status from 3Di

According to the diagnostic criteria of the 3Di, 21 participants (32.8%) no longer met any Autism Spectrum Diagnosis (NA group), 25 (39.1%) were diagnosed as having Atypical Autism (AA group) and 18 (28.1%) were having Autism (A group).

Among those 21 participants who did not have a diagnosis of autism, only seven (33.3%) could be regarded as no longer having any symptoms, as they scored below the cut-off on all three subscales, namely, ‘reciprocal social interaction skills’ (Social), ‘use of language and communication skills’ (Communication) and ‘repetitive/stereotyped behaviours and routines’

(Stereotyped Behaviours). Three (14.3%) were still impaired in their social functioning, 9(42.9%) in communication, while two (9.5%) in both communication and stereotyped behaviours. In other words, more than 60% of individuals without a diagnosis according to 3Di criteria still had some degree of autistic deficits. On the other hand, the 18 participants who scored above cut-off in all three subscales were given a full diagnosis of autism. All 25 participants meeting the criteria of Atypical Autism in 3Di were impaired in social functioning and communication, but not in stereotyped behaviours.

Correlations between the three subscales of 3Di were expectedly high and significant, as shown in Table 14.

Table 14
Pearson correlations between subscale scores of 3Di

	1. Reciprocal social interaction skills	2. Use of language and other social communication skills	3. Repetitive /stereotyped behaviours and routines
1. Reciprocal social interaction skills	-	.61(**)	.34(**)
2. Use of language and other social communication skills		-	.45(**)
3. Repetitive /stereotyped behaviours and routines			-

Note. N=64. ** Correlation is significant at the .01 level (2-tailed)

The mean scores of the three subscales for the whole group as well as for the three diagnostic groups are summarized in Table 15. Using one-way ANOVA statistical test, the diagnostic groups were significantly different from one another in all three subscales. The NA group had a mean of 7.8 in the social functioning subscale which was below threshold and differed significantly from the two autistic groups *(F(*2,61)=51.5, *p*<.001 *EF*=.63*)*. The differences in score were less prominent between the diagnostic groups in the communication subscale *(F(*2,61)=27.5, *p*<.001, *EF*=.48). It was noteworthy that the mean communication score at 8.2 of the NA group was above the threshold, reflecting again that the NA group was still poor in functioning in terms of language and communication skills. In the stereotyped behaviour subscale, only the A group had a mean score above the threshold and the AA group resembled the NA group with mean scores below the threshold *(F(*2,61)=29.5, *p*<.001, *EF*=.49).

Table 15
Mean scores of subscales of 3Di across 3 different diagnoses

			Reciprocal social interaction skills (cut-off score=10)			Use of language and other social communication skills (cut-off score=8)			Repetitive/stereotyped behaviours and routines (cut-off score=3)		
		N	M	SD	*F values*	M	SD	*F values*	M	SD	*F values*
Diagnosis	No Diagnosis	21	7.86	2.26	51.5*	8.24	2.39	27.5*	1.84	1.47	29.5*
	Atypical Autism	25	14.42	3.74		10.21	2.15		1.82	1.09	
	Autism	18	17.82	3.12		13.68	2.39		4.59	1.33	
	Total	64	13.23	5.08		10.54	3.12		2.61	1.79	

Note. **p* <.000

3.1 Diagnostic Status and Educational Attainment

The educational attainment of individuals belonging to different diagnostic groups are summarized in Table 16. Given that the sample size of 64 was relatively small for the chi-square test, the atypical autism (AA) and the autistic group (A) were first collapsed to form the autism spectrum disorder (ASD) group before comparing them on the three levels of educational attainment. Chi-square test results marginally missed the conventional significant level of .05, showing a trend better educaiton in the

NA group($\chi^2(2,N=64)=4.85$, $p=.08$) (Table 17). There was little difference in the proportions of individuals pursuing post-secondary academic qualification between groups, being 14.3% in NA and 14.0% in ASD group. Instead, the majority of the ASD group (51.1%) had only secondary education, while the majority of the NA group (61.9%) had post-secondary vocational education. The latter group thus appeared to have a higher level of educational attainment. In other words, diagnostic status was related to educational attainment.

When educational attainment was regrouped into two categories, namely, Secondary and Post Secondary Education, chi square analysis found a significant relationship ($\chi^2(1,N=64)=4.32$, $p=.03$). The trend as noted in the former chi-square analysis was confirmed. 76.1% of the NA group, as contrasted to 48.8% of the ASD group, had a post-secondary education (Table 17). Diagnostic continuity at early adulthood had led to lower educational attainment.

Table 16

Educational attainment of 3 diagnostic groups

		Educational Attainment						
Diagnosis		Lower Secondary	Upper Secondary	Sixth form	Post-secondary (Diploma/ Certificate)	Post-secondary (sub-degree course)	Post-secondary (Degree course)	Total
No Diagnosis	n	0	5	1	6	7	2	21
	%	.0%	23.8%	4.8%	28.6%	33.3%	9.5%	100.0%
Atypical Autism	n	2	9	1	6	4	3	25
	%	8.0%	36.0%	4.0%	24.0%	16.0%	12.0%	100.0%
Autistic Disorder	n	3	8	1	3	2	1	18
	%	16.7%	44.4%	5.6%	16.7%	11.1%	5.6%	100.0%
Total	n	5	22	3	15	13	6	64
	%	7.8%	34.4%	4.7%	23.4%	20.3%	9.4%	100.0%

Table 17

Educational attainment by 2 & 3 levels of 2 diagnostic groups

		Diagnosis				
		No Diagnosis (n=21)		Autism Spectrum Disorder (n=43)		
		n	%	n	%	χ^2
Educational attainment by 3 levels	Secondary	5	23.8	22	51.1	4.85
	Post-secondary vocational	13	61.9	15	34.8	
	Post-secondary academic	3	14.2	6	13.9	
Educational attainment by 2 levels	Secondary	5	23.8	22	51.1	4.32*
	Post-secondary	16	76.1	21	48.8	

Note. **p* <.05

Chi square tests were run to see whether the three areas of impairment in autism, as assessed by 3Di, might be related to 3-levels of education (Table 18). Education was found to be significantly related to social interaction skills (χ^2(2,N=64) =8.66, *p*=.01), but not to communication and stereotyped behaviours (χ^2(2,N=64) =2.66, *p*=.26; χ^2 (2,N=64) =1.98, *p*=.37 respectively). In order to meet the cell count requirement of the chi-square test, the analysis was re-run again with 2 levels of education (Table 18). Again, education was significantly related to social interaction (χ^2(1,N=64) =6.69, *p*=.01), but not to communication and stereotyped behaviours (χ^2(1,N=64) =.02, *p*=.87; χ^2(1,N=64) =1.95, *p*=.16 respectively). Both analyses indicated that the majority of those below threshold in the social interaction scale (non-clinical) had a higher educational attainment. For example, in the latter 2x2 chi-square test, 83.3% of those below threshold in the social interaction scale, as contrasted to 47.8% above threshold, had post-secondary education. In other words, deficits in social skills were related to lower educational attainment.

Table 18

Educational attainment by 2 & 3 levels of clinical and non-clinical groups in subscales of 3Di

		Reciprocal social interaction skills			Use of language and other social communication skills			Repetitive/stereotyped behaviors and routines		
		Non-clinical	Clinical		Non-clinical	Clinical		Non-clinical	Clinical	
		n (%)	n (%)	χ^2	n (%)	n (%)	χ^2	n (%)	n (%)	χ^2
Education by 3 levels	Secondary	3 (11.1%)	24 (88.9%)	*8.66**	4 (14.8%)	23 (85.2%)	*2.66*	16 (59.3%)	11 (40.7%)	*1.98*
	Post-secondary vocational	13 (46.4%)	15 (53.6%)		3 (10.7%)	25 (89.3%)		21 (75.0%)	7 (25.0%)	
	Post-secondary academic	2 (22.2%)	7 (77.8%)		3 (33.3%)	6 (66.7%)		7 (77.8%)	2 (22.2%)	
Education by 2 levels	Secondary	3 (16.6%)	24 (52.1%)	*6.68***	4 (14.8%)	23 (85.2%)	*.02*	16 (59.3%)	11 (40.7%)	*1.95*
	Post-secondary	15 (83.3%)	22 (47.8%)		6 (16.2%)	31 (83.8%)		28 (75.7%)	9 (24.3%)	

Note. * $p < .05$, ** $p < .01$

3.2 Diagnostic Status and Occupation

The types of occupation taken up by working individuals of different diagnostic status are summarized in Table 19 (n=33). Four out of eight in the autistic group were having elementary occupation and two were in sheltered workshops, together comprising 75% of the group. Again, a majority of atypical individuals with autism, i.e., nine out of 13 (69%), took up elementary work. The proportion of individuals with unskilled jobs was relatively smaller in the non-autistic group, being only 33% (4 out of 12 people).

Table 19

Occupations of 3 diagnostic groups

Diagnosis		Occupation						Total
		Associate professionals	Clerks	Service workers and shop sales workers	Craft and related workers	Elementary occupations	Others	
No Diagnosis	n	1	2	4	1	4	0	12
	%	8.3%	16.7%	33.3%	8.3%	33.3%	.0%	100.0%
Atypical Autism	n	0	1	2	1	9	0	13
	%	.0%	7.7%	15.4%	7.7%	69.2%	.0%	100.0%
Autistic Disorder	n	0	1	1	0	4	2	8
	%	.0%	12.5%	12.5%	.0%	50.0%	25.0%	100.0%
Total	n	1	4	7	2	17	2	33
	%	3.0%	12.1%	21.2%	6.1%	51.5%	6.1%	100.0%

Note. N=33

Due to the small sample size for chi-square test, occupation was regrouped by putting 'associate professionals', 'clerks', 'service workers and shop sales and workers' and 'craftman and related workers' into the skilled work category and 'elementary occupation' and 'others' into unskilled work category. Comparison of occupation across three diagnostic groups using two work categories did not find significant results (Table 20). When chi-square analysis was redone on two diagnostic groups (NA and ASD) instead of three, a significant relationship was found ($\chi^2(1,N=33)=4.53$, $p=.03$). A significantly larger proportion (8 out of 12, 66.7%) of individuals without a diagnosis was engaged in skilled work while the majority of the ASD group (15 out 21, 71.4%) was employed as unskilled workers (Table 20).

Table 20

Occupations by 2 categories of 2 & 3 diagnostic groups

		Occupation		
		Skilled work n (%)	Unskilled work n (%)	χ^2
Diagnosis by 3 levels	No Diagnosis	8(66.7%)	4(33.3%)	*4.60*
	Atypical Autism	4(30.8%)	9(69.2%)	
	Autistic Disorder	2(25.0%)	6(75.0%)	
Diagnosis by 2 levels	No Diagnosis	8(66.7%)	4(33.3%)	*4.53* *
	Autism Spectrum Disorder	6(28.6%)	15(71.4%)	

Note. * $p < .05$

The relationship between occupation and the 3 areas of impairment in autism, as assessed by 3Di, was examined. Occupation was found to be significantly related to social interaction (χ^2(1,N=33) =4.46, *p*=.03), but not to communication and stereotyped behaviours (χ^2(1,N=33) =.74, *p*=.38, χ^2(1,N=33) =1.31, *p*=.25 respectively) (Table 21). 70.0% of those below threshold in the social interaction scale of 3Di, as contrasted to only 30.4% above threshold, had skilled jobs. In other words, deficits in social skills were related to having unskilled jobs.

Table 21

Occupation by 2 categories of clinical and non-clinical groups of 3 subscales of 3Di

		Occupation		
		Skilled Work n (%)	Unskilled Work n (%)	χ^2
Reciprocal social interaction skills	Non-clinical	7(70.0%)	3(30.0%)	*4.47 **
	Clinical	7(30.4%)	16(69.6%)	
Use of language and other social communication skills	Non-clinical	3(60.0%)	2(20.0%)	*.75*
	Clinical	11(39.3%)	17(60.7%)	
Repetitive/stereotyped behaviors and routines	Non-clinical	12(48.0%)	13(52.0%)	*1.31*
	Clinical	2(25.0%)	6(75.0%)	

Note. **p* ≤.05

4. Overall Outcomes

4.1 Overall Outcome Rating

The overall outcome rating ranged from 0 to 15 scores, being a composite score derived from five categories all with a range from 0 to 3. They were classified into four levels (score 0-1 = near normal functioning; score 2-4 = good outcome; score 5-9 = fair outcome; score being 10 or over= poor outcome). Fifteen individuals (23.4%) were able to lead a life with ‘near normal functioning’. Twelve (18.8%) were considered to have ‘good’ outcome. Thirty one (48.4%) had ‘fair’ outcome and only six (9.4%) were in the ‘poor’ outcome range (Table 22).

Of the 15 individuals with ‘normal to near normal functioning’, six were still studying, two being university students, one studying at the Academy of

Performing Arts, one finishing an Associate degree and two in Form 6 preparing for advanced level examination. Of the nine working, one worked under the YWET program, one handled logistics in his father's company, seven were in open employment of various kinds. The only female in the group was a piano teacher. Others were a clerk, a programme/activity assistant, an electrical technician, a security guard, a store keeper, and a warehouse labourer. Two currently had a girl-friend and three had had some short-term relationships. To various degrees, all had a couple or a small group of friends whom they would go out with to have meals together, go shopping (most often than not, in computer shops), or sing karaoke with. With people they were at ease with, they could talk freely, building on dialogues, although the tendency to talk rather than listen was still common. Parents of some of them would describe their grown-up children as 'not being very different from people of his/her age'. They were able to go around places on their own and take care of their own money.

Of the 12 individuals in the 'good' outcome category, five were students, two in the university, and three studying in a High Diploma program. Seven were working. One was a clerk, two worked as a programme assistant in schools, one a program assistant in social service agency, and one a parcel deliverer. The only lady was an office assistant. The last one helped in his father's company. But his main interest was drawing comic books and he came to know some friends who shared this interest. Their circle of friends was relatively small. While two seemed to be contented with being alone, most of them showed a desire to make friends, but seemed somehow limited in skills to express themselves well and to keep friendship. They could maintain simple conversation and reply appropriately, but might not be able to elaborate well and might occasionally wander off to other topics. People conversing with them might find them somehow not quite the same as their peers. Most had no difficulty handling money for daily needs.

Fifteen of the 31 individuals having a 'fair' outcome were still studying. One was in an Associate Degree program, most were studying in a diploma course at the Institute of Vocational Education (IVE), and two were in the Youth College (which was a form of bridging courses for Form 5 school leavers unable to further study. A lady never worked. Fifteen had various kinds of day time occupation. Of the five in open employment, two were in parcel delivery, one was a waitress, one was a school clerk, and the other was a programme assistant in a social service agency. Three worked in the family's business. Others were in the YWET program or supervised work experience and part-time work. They were a group of individuals with difficulties in various areas of adjustment. Most were not able to make friends on their own, might meet acquaintances in arranged settings or activities, and were barely able to keep a simple dialogue of questions and answers. While a lot could travel around quite independently, they were probably not trusted with managing their money.

Among the six individuals with 'poor' outcome, two worked in a shelter workshop, one never worked, two were in special skill training centres, and one was repeating Form 5. None were able to make any friends and few seemed interested in people outside their family, although one would join activities arranged for him by his mother. Two seemed unable to travel by themselves and were reliant on their mother while going out. A lot still had preoccupation and stubborn behaviours. Repetitive speech and questioning were common. The only lady worked in a sheltered workshop and she was very happy living a life between the sheltered workshop placement and her interests which consisted of collecting Japanese singer albums, reading comics, and consuming snacks. The 19-year-old young man with the poorest score actually had a FIQ of 99, yet he was very much preoccupied with his own ideas which were related to news and political figures of the world. On these topics, he would repeat them to himself or seek others' confirmation repetitively. His parents still took care of him as a young boy so much so that he was totally dependent on his mother. He was put through various training programmes without really learning any skills.

Table 22
Distribution of overall outcome rating

	Frequency	Percent	Cumulative Percent
Near normal functioning (0-1)	15	23.4	23.4
Good (2-4)	12	18.8	42.2
Fair (5-9)	31	48.4	90.6
Poor (10 and 0ver)	6	9.4	100.0
Total	64	100.0	

Note. N=64

4.2 Outcomes in terms of the 5 Separate Categories

Work

Twenty-nine individuals (45%) in the sample were still studying and they were rated in the 'work' category according to their academic attainment. The majority of the students (26 out of 29, 89%) was in post-secondary education and was rated in the ‘near normal’ and ‘good’ outcome categories. Three individuals (11%) undergoing training in training centers for the handicapped were rated as having ‘fair’ outcome. Of all the people having a job (n=33), 27 (82%) were able to engage in some form of salary-earning work without close supervision, either in open employment or Labour Department assisted jobs, and they were rated in the ‘near normal’ and ‘good’ outcome categories. Only six fell in the ‘fair’ and ‘poor’ outcome range. So, the group as a whole was actively engaged in a job or study and few stayed idle at home.

Friendship

In terms of friendship, there was a fairly even spread in distribution from ‘good’ to ‘poor’ outcomes, but with a skew in the direction of poor adjustment. Thirteen (20%) individuals had normal relationship with friends, meaning that they had at least one friend of their age and would meet them outside a group setting. Two had a girl-friend currently and three had a relationship before which was either brief or unsatisfactory. Fifteen (23%) had limited friendship meaning that they would go out with friends, but the relationship was relatively superficial and they were unable to share deeply. 17 (26%) had no friends apart from acquaintances they met in group situations such as church gathering or activities together with other individuals with autism, usually arranged by parents. Nineteen (almost 30%) had no friends at all.

Independent living

Considering their ability for independent living, the group as a whole had the least problems comparing to their adjustment in other areas. Thirty three (52%) had no problems in self-care, traveling by themselves, and managing their own finance in a simple way. Twenty eight (44%) had no problems in self-care and independent traveling, but were not trusted with managing their money. Only three (4.7%) were largely dependent on their family members in self-care, required company to travel, and did not have a clear money concept.

Stereotyped and repetitive behaviours

With regard to autistic-type stereotyped and repetitive behaviours, the group as a whole did not seem to be affected greatly by these symptoms. Twenty eight (44%) individuals reported no unusual preoccupations, rituals or compulsions, and were not bothered by changes in routines or rituals. Twenty five (39%) however still reported having one of the above autistic characteristics. Eleven (17%) seemed to be still affected greatly by these symptoms having at least two of the stereotyped characteristics.

Use of language

In terms of their use of language, all were able to use sentences with mature grammar. Twenty (31%) could take instructions from others and maintain some flow in simple conversations. Sixteen (25%) were able to build on others' dialogue and followed others' topics of interest. However, twenty eight (44%) were unable to engage or maintain conversations with others.

4.3 Overall Outcome and Educational Attainment

In Table 23, all five individuals who stopped at lower secondary education had only ‘fair’ or even ‘poor’ outcome. The majority (15 out of 22, 68.2%) of those finishing higher secondary schools also had ‘fair’ or ‘poor’ outcome. All the three students studying in sixth form were functioning in the ‘good’ or ‘near-normal’ range. Those having studied beyond secondary school up to certificate and diploma level (n=15) were quite spread out in terms of their overall outcome, with three (20%) having ‘near normal’ functioning, three (20%) ‘good’ outcome, eight (53.3%) ‘fair’ outcome and one (6.7%) ‘poor’ outcome. The range of spread of the overall outcome was similar in the group finishing postsecondary education up to high diploma or sub-degree level (n=13), with three (23.1%) with ‘near normal’ functioning, three (23.1%) ‘good’ outcome, seven (53.8%) ‘fair’ outcome. A great majority (83.3%) of the group having acquired or studying for a university degree (n=6) functioned either in the ‘near normal’ or ‘good’ outcome range.

Table 23
Educational attainment of different overall outcome groups

		Educational Attainment						
Overall outcome		Lower Secondary	Upper Secondary	Sixth form	Post-secondary (Diploma/ Certificate)	Post-secondary (sub-degree course)	Post-secondary (Degree course)	Total
Near normal functioning	n	0	4	2	3	3	3	15
	(%)	(0%)	(18.2%)	(66.7%)	(20%)	(23.1%)	(50%)	
Good	n	0	3	1	3	3	2	12
	(%)	(0%)	(13.6%)	(33.3%)	(20%)	(23.1%)	(33.3%)	
Fair	n	4	11	0	8	7	1	31
	(%)	(80%)	(50%)	(0%)	(53.3%)	(53.8%)	(16.7%)	
Poor	n	1	4	0	1	0	0	6
	(%)	(20%)	(18.2%)	(0%)	(6.7%)	(0%)	(0%)	
Total	n	5	22	3	15	13	6	64
	(%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	

Due to the small sample size for chi-square analysis, overall outcome rating was collapsed into three broader categories, by collapsing 'near normal functioning' with 'good' outcome and those with 'fair' or 'poor' outcome. When the outcomes of the three groups in three educational levels were compared, the chi-square value was significant ($\chi^2(4, N=64) = 13.6$, $p<.001$) (Table 24) . 88.9% and 42.8% of those participants with respectively post-secondary academic educationi and post-secondary vocational education had 'near normal'/'good' outcome, in contrast to 25.9% of those with only secondary education. Thus, better education appeared to be related to better overall outcome.

Chi-square test was done again by collapsing overall outcome into two levels because there were too many cells not meeting the required cell counts. Significant relationship was also found ($\chi^2(2, N=64) = 10.9$, $p<.001$ (Table 24). The results confirmed the findings of the former 3x3 chi-square test. The majority of the secondary school leavers (74.1%) had a 'fair'/'poor' outcome, while all but one of those pursuing or having acquired university qualifications (88.9%) functioned in the 'near normal'/'good' outcome range.

ANOVA was run to compare the overall outcome rating of individuals in three levels of education. Results were significant as well (Table 25)($F(2, 61) = 7.40$, $p<.001$, $EF=.19$). Again, those attaining post-secondary academic education had the lowest (best) overall outcome rating, followed by those with post-secondary vocational education, while the secondary school leavers had the highest (worst) rating. In sum, individuals with better education seemed to have better outcome than those with poorer education.

Table 24
Educational attainment by 3 categories of different outcome groups

		Educational Attainment			
		Secondary	Post-secondary vocational	Post-secondary academic	
		n (%)	n (%)	n (%)	χ^2
Overall outcome in 3 levels	Near normal functioning / good	7 (25.9%)	12 (42.8%)	8 (88.9%)	*13.6**
	Fair	15 (55.6%)	15 (53.6%)	1 (11.1%)	
	Poor	5 (18.5%)	1 (3.6%)	0 (0%)	
Overall outcome in 2 levels	Near normal functioning / good	7 (25.9%)	12 (42.9%)	8 (88.9%)	*10.9***
	Fair/poor	20 (74.1%)	16 (57.1%)	1 (11.1%)	

Note. **p≤.01

Table 25
Mean overall outcome rating of 3 educational levels

		M	SD	n	*F value*
Education	Secondary	6.44	3.63	27	*7.40****
	Post-secondary vocational	4.43	2.69	28	
	Post-secondary academic	2.11	2.26	9	
	Total	4.95	3.38	64	

Note. ****p* ≤ .001. Lower score = better outcome

One of the categories contributing to the overall outcome rating is 'work'. Since educational attainment was used as an index of work adjustment with individuals still studying, overlap with the overall outcome rating was expected and perhaps accounted partly for the significant relationship between educational attainment and overall outcome. In order to avoid the bias caused by this overlap, a second overall outcome index was created by removing the 'work' score from the overall outcome rating. ANOVA was conducted on this 'outcome-without-work' rating using the 3-category educational groups. Results were also significant (*F(*2, 61) =6.22, *p<.001*, *EF*=.17) (Table 26), confirming the findings of above analysis with the full overall outcome index and indicating that educational attainment was also strongly associated with an overall outcome measure comprising of only friendship, independent living, autistic-type behaviours, and language use. Hence, individuals pursuing or having acquired post-secondary academic education were more likely to have a better outcome (i.e., a lower (better) outcome rating) than those acquiring or having acquired post secondary vocational qualifications, while the secondary school leavers were more likely to have a poorer outcome (i.e., the highest (worst) outcome rating).

Table 26
Mean outcome ratings (without work) of 3 educational levels

		M	SD	n	*F value*
Educational Attainment	Secondary	5.26	2.77	27	*6.22***
	Post-secondary vocational	3.75	2.37	28	
	Post-secondary academic	2.00	2.18	9	
	Total	4.14	2.73	64	

Note. ***p*≤.01 Lower score = better outcome

4.4 Overall Outcome and Occupation

The relationships between overall outcome and occupation are summarized in Table 27. The piano teacher who was the only one belonging to the associate professional category had ‘near normal’ functioning. One clerical assistant had ‘near normal’ functioning, two with a ‘good’ outcome but one had a ‘fair’ outcome. In the service worker category (n=7), four were programme assistant at social service agencies, and two of them had ‘near normal’ functioning, one a ‘good’ outcome, and one a ‘fair’ outcome. One waiter could function in the ‘near normal’ range, but another waitress had only 'fair' adjustment. One who was a shop assistant functioned well in the 'near normal' range. So, altogether in this service work category, three (42.8%) was in the 'near normal' range, two (28.6%) had a 'good' outcome and two (28.6%) had a 'fair' outcome. In the craftman category, there were only two individuals, one was a taxi meter technician who had 'near normal' functioning while the other was a school IT assistant but he only had a 'fair' outcome. In the elementary occupation (n=17), three (17.65%) who functioned as 'near normal' were a messenger in a family business, a store keeper, and a watchman. Three (17.65%) having a 'good' outcome consisted of two messengers and a handyman at his father's business. The majority (11 out of 17, 64.7%) who were employed as cleaners, office assistants and labourers had a 'fair' outcome. The two individuals who worked in sheltered workshops were the only two with a 'poor' overall outcome.

Table 27
Occupation of different overall outcome groups

		Occupation						
Overall Outcome		Associate professionals	Clerks	Service workers and shop sales workers	Craft and related workers	Elementary occupations	Others	Total
Near normal functioning	n	1	1	3	1	3	0	9
	(%)	(100%)	(25%)	(42.80%)	(50%)	(17.65%)	(.0%)	
Good	n	0	2	2	0	3	0	7
	(%)	(.0%)	(50%)	(28.60%)	(.0%)	(17.65%)	(.0%)	
Fair	n	0	1	2	1	11	0	15
	(%)	(.0%)	(25%)	(28.60%)	(50%)	(64.70%)	(.0%)	
Poor	n	0	0	0	0	0	2	2
	(%)	(.0%)	(.0%)	(.0%)	(.0%)	(.0%)	(100.0%)	
Total	n	1	4	7	2	17	2	33
	(%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)	

Given our small sample size, categories were first collapsed for the chi square test. When it was run on three levels of outcome and two categories of occupation, results just missed statistical significance (χ^2(2,N=33) =5.64 , *p*=.06) (Table 28). Outcome was then further combined into two levels (near normal functioning and good outcome as one category and fair to poor into another category) to re-run the chi square test, significant results were found (χ^2(1,N=33) =5.12 *p*=.02) (Table 28). The majority of the skilled workers (10 out of 14, 71.4%) had 'near normal'/'good' functioning, while the majority of the unskilled workers (13 out of 19, 68.4%) had 'fair'/'poor' outcome. Independent-sample t-test was run also to compare the overall outcome rating of skilled and unskilled workers. Results were again significant (Table 29) (*t*=-2.41, *df*=31, *p(2-tailed)*=.02, *effect size*=.85). The skilled workers had a significantly lower (better) rating than that of the unskilled workers.

Table 28

Occupation by 2 categories of different outcome groups

		Occupation		
		Skilled work n (%)	Unskilled work n (%)	χ^2
Overall outcome in 3 levels	Near normal functioning / good	10 (71.4%)	6(31.6%	*5.64*
	Fair	4 (28.6%)	11 (57.9%)	
	Poor	0 (.0%)	2 (10.5%)	
Overall outcome in 2 levels	Near normal functioning / good	10 (71.4%)	6 (31.6%)	*5.12**
	Fair/poor	4 (28.6%)	13 (68.4%)	

Note. **p* ≤.05

Table 29

Mean outcome rating of occupation by 2 categories

		M	n	SD	SE	*t* value
Occupation (Outcome total)	Skilled work	3.00	14	2.57	0.69	*-2.41**
	Unskilled work	5.58	19	3.34	0.76	

Note. **p* ≤.05 Lower score = better outcome

Once again, the 'work' category in the overall outcome rating might partly inflate the relationship between occupation and overall outcome. So the 'work' score from the overall outcome rating was removed and a new 'outcome-without-work' rating was used for re-analysis. A t-test was run comparing the 'outcome-without-work' rating between skilled and unskilled work groups. The results were also significant (*t*=-2.20, df= 32, *p*=.03) (Table 30), confirming the findings of previous analyses and suggesting that occupation was strongly associated with overall outcome in areas other than work. The skilled workers had a lower (better) outcome rating than that of the unskilled workers.

Table 30

Means outcome rating (without-work) of occupation by 2 categories

		M	n	SD	SE	*t* value
Occupation	Skilled work	2.71	14	2.43	0.65	*-2.20**
	Unskilled work	4.68	19	2.63	0.61	

Note. **p* ≤.05 Lower score = better outcome

5. IQ

5.1 IQ Stability

5.1.1 Stability in terms of group means

By virtue of the inclusion criteria, all participants had a current Full IQ equal to and over 75. The mean full IQ was 96.4 (SD=13.2; range 75-129), mean verbal IQ was 96.3 (SD= 13.7; range 73-128) and mean performance IQ was 97.3 (SD=14.7; range 72-139).

Fifty participants (78.1%) were found to have been tested on the Hong Kong Wechsler Intelligence Scale for Children (HK-WISC) at a younger age. The average time gap between their first assessment and the current one was 11 years 7months (SD= 40.4 months ; range 4 years 1 month to 18 years 10 months). The earliest assessment was conducted at 5 years 3 months and the latest at 15 years 3 months. The mean age at assessment was 9 years 9 months. Forty-five had records of a full IQ score and 39 had records of verbal and performance IQ. In one participant, there was a record of only IQ range but not exact scores. Only full IQ range was known in two participants and another three had only verbal and performance IQ range. The childhood mean full IQ was 91.4 (n= 45; SD=15.4; range 69-140), mean verbal IQ was 85.8 (n= 39; SD=16.2 ; range 51-121) and mean performance IQ was 97.2 (n=39; SD=14.73; range 69-126) (Table 31). Correlations between current and Childhood IQs were highly significant (childhood-current FIQ r=.77, n=45, *p*<.01; childhood-current VIQ r=.68, n=39, *p*<.01; childhood-current PIQ r=.56, n=39, p<.01) (Table 32). Intra-class correlations were also computed and were highly significant for all measures of IQs, being .828 (95%CI .607-.916

p<.001) for FIQ, .718 (95%CI .116-.884 *p*<.001) for VIQ, .714 (95%CI .450-.850 *p*<.001) for PIQ (Table 33)

Table 31

Mean current and childhood IQs

	M	n	SD
Full IQ	96.4	64	13.2
Full IQ (childhood)	91.4	45	13.7
Verbal IQ	96.3	64	14.9
Verbal IQ (childhood)	85.8	39	16.2
Performance IQ	97.3	64	14.7
Performance IQ (childhood)	97.2	39	16.2

Table 32

Pearson correlations between childhood and current IQs

	Full IQ	Verbal IQ	Performance IQ	Full IQ (child-hood)	Verbal IQ (child-hood)	Performance IQ (child-hood)
Full IQ	-	.91(**)	.86 (**)	.77(**)	.64(**)	.51 (**)
Verbal IQ		-	.57(**)	.66 (**)	.68(**)	.33(*)
Performance IQ			-	.64(**)	.35(*)	.56(**)
Full IQ (childhood)				-	.83(**)	.77 (**)
Verbal IQ (childhood)					-	.28
Performance IQ (childhood)						-

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 33

Intra-class correlations between childhood and current IQs

	ICC	95% Lower Bound	95% Upper Bound
Current FIQ - Childhood FIQ	.828	.607	.916
Current VIQ – Childhood VIQ	.718	.116	.884
Current PIQ – Childhood PIQ	.714	.450	.850

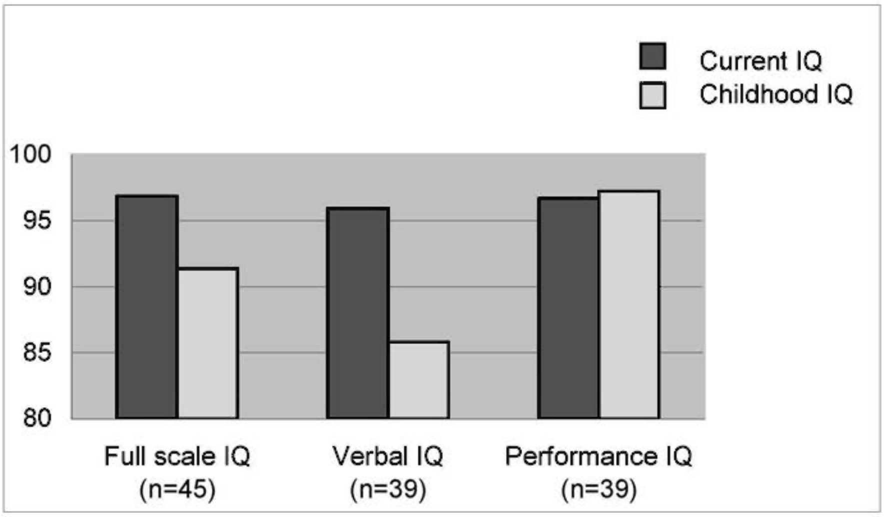
p<.001

Comparison using paired sample t-test (Table 34) found that the mean FIQ of the group had significantly improved by 5.3 IQ points (*t*=3.58, *df*=44, *p*<.001, *ES*=0.37) and the mean VIQ had also significantly improved by 10.1 IQ points (*t*=5.01, *df*=38, *p*<.001, *ES*=0.65). PIQ, however, remained more or less similar at a mean of 96.8 (current) and 97.2 (childhood). The differences in childhood and current IQ were shown in Figure 1. Results suggested that on the whole, changes in intellectual functioning in terms of FIQ and VIQ took place in a positive direction. There was, however, little change in PIQ. The above were group means. It might be possible that there were changes in individual IQs, including PIQ, which were not reflected in group means. This would be studied in the ensuing section.

Table 34
Paired samples t-test for current IQs versus childhood IQs

	M	SD	*t*	*df*	*p*	*ES*
Full IQ - Full IQ (childhood)	5.3	10.0	3.58	44	.00	.37
Verbal IQ - Verbal IQ (childhood)	10.1	12.6	5.01	38	.00	.65
Performance IQ - Performance IQ (childhood)	-.36	14.2	-.16	38	.87	–

Figure 1. Comparison of means between current and childhood IQ



5.1.2 Stability in terms of IQ levels

The overall increase in FIQ and VIQ, though statistically significant, might not bear significant clinical implication. As mentioned previously, changes in IQ points should be at least one standard deviation to be clinically meaningful (Dietz et al., 2007). Hence, in order to examine IQ changes in terms of clinical significance, the IQs of the present sample were grouped into three levels, namely, 'below average' for scores between 75 to 89, 'average' for scores between 90 to 109 and 'above average' for those equal and over 110.

The proportions of individuals who remained in the same level of intelligence from childhood to early adulthood were similar in all three types of IQs, ranging from 53.5% to 58.1%, but the pattern of changes in IQ levels in PIQ appeared very different from that of VIQ and FIQ (Table 35). Chi square test yielded significant results (χ^2(4,N=133) =12.9, *p*=.01). There were significantly more individuals who moved up than moving down in FIQ and VIQ level. Sixteen out of 20 (80%) individuals whose FIQ had changed improved and four had an increase of over 15 points (range= 19-28). Sixteen out of 18(88.9%) whose VIQ had changed improved and 12 had an increase of over 15 points (range= 15-42). Only a small proportion in FIQ and VIQ moved down in levels (4 out of 20 , 20% and 2 out of 18, 11.1% respectively), and only two dropped over 15 points in FIQ and none dropped below 15 points in VIQ. In contrast, only eight out of 20 (40%) of those moved up the level in PIQ, whereas 12 out of 20 (60%) in fact deteriorated. Five improved over 15 points (range=16-30), but eight dropped more than 15 points (range= 15-31). So, it appeared that there was relatively more variability in changes in

PIQ. Hence, the apparent similarity in group means of childhood and current PIQ might not be interpreted as a lack of change. It was very likely the result of the presence of both positive and negative changes which cancelled one another out when group means were computed.

Table 35
Comparison of changes in IQ levels

	FIQ	VIQ	PIQ	
	n (%)	n (%)	n (%)	χ^2
no change in level	27(57. 5%)	25(58.1%)	23(53.5%)	*12.9***
positive change in level	16(34.0%)	16(37.2%)	8(18.6%)	
negative change in level	4(8.5%)	2(4.7%)	12(27.9%)	

Note. ***p*≤.01

In summary, in terms of group means, significant increases were found in FIQ and VIQ, but not PIQ, over time. When comparisons were made in terms of changes of IQ levels, over half of the sample remained in the same level in all three categories of IQs, suggesting that IQs had been stable across time for the majority of the group. Where changes took place, there were more improvement than deterioration in FIQ and VIQ. However, more variability was noted in the changes of PIQ levels such that the proportions of positive and negative changes were quite similar.

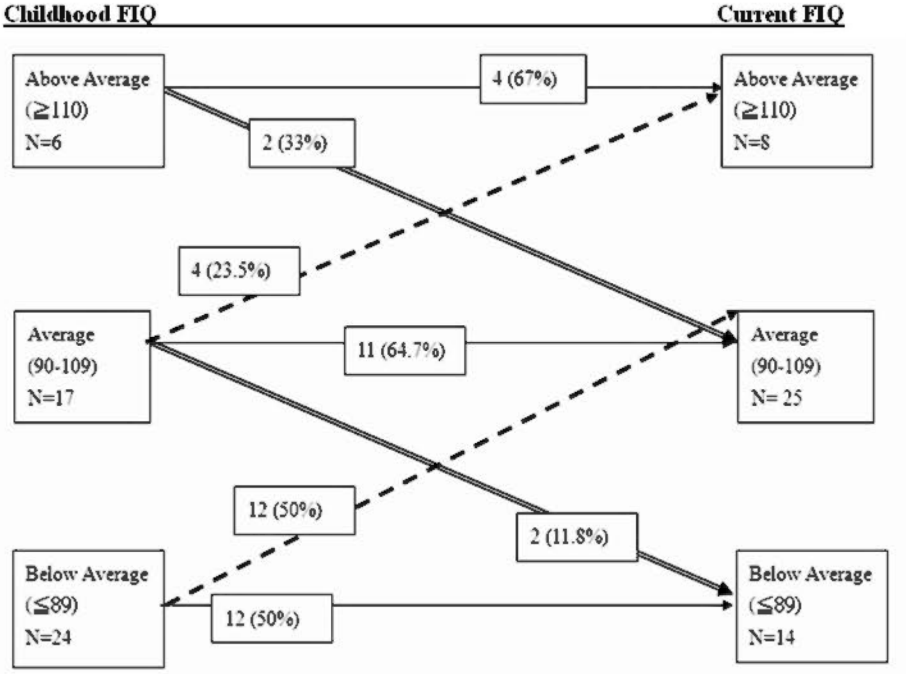
5.1.3 IQ stability and childhood IQ levels

IQ changes were also examined in terms of childhood IQs. Changes in FIQ levels are summarized in Table 36 and Figure 2. More than half of the individuals stayed in the same level of their childhood FIQs in early adulthood, 12 out of 24 (50%) in the below average range, 11 out of 17 (64.7%) in the average range, and four out of six (67%) in the above average range. Twelve (50%) of those in the below average range in childhood progressed one level up in early adulthood. Four (23.5%) in the average group had improved by one level, but two(11.8%) moved to the below average level. Two (33%) in the above average range were found to have deteriorated and moved down by one level.

Table 36
Change of FIQ level from childhood to early adulthood

	Current FIQ			
Childhood FIQ	Above Average (≧110)	Average (90-109)	Below Average (≦89)	n
Above Average	4 (67.0%)	2(33.0%)	0	6(100%)
Average	4(23.5%)	11(64.7%)	2(11.8%)	17(100%)
Below Average	0	12(50.0%)	12(50.0%)	24(100%)
N	8(17.0%)	25(53.2%)	14(29.8%)	47(100%)

Figure 2. Stability of FIQ level from childhood to early adulthood

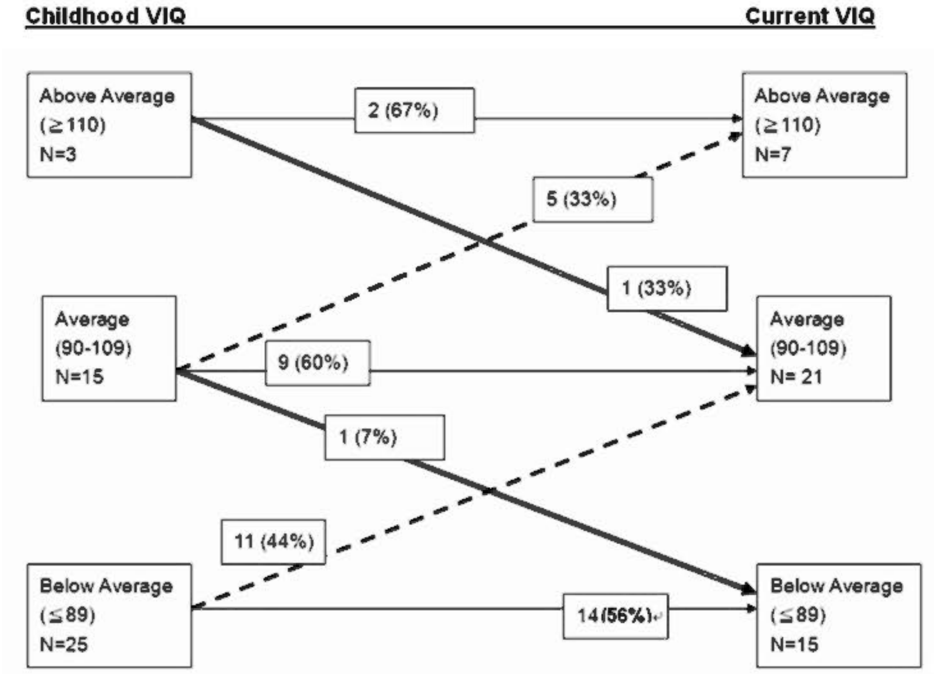


Changes in VIQ levels from childhood to early adulthood are summarized in Table 37 and Figure 3. Stability of verbal IQ was similar at all three levels, with 14 out of 25 (56%) staying in the below average range, nine out of 15 (60%) in the average range, and two out of three (67%) in the above average range in early adulthood. Except one (7%) in the average group and one (33%) in the above average group, all others (16 out of 43, 37.21%) progressed in VIQ by one level.

Table 37
Change of VIQ level from childhood to early adulthood

	Current VIQ			n
Childhood VIQ	Above Average (≧110)	Average (90-109)	Below Average (≦89)	
Above Average	2(67.0%)	1(33.0%)	0	3(100%)
Average	5(33.0%)	9(60.0%)	1(7.0%)	15(100%)
Below Average	0	11(44.0%)	14(56.0%)	25(100%)
N	7(16.3%)	21(48.8%)	15(34.9%)	43(100%)

Figure 3. Stability of VIQ from childhood to early adulthood

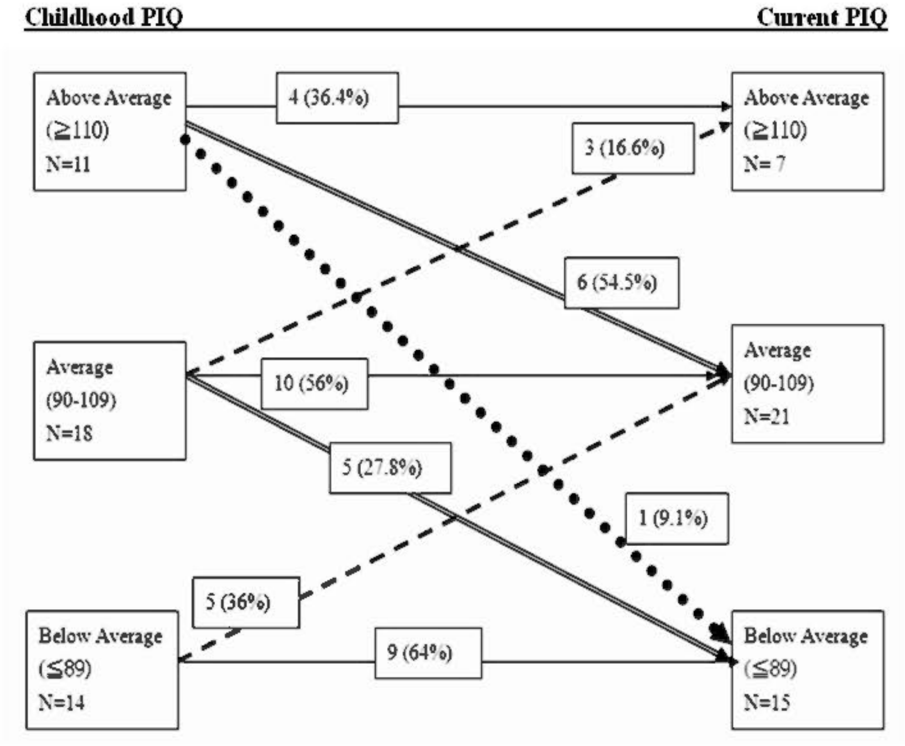


Changes in PIQ levels between childhood and early adulthood are summarized in Table 38 and figure 4. In the group with childhood PIQ in below average range (n=14), nine (64%) individuals remained in the same level, while five (36%) moved up one level. Variability was greater in the average group (n=18) with ten (55.6%) remaining in the same level, three (16.6%) having improved by one level while five (27.8%) going down one level. Deterioration in PIQ was seen in the above average group, since only four (36.4%) stayed in the same level, but six (54.5%) moved down one level and one (9.1%) moved down even two levels .

Table 38
Change of PIQ level from childhood to early adulthood

	Current PIQ			
Childhood PIQ	Above Average (≧110)	Average (90-109)	Below Average (≦89)	n
Above Average	4(36.4%)	6(54.5%)	1(9.1%)	11
Average	3(16.6%)	10(55.6%)	5(27.8%)	18
Below Average	0	5(36%)	9(64%)	14
n	7(16.3%)	21(48.8%)	15(34.9%)	43(100%)

Figure 4. Stability of PIQ from childhood to early adulthood



Stability of IQs among participants of different levels of childhood IQs were tested using the chi-square statistics. Results did not find significant relationship between changes in IQ levels and different childhood FIQ ,VIQ and PIQ levels (Table 39) ($\chi^2(2,N=47) = 1.12, p=.57; \chi^2(2,N=43) = .16, p=.92; \chi^2(2,N=433) = 1.98, p=.37$ respectively). Overall, childhood IQ levels did not seem to predict clinically significant changes (change in IQ level) in an individual's intelligence from childhood to early adulthood.

Table 39

Changes of IQ in individuals in different childhood IQ levels

		childhood IQ level			
		Below Average	Average	Above Average	
		n(%)	n(%)	n(%)	χ^2
FIQ	No change in level	12(50.0%)	11(61.1%)	4(66.7%)	*1.12*
	Change in level	12(50.0%)	6(38.9%)	2(33.3%)	
VIQ	No change in level	14(56.0%)	9(60.0%)	2(66.7%)	*.16*
	Change in level	11(44.0%)	6(40.0%)	1(33.3%)	
PIQ	No change in level	9(64.3%)	10(55.6%)	4(36.4%)	*1.98*
	Change in level	5(35.7%)	8(44.4%)	7(63.6%)	

Another way to examine the relationship between childhood IQs and the stability of IQs was to compare the childhood IQ scores of groups of individuals whose IQs had changed or not changed. After coding stability or instability in terms of the change in IQ level (i.e, +1= positive change, 0 = no change, -1 = negative change), ANOVA test was conducted between three groups thus created by the above coding, i.e., groups with positive change, no change, and negative change. Results are summarized in Table 38. Results were only significant with childhood PIQ (*F(*2, 42) =7.84, *p*<.001, *EF*=.30), indicating that the childhood PIQs of the groups with no change, positive change, and negative change were significantly different. When the mean scores of the three groups were compared, it seemed to suggest that individuals with lower childhood PIQ were more likely to improve, but those of higher childhood PIQ were more likely to move down in IQ levels. Although the differences in childhood FIQ and VIQ among the three groups were statistically not significant, the same trend was noted, i.e., individuals with lower childhood FIQ or VIQ having positive changes, while individuals with higher childhood FIQ or VIQ having negative changes.

When categorical data were used in the chi-square test, insignificant relationship was found between childhood IQ levels and IQ changes. Though ANOVA test results were only significant with PIQ, there was also a trend in both VIQ and FIQ that those who improved over the years tended to have a poorer childhood IQ and those who deteriorated had a better childhood IQ. Results from the chi-square test were less illustrative as only changes in IQ levels were examined without taking account of the direction of changes. Hence, analysis by comparing groups having positive change, no change and negative change in terms of childhood IQs actually involved more data and results should be more informative. Unfortunately, the small sample size, particularly the groups with negative change in FIQ and VIQ (n=3 and 2 respectively), limited our confidence in the generalizability of the present findings. So, the apparent association between childhood IQs and changes in IQs from childhood to early adulthood should at best be viewed as tentative.

Table 40

Comparison of mean childhood IQ scores of groups with or without changes of IQ level

		childhood IQ			
		M	SD	n	*F* value
FIQ level	Negative change	101.6	17.6	3	*1.66*
	No change	93.1	16.8	26	
	Positive change	86.5	11.6	16	
	Total	91.3	15.4	45	
VIQ level	Negative change	102.0	11.3	2	*1.11*
	No change	85.5	15.8	24	
	Positive change	83.7	17.2	13	
	Total	85.8	16.2	39	
PIQ level	Negative change	110.4	9.1	11	*7.84****
	No change	94.3	16.2	20	
	Positive change	86.3	12.6	8	
	Total	97.2	16.2	39	

Note. ***$p \leq .001$

5.1 IQ and Educational Attainment

The level of educational attainment of individuals with different levels of intellectual functioning are summarized in Table 41. To look at the relationship between intelligence and education, chi-square test was run on IQ levels and 3-category educational attainment (Table 42). Results were significant for all three types of IQs (FIQ: $\chi^2(4,N=64)=18.7$, $p<.001$; VIQ: $\chi^2(4,N=64)=11.8$, $p=.01$; PIQ: $\chi^2(4,N=64)=14.6$,$p<.001$). The pattern of results was very similar across all three types of IQs. The majority of those with below average IQs (14 out of 20, 70%; 13 out of 20, 65% & 14 out of 22, 63.6% for FIQ, VIQ & PIQ respectively) studied only up to secondary level and the rest only reached post-secondary vocational education. In the average IQ group, the largest proportion attained up to post-secondary vocational education (17 out of 33, 51.5%;16 out of 33, 48.55% & 15 out of 30, 50% for FIQ, VIQ & PIQ respectively), and a sizable proportion just finished secondary education, being 36.4%, 39.4% and 36.7% for FIQ, VIQ and PIQ respectively. In the above average FIQ and PIQ group, the proportion with post-secondary vocational and academic education was identical, being 45.5% and 41.7% respectively. In the above average VIQ group, the largest proportion was found in the post-secondary vocational education level (6 out of 11, 54.5%).

Table 41
Educational attainment in different levels of IQs

			Educational attainment					
			Lower secondary	Upper secondary	Sixth form	Post-secondary (Diploma/ Certificate)	Post-secondary (Sub-degree course)	Post-secondary (Degree course)
FIQ Level	Below Average	n(%)	5(25.0%)	9(45.0%)	0(0.0%)	5(25.0%)	1(5.0%)	0(0.0%)
	Average	n(%)	0(0.0%)	12(36.4%)	3(9.1%)	8(24.2%)	9(27.3%)	1(3.0%)
	Above Average	n(%)	0(0.0%)	1(9.1%)	0(0.0%)	2(18.2%)	3(27.3%)	5(45.5%)
VIQ Level	Below Average	n(%)	5(25.0%)	8(40.0%)	0(0.0%)	5(25.0%)	1(5.0%)	1(5.0%)
	Average	n(%)	0(0%)	13(39.4%)	2(6.1%)	8(24.2%)	8(24.2%)	2(6.1%)
	Above Average	n(%)	0(0.0%)	1(9.1%)	1(9.1%)	2(18.2%)	4(36.4%)	3(27.3%)
PIQ Level	Below Average	n(%)	4(18.2%)	10(45.5%)	0	5(0.0%)	3(13.6%)	0(0.0%)
	Average	n(%)	1(3.3%)	10(33.3%)	2(6.7%)	8(26.7%)	7(23.3%)	2(6.7%)
	Above Average	n(%)	0(0.0%)	2(16.7%)	1(8.3%)	2(16.7%)	3(25.0%)	4(33.3%)

Table 42
Educational attainment by 3 categories in different levels of IQs

			Educational levels			
			Secondary	Post-secondary Vocational	Post-secondary Academic	χ^2
FIQ Level	Below Average	n(%)	14(70.0%)	6(30.0%)	0(.0%)	*18.7****
	Average	n(%)	12(36.4%)	17(51.5%)	4(12.1%)	
	Above Average	n(%)	1(9.1%)	5(45.5%)	5(45.5%)	
VIQ Level	Below Average	n(%)	13(65.0%)	6(30.0%)	1(5.0%)	*11.8**
	Average	n(%)	13(39.4%)	16(48.5%)	4(12.1%)	
	Above Average	n(%)	1(9.1%)	6(54.5%)	4(36.4%)	
PIQ Level	Below Average	n(%)	14(63.6%)	8(36.4%)	0(.0%)	*14.6**
	Average	n(%)	11(36.7%)	15(50.0%)	4(13.3%)	
	Above Average	n(%)	2(16.7%)	5(41.7%)	5(41.7%)	

Note. **p* ≤.05 ****p*≤.001

ANOVA was also run to compare the IQs of individuals with different levels of educational attainment. Results were again significant for all IQs (Table 43) (*F(*2, 61) =12.7, *p<.001*, *EF*=.28 for FIQ , *F(*2, 61) =10.0, *p<.001*, *EF*=.24 for VIQ; *F(*2, 61) =8.9, *p*<.001, *EF*=.22 for PIQ). Individuals with the highest level of educational attainment, i.e, post-secondary academic education, had the highest IQs, while individuals with the lowest level of educational attainment, i.e, secondary education, had the lowest IQs. Thus, both findings from chi-square test and ANOVA converged to support the relationship between intelligence and educational attainment. Individuals with better intelligence as adults were more likely to be better educated.

Table 43
Mean IQ scores of different educational levels

		Educational levels			
		Secondary n=27	Post-secondary vocational n=28	Post-secondary academic n=9	*F* value
Full IQ	M	89.5	98.3	110.7	*12.7****
	SD	9.8	13.2	7.7	
Verbal IQ	M	89.3	98.8	109.0	*10.0****
	SD	10.5	13.3	12.2	
Performance IQ	M	91.1	98.4	112.3	*8.9****
	SD	12.2	14.8	9.5	

Note. ***$p \leq .001$

The relationship between childhood IQs levels and educational attainment was examined. Chi-square analysis on 3-category educational levels by IQ levels found significant relationship only between childhood VIQ and educational attainment (χ^2(4,N=43) =10.0, *p*=.04) (Table 44). ANOVA was run to compare the childhood IQs of individuals with different levels of educational attainment. Results were significant for all three types of childhood IQs (Table 45) (*F(*2, 42) =5.21, *p<.001*, *EF*=.20 for childhood FIQ,

$F(2, 36) = 5.54$, $p<.001$, $EF=.23$ for childhood VIQ; $F(2, 36) = 3.83$, $p=.03$, $EF=.17$ for childhood PIQ). Individuals with the highest level of educational attainment, i.e., post-secondary academic education, had the highest childhood IQs, while individuals with the lowest level of educational attainment, i.e., secondary education, had the lowest childhood IQs. So the results of ANOVA suggested that childhood IQs were good predictors of eventual educational attainment, indicating those with better intelligence in childhood were more likely to excel in education than those with lower intelligence. ANOVA, as a parametric statistics, was more powerful in identifying significant differences than the chi-square test as a non-parametric statistics.

Table 44

Comparison of educational attainment by 3 categories in different levels of childhood IQs

			Educational levels			
			Secondary	Post-secondary vocational	Post-secondary academic	χ^2
Childhood FIQ	Below Average	n(%)	13(54.2%)	10(41.7%)	1(4.2%)	*6.08*
	Average	n(%)	6(35.3%)	7(41.2%)	4(23.5%)	
	Above Average	n(%)	1(16.7%)	3(50.0%)	2(33.3%)	
Childhood VIQ	Below Average	n(%)	12(48.0%)	12(48.0%)	1(4.0%)	*10.02**
	Average	n(%)	6(40.0%)	5 (33.3%)	4(26.7%)	
	Above Average	n(%)	0(.0%)	1(33.3%)	2(66.7%)	
Childhood PIQ	Below Average	n(%)	7(50.0%)	7(50.0%)	0(.0%)	*6.15*
	Average	n(%)	7(38.9%)	8(44.4%)	3(16.7%)	
	Above Average	n(%)	4(36.4%)	3(27.3%)	4(36.4%)	

Note. $^*p \leq .05$

Table 45

Mean childhood IQ scores in different educational levels

		Educational levels			
		Secondary	Post-secondary vocational	Post-secondary academic	*F* value
Childhood Full IQ	M	86.0	91.6	106.1	5.21**
	SD	11.0	17.6	11.6	
	n	20	18	7	
Childhood Verbal IQ	M	79.0	86.6	100.7	5.54**
	SD	15.1	14.5	12.9	
	n	17	15	7	
Childhood Performance IQ	M	95.1	93.0	111.4	3.83*
	SD	16.5	14.7	11.7	
	n	17	15	7	

Note. *p ≤.05 **p≤.01

5.2 IQ and Occupation

There was no significant difference in the types of occupation taken up by individuals of different levels of intelligence in adulthood. Nor did childhood IQs bear any significant relationship on occupation (Appendix 8).

However, the majority of people with below average full and verbal IQs, whether current or childhood, engaged in unskilled jobs (71.4 % in FIQ, 73.3% in VIQ, 61.5% in childhood FIQ and 71.4% in childhood VIQ). At the same time, the majority of those with above average FIQ or VIQ, whether current or childhood, engaged in skilled jobs (75-100%). The trend was however less evident with current PIQ (33.3% with below average PIQ in skilled jobs and 60% with above average PIQ in skilled jobs), and not evident in childhood PIQ where 50% of the above average PIQ was in unskilled jobs and 50% in skilled jobs. With data from only 33 employed individuals and even fewer from a subgroup with known childhood IQs (n= 25 for FIQ, 21 for VIQ and PIQ), it would not be surprised that the chi-square test would not have sufficient power to identify the above differences.

5.3 IQ and Diagnostic Status

5.3.1 IQ and diagnosis

ANOVA was run to test whether current IQ differed according to diagnostic status. Differences amongst the three diagnostic groups reached statistical significance only in current VIQ (*F(*2, 61) =3.21, *p*=.04, *EF*=.09). The results with current FIQ marginally missed significance (*F(*2, 61) =2.60, *p*=.08) (Table 46). Both the A and AA groups, compared to the NA group, had lower current FIQ and VIQ. The same trend could still be seen in current PIQ, though the differences were evidently smaller.

When the atypical autism and autism groups were combined to form an Autism Spectrum Diagnosis (ASD) group and compared with the no-diagnosis group, significant relationships were found between current FIQ and VIQ, but not with PIQ (*F(*1, 61) =4.88 at *p*=.03, *EF*=.58, *F(*1, 61) =5.97 at *p*=.01, *EF*=.65; *F(*1, 61) =1.84 at *p*=.17 respectively) (Table 47). The results confirmed those of the previous analysis; those individuals no longer having a diagnosis of autism as adults tended to possess better FIQ and VIQ in adulthood than those keeping a diagnosis. Current PIQ also seemed to be better in the NA group, but the difference was obviously smaller and thus not significant.

Table 46
Mean current IQ scores of 3 diagnostic groups

	Diagnosis										
	No Diagnosis			Atypical Autism			Autistic Disorder				
	n	M	SD	n	M	SD	n	M	SD	*F* value	*p* value
Full IQ (current)	21	101.5	14.2	25	95.0	12.5	18	92.6	11.8	*2.60*	*.08*
Verbal IQ (current)	21	102.1	14.9	25	94.7	12.3	18	91.8	12.5	*3.21*	*.04*
Performance IQ (current)	21	100.9	15.4	25	96.2	13.8	18	94.7	15.3	*0.96*	*.38*

Furthermore, with individuals having known childhood IQ scores, the no-diagnosis group and the ASD group was found to differ in childhood FIQ and VIQ (*F(*1, 61) =5.61 at p=.02, *EF*=.73; *F(*1, 61) =4.07 at p=.05, *EF*=.66) (Table 47). However, the two groups did not differ in PIQ. Once again, as in the case of current IQs, the ASD group had childhood lower FIQ and VIQ. The same trend was observed in PIQ, but difference was evidently smaller.

Table 47
Mean IQ scores of 2 diagnostic groups

	Diagnosis								
	No-Diagnosis			ASD					
	n	M	S.D	N	M	S.D	*F* value	*p* value	Effect size
Full IQ	21	101.5	14.2	43	94.0	12.1	*4.88*	*.03**	*.58*
Verbal IQ	21	102.1	14.9	43	93.5	12.3	*5.97*	*.01**	*.65*
Performance IQ	21	100.9	15.4	43	95.6	14.3	*1.84*	*.17*	*.36*
Full IQ (childhood)	16	98.4	18.7	29	87.5	12.0	*5.61*	*.02**	*.73*
Verbal IQ (childhood)	15	92.2	15.7	24	81.8	15.6	*4.07*	*.05*	*.66*
Performance IQ (childhood)	15	100.6	18.7	24	95.1	14.5	*1.05*	*.31*	*.33*

5.3.2 IQ and subscales of 3Di

Significant correlations were only found between current FIQ and the communication and social interaction subscales of 3Di (*r*=-.32 *p*<*.001*; *r*=-.24 *p*=.05) and between current VIQ and the social interaction and communication subscales (*r*=-.28 *p*=.02 and *r*=-.33 *p*<*.001* respectively) (Table 48). Current PIQ had weak association with all the subscales. Also, all current IQs did not seem to be related in any way with stereotyped behaviours. With regard to childhood IQs, significant correlations were only present between communication subscale and childhood FIQ and VIQ (*r*=-.31, *p*=.03 and *r*=-.33 *p*=.03 respectively) (Table 49).

Table 48
Pearson correlations between current IQs and 3Di subscales

	FIQ	VIQ	PIQ
Reciprocal social interaction skills	-.24	-.28*	-.13
Use of language and other social communication skills	-.33(**)	-.33 (**)	-.24
Repetitive/stereotyped behaviours and routines	-.17	-.11	-.20

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 49
Pearson correlations between childhood IQs and 3Di subscales

	Childhood FIQ	Childhood VIQ	Childhood PIQ
Reciprocal social interaction skills	-.26	-.27	-.06
Use of language and other social communication skills	-.32*	-.34(*)	-.09
Repetitive/stereotyped behaviours and routines	-.17	-.10	-.17

Note. * Correlation is significant at the 0.05 level (2-tailed).

ANOVA test was also run to compare IQs between clinical and non-clinical groups as defined by cut-off scores in the three main symptom scales of 3Di (Table 50). There were significant differences in current FIQ and VIQ but not in PIQ between clinical and non-clinical group defined by the social interaction scale ($F(1, 61) = 4.55$, $p = .03$, $EF = .59$; $F(1, 61) = 5.32$, $p = .02$, $EF = .64$ respectively). All three types of IQs were significantly different between clinical and non-clinical group defined by the communication scale ($F(1, 61) = 14.5$, $p < .001$, $EF = 1.23$ for FIQ, $F(1, 61) = 15.2$, $p < .001$, $EF = 1.34$ for VIQ; $F(1, 61) = 6.97$, $p = .01$, $EF = 0.91$ for PIQ). No significant relationship was found between all three types of IQs in adulthood and the clinical and non-clinical groups defined by the autistic-type stereotypic behaviours scale. For those with known childhood IQs, childhood FIQ and VIQ were found to be significantly different between the clinical and non-clinical groups defined by the communication scale only ($F(1, 61) = 13.24$, $p < .001$, $EF = 1.21$ and $F(1, 61) = 9.81$, $p < .001$, $EF = 1.24$ respectively). No other significant difference was found.

In sum, deficits in communication, represented by a clinical group who was defined by the above threshold in the corresponding scale in 3Di, were related to lower childhood and current IQs, mainly FIQ and VIQ. Deficits in social skills were also related to FIQ and VIQ, but mainly current. Repetitive sterotyped behaviours did not seem to be related to any type of IQs, current or childhood.

Table 50

Results of ANOVA tests on current and childhood IQs and subscales of 3Di

	Non-clinical			Clinical			*F* value	*p* value	Effect size
	n	M	S.D	n	M	S.D			
(1) Reciprocal social interaction skills									
Full IQ	18	101.8	15.0	46	94.2	11.8	4.55	.03*	.59
Verbal IQ	18	102.4	15.4	46	93.9	12.3	5.32	.02*	.64
Performance IQ	18	101.1	15.4	46	95.8	14.4	1.64	.20	
Full IQ (childhood)	13	97.9	19.4	32	88.7	13.0	3.45	.07	
Verbal IQ (childhood)	12	90.8	14.6	27	83.6	16.7	1.69	.20	
Performance IQ (childhood)	12	100.0	18.3	27	96.0	15.4	.50	.49	
(2) Use of language and other social communication skills									
Full IQ	10	109.7	12.2	54	94.0	12.9	14.65	.00***	1.23
Verbal IQ	10	110.3	12.6	54	93.7	12.3	15.21	.00***	1.34
Performance IQ	10	108.1	17.8	54	95.3	13.4	6.97	.01**	.91
Full IQ (childhood)	9	106.2	19.5	36	87.7	15.5	13.24	.00***	1.21
Verbal IQ (childhood)	8	100.3	13.1	31	82.1	15.0	9.81	.00**	1.24
Performance IQ (childhood)	8	103.5	22.1	31	95.6	14.4	1.52	.23	.56
(3) Repetitive stereotyped behaviours and routines									
Full IQ	44	98.3	13.7	20	92.3	11.1	2.94	.09	
Verbal IQ	44	98.2	14.2	20	92.1	11.9	2.86	.09	
Performance IQ	44	98.8	14.7	20	94.0	14.7	1.51	.22	
Full IQ (childhood)	31	93.4	16.5	14	87.0	12.2	1.65	.21	
Verbal IQ (childhood)	25	87.9	16.1	14	82.1	16.4	1.13	.30	
Performance IQ (childhood)	25	98.0	18.5	14	95.8	11.7	.17	.68	

5.4 IQ and Overall Outcome

Current IQs were significantly correlated with the overall outcome as well as the sub-categories of work, friendship, independence and language (r ranging from -.27 to -.40, N=64, p<.05) (Table 51). Their relationship with stereotyped behaviours was however weak, in line with the above results between IQs and the autistic-type stereotyped behaviour scale of the 3Di.

Significant correlations were also found between available childhood IQs and the overall outcome (r = -.45, n=45 for childhood FIQ; r=-.34, n=39 for childhood VIQ; r= -.32, n=39 for childhood PIQ, p<.05). However, only childhood FIQ, but not VIQ or PIQ, was significantly correlated with all sub-categories, except stereotyped behaviours (r = -.30 to -.43, n= 45, p<.05). Friendship stood out as having a significant correlation with childhood VIQ and PIQ as well (r=-.36 &-.33 respectively). Yet, stereotyped behaviours bored an insignificant relationship with childhood IQs just as with current IQs.

In sum, the significant negative correlations suggested that those participants of this study with lower (better) outcome ratings had higher IQs. The current IQs had a strong relationship to the overall outcome and its sub-categories, with the exception of stereotyped behaviours. So did the childhood IQs, particularly with the overall outcome, but less so with the sub-categories.

Table 51

Pearson correlations between IQs and outcome ratings

	Full IQ N=64	Verbal IQ N=64	Performance IQ N=64
Outcome Total	-.40(**)	-.37(**)	-.33(**)
Work	-.33(**)	-.30(*)	-.29(*)
Friendship	-.38(**)	-.37(**)	-.31(*)
Independence	-.32(*)	-.27(*)	-.29(*)
Stereotype	-.16	-.17	-.11
Language	-.35 (**)	-.33(**)	-.29 (*)

	Full IQ (childhood) N=45	Verbal IQ (childhood) N=39	Performance IQ (childhood) N=39
Outcome Total	-.45(**)	-.34(*)	-.32 (*)
Work	-.31(*)	-.23	-.24
Friendship	-.43(**)	-.36(*)	-.33 (*)
Independence	-.30(*)	-.19	-.25
Stereotype	-.27	-.22	-.23
Language	-.36(**)	-.31	-.22

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Regression analysis was conducted to further test IQ as a predictor of the overall outcome. Only VIQ and PIQ were used as FIQ was a composite score of VIQ and PIQ and hence would not have any independent contribution to the variance. As seen in Table 52, both current and childhood VIQ and PIQ were independently significant predictors of the overall outcome ($F(2, 61) =5.727$ at $p<.0015$ and $F(2, 36) =3.739$ at $p=.033$ respectively). The findings of the regression analyses confirmed those of the above, providing converging evidence that both current and childhood IQs were predictive of better overall outcome.

Considering the general increase in current IQs compared to childhood IQs, particularly in VIQ, it would be of interest to find out whether the improvement in IQs by adulthood would have a unique contribution to the overall outcome on top of the childhood IQ. Regression analysis was thus run again with current IQs to predict the overall outcome, after controlling for childhood IQ scores. Results indicated that the added variance by current IQs (only 1.8% of the total variance of 19%, *F* change (2, 34)=.382 at p=.38) was insignificant, when childhood IQs were controlled for. Results suggested that individuals with better IQ at childhood were more likely to have a better outcome when they grew up as adults. Particularly, the childhood IQs were sufficiently predictive of the overall outcome at early adulthood. Current IQs did not add any significant variance. This finding was not entirely unexpected, given the strong stability of IQs from childhood to early adulthood, as noted in previous analyses.

Table 52

Summary of regression analyses on IQ as predictor of overall outcome rating

Result of current IQs and childhood IQs as predictors of overall outcome rating (DV= Outcome Total)

Predictors	Sum of Squares	df	Mean Square	F	Sig.
Current VIQ,PIQ	113.64	2	56.8	5.727	.005**
Childhood VIQ,PIQ	75.89	2	37.9	3.739	.033**

Result of current IQs as predictors of overall outcome rating controlling for childhood IQs (DV= Outcome Total)

			Change Statistics				
Model	R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1[a]	.172	3.186	.172	3.739	2	36	.013
2[b]	.190	3.242	.018	0.382	2	34	.685

Note. [a] Predictors: (Constant), childhood VIQ, childhood PIQ

[b] Predictors: (Constant), childhood VIQ, childhood PIQ, current VIQ, current PIQ

In order to compare with results from Howlin et al. (2004) who found no difference in a social outcome score between individuals with childhood performance IQ of 70-99 and those with IQ over 100, participants in our sample were also divided into groups by all three types of childhood IQs below or over 100 for analysis. ANOVA was run on the overall outcome rating between the two groups. Results were significant for all three types of childhood IQs, suggesting that individuals with childhood IQs over 100 had a lower (better) overall outcome rating than those with childhood IQs below 100 (*F(*1, 61) =7.28, *p*=.01, *EF*=.14 for childhood FIQ; *F(*2, 61) =5.93, *p*=.02, *EF*=.14 for childhood VIQ; *F(*1, 61) =6.12, *p*=.01, *EF*=.14 for childhood PIQ) (Table 53).

Table 53
Mean overall outcome ratings of groups with childhood IQs below and above 100

	Childhood IQ								
	<100			≧100					
	n	Mean	S.D	n	Mean	S.D	*F* value	*p* value	Partial Eta Squared
Childhood FIQ Overall outcome	34	5.32	3.24	11	2.45	2.45	7.28	.01	.14
Childhood VIQ Overall outcome	30	5.30	3.40	9	2.33	2.40	5.93	.02	.14
Childhood PIQ Overall outcome	30	5.85	3.30	9	3.32	3.10	6.12	.02	.14

Note. Lower rating= better outcome

As indicated in Table 54 and graphs in Figures 5 to 7, the majority of individuals with childhood IQs over 100 had near 'normal functioning'/'good' outcome (72.7%, 77.8% and 63.2% for childhood FIQ, VIQ and PIQ), whereas the majority of those with childhood IQs below 100 were found functioning within a 'fair'/'poor' range (61.8%, 60.0% and 65.0% for childhood FIQ, VIQ and PIQ).

Table 54

Outcome by 2 levels and childhood FIQ, VIQ and PIQ below and above 100

			Outcome	
			Near normal functioning / good	Fair /Poor
Childhood FIQ	< 100	n(%)	13 (38.2%)	21 (61.8%)
	≥ 100	n(%)	8 (72.7%)	3 (27.3%)
Childhood VIQ	< 100	n(%)	12 (40.0%)	18 (60.0%)
	≥ 100	n(%)	7 (77.8%)	2 (22.2%)
Childhood PIQ	< 100	n(%)	7 (35.0%)	13 (65.0%)
	≥ 100	n(%)	12 (63.2%)	7 (36.8%)

Figure 5. Overall outcome of groups with childhood FIQ < 100 and ≥ 100

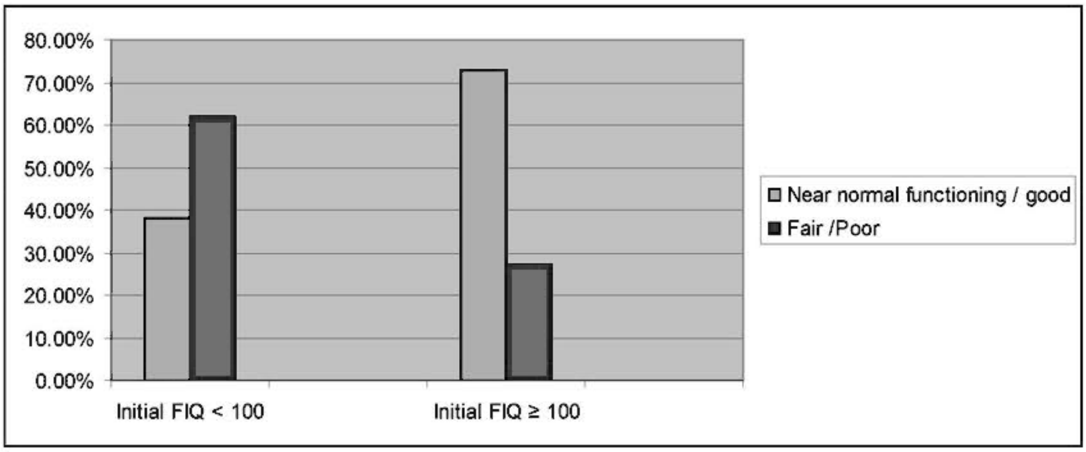


Figure 6. Overall outcome of groups with childhood VIQ < 100 and ≥100

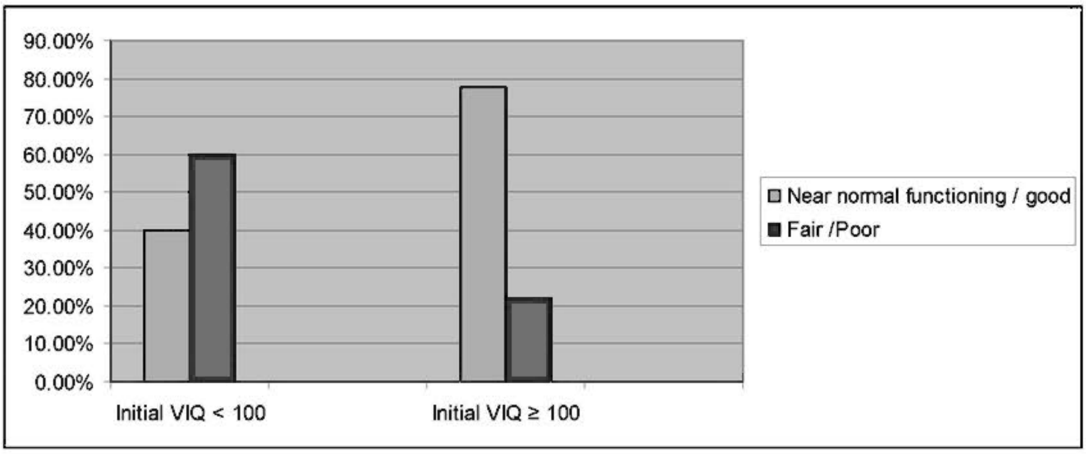
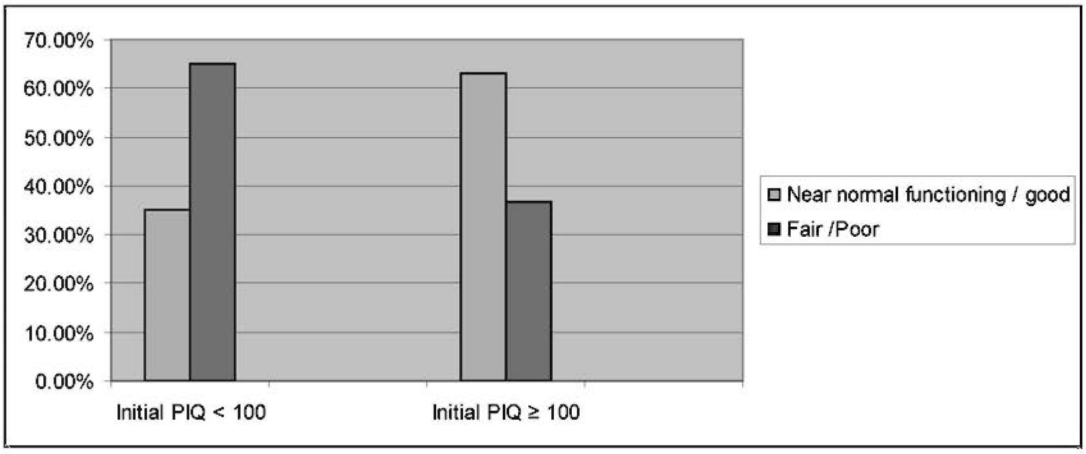


Figure 7. Overall outcome of groups with childhood PIQ < 100 and ≥100



6. Diagnostic Status and Overall Outcome

6.1 Diagnostic Status and Overall Outcome Rating

The three diagnostic groups (i.e., A, AA, and NA groups) differed significantly in terms of their overall outcome (χ^2 (9, N=64)=32.0, *p*<.001) (Table 55). Given the small sample size and the resultant fewer than five observations in some cells, analysis was re-run again, using two diagnostic groups and combined levels of overall outcome rating. Significant results were obtained (Table 56) both with the original four levels of overall outcome and two levels of outcome ($\chi^2(3, N=64)=16.6$ $p<.001$; $\chi^2(1, N=64)=10.9$, $p<.001$ respectively). According to Table 55, in the NA group, 11 out of 21 (52%) had ‘near normal’ outcome, four (19%) had ‘good’ outcome, while the rest (6/21, 28.6%) had a ‘fair’ outcome. In the atypical autism (AA) group, only three out of 25(12%) had ‘near normal’ outcome, seven (28%) had ‘good’ outcome, while 15 (60%) had fair outcome. In the autistic (A) group, however, only one had ‘near normal’ functioning, while another one with ‘good’ outcome. Ten out of 18 (55.6%) had only a ‘fair’ outcome. Furthermore, six (33.3%) of the autistic group had poor outcome, while none of NA and AA groups had a ‘poor’ outcome. So, it appeared that individuals who no longer bore a diagnosis in early adulthood had the best overall outcome. They were followed by the AA individuals, and those who were in the A group had the poorest outcome in early adulthood. Results of the further analysis presented in Table 56 essentially confirmed the same pattern of findings as in Table 55, i.e., individuals with diagnosis had a worse outcome when compared to those without diagnosis.

Table 55

Overall outcome of three diagnostic groups

			Diagnosis			
			No Diagnosis	Atypical Autism	Autism	χ^2
Outcome	Near normal functioning	n	11	3	1	*32.0****
		(%)	(52.4%)	(5.6%)	(12.0%)	
	Good	n	4	7	1	
		(%)	(19.0%)	(5.6%)	(28.0%)	
	Fair	n	6	15	10	
		(%)	(28.6%)	(55.6%)	(60.0%)	
	Poor	n	0	0	6	
		(%)	(0.0%)	(0.0%)	(33.3%)	

Table 56

Overall outcome of combined two diagnostic groups

			Diagnosis		
			No Diagnosis	Autism Spectrum Disorder	χ^2
Outcome	Near normal functioning	n	11	4	*16.6****
		(%)	(52.4%)	(9.3%)	
	Good	n	4	8	
		(%)	(19.0%)	(18.6%)	
	Fair	n	6	25	
		(%)	(28.6%)	(58.1%)	
	Poor	n	0	6	
		(%)	(0.0%)	(14.0%)	
Outcome	Near normal functioning / good	n	15	12	*10.9****
		(%)	(71.4%)	(27.9%)	
	Fair / poor	n	6	31	
		(%)	(28.6%)	(72.1%)	

Note. ***$p \leq .001$.

6.2 Diagnostic Status and Sub-categories of Overall Outcome

Results of the chi-square analyses showed that the diagnostic groups were significantly different in all sub-categories of the overall outcome (Table 57 to 59).

With respect to friendship and diagnosis, chi-squared test was significant ($\chi^2(6, N=64) = 24.9$, $p<.001$). Nine of the 21 individuals no longer having a diagnosis (42.9%) were considered as having 'normal' friendship. Yet, only three of the 25 atypically autistic group (12%) and one of the 18 autistic group (5.6%) could be considered as such. Another eight individuals with no diagnosis (53.3%), but only five with atypical autism (20%) and two with autism (11%) had limited friendship. Only four individuals with no diagnosis (19%) had no friends but some acquaintances. But relatively more individuals with atypical autism (9 out of 25, 36%) and four with autism (22%) were in this category. Eight individuals with atypical autism (32%) and majority of those with autism (11 out of 18, 61.1%) had no friends at all.

Having a number of cells with observations fewer than five in the above analysis, chi-squared test was re-run with two diagnostic groups, the NA and the ASD group. Results were also significant (Table 58) (χ^2 (3, N=64) =20.6, $p<.001$). The majority of the NA group (17 out of 21, 81.0%) had 'normal' or 'limited' friendship, whereas the majority of the ASD group (32 out of 43, 74.4%) had practically no friends at all. Diagnostic continuity at early adulthood was hence significantly related to the friendship subcategory, indicating that individuals with a continual diagnosis of ASD tended to have more relationship difficulties than the group without a diagnosis.

Significant results were obtained when three diagnostic groups were compared in their scores in the sub-category of autistic type stereotyped and repetitive behaviours (Table 57) (χ^2(6, N=64) =25.2, *p*<.001). The majority of the group with no diagnosis (14 out of 21, 66.7%) was rated as no longer bothered by such behaviours; five (23.8%) still had one type of such problematic behaviours, be it unusual preoccupations, rituals or compulsions or resistance to change, while two (9.5%) had two types of such problematic behaviours. A large proportion of the atypical autistic group (14 out of 25, 56%) was also free of such problematic behaviours; ten (40%) had one type and one (4%) had two types. In contrast, all individuals in the autistic group reported problems in this area which was actually expected as the presence of such symptomatic behaviours was one of the necessary criteria for diagnosis of autism. Ten out of the 18 (55.8%) had one type, seven (38.9%) had two types and one (5.6%) had multiple types in this area. So diagnostic continuity at early adulthood was related to more repetitive stereotyped behaviours.

However, due to some cells having less than five observations,in the above analysis, chi-squared test was re-run with two diagnostic groups, the NA and the ASD group. Results, however, were only marginally significant (Table 58) (χ^2(3, N=64) =6.84, *p*=.07). This was somehow expected as the AA group actually differed from the A group by not having a great deal of stereotyped and repetitive behaviours. By collapsing the two groups into one single ASD group, the contrast with the NA group was inevitably compromised. Hence, results suggested that the individuals with autism were most affected in their daily living by their stereotypic behaviours and unusual preoccupations, whereas the non-autistic and atypical autism groups were relatively less bothered by these problematic behaviours.

Significant differences were found among the 3 diagnostic groups in terms of language (Table 57) (χ^2(4, N=64) =20.6, p<.001). Results remained significant when analysis was conducted on the two collapsed diagnostic groups (Table 58) (χ^2(2, N=64) =15.6, p<.001). Over half of the group with no diagnosis (11 out of 21, 52.4%) were able to converse with others and build on other's dialogue, but only four (16%) of the AA group and one (5.6%) of the A group were able to do so. Seven of the group with no diagnosis (33.3%) and ten (40%) of the AA group could engage in simple conversation which might not be reciprocal, while only three (16.7%) of the A group were able to do so. In contrast, the majority of the A individuals (14 out of 18, 77.8%) stayed at the level of having only simple speech, but unable to maintain a conversation with others. Eleven (44%) of the atypical autistic group and only three (14.3%) of the group with no diagnosis were at this level of language use. Thus, diagnostic continuity at early adulthood was associated with language deficits in communication, indicating that adults with autism had more difficulties in communication.

Table 57

Comparison of 'friendship', 'stereotype' and 'language' score between 3 diagnostic groups

			Diagnosis			
			No Diagnosis	Atypical Autism	Autism	χ^2
Friendship	0	n(%)	9(42.9%)	3(12.0%)	1(5.6%)	24.9***
	1	n(%)	8(38.1%)	5(20.0%)	2(11.1%)	
	2	n(%)	4(19.0%)	9(36.0%)	4(22.2%)	
	3	n(%)	0(.0%)	8(32.0%)	11(61.1%)	
Stereotype	0	n(%)	14(66.7%)	14(56.0%)	0(.0%)	25.2***
	1	n(%)	5(23.8%)	10(40.0%)	10(55.6%)	
	2	n(%)	2(9.5%)	1(4.0%)	7(38.9%)	
	3	n(%)	0(.0%)	0(.0%)	1(5.6%)	
Language	0	n(%)	11(52.4%)	4(16.0%)	1(5.6%)	20.6***
	1	n(%)	7(33.3%)	10 (40.0%)	3(16.7%)	
	2	n(%)	3(14.3%)	11(44.0%)	14(77.8%)	

Note. ***p≤.001

Table 58

Comparison of 'friendship', 'stereotype' and 'language' score between NA and ASD diagnostic groups

			Diagnosis		
			No Diagnosis	Autism Spectrum Disorder	χ^2
Friendship	0	n(%)	9(42.9%)	4(9.3%)	20.6***
	1	n(%)	8(38.1%)	7(16.3%)	
	2	n(%)	4(19.0%)	13(30.2%)	
	3	n(%)	0(.0%)	19(44.2%)	
Stereotype	0	n(%)	14(66.7%)	14(32.6%)	6.8***
	1	n(%)	5(23.8%)	20(46.5%)	
	2	n(%)	2(9.5%)	8(18.6%)	
	3	n(%)	0(.0%)	1(2.3%)	
Language	0	n(%)	11(52.4%)	5(11.6%)	15.6***
	1	n(%)	7(33.3%)	13(30.2%)	
	2	n(%)	3(14.3%)	25(58.1%)	

Note. ***p≤.001

The strong relationships between diagnosis and those sub-categories of friendship, language and stereotypic behaviours in the overall outcome were expected as our diagnostic tool, the 3Di, was also tapping similar areas of functioning represented by those sub-categories. Thus, it was noteworthy that outcomes in terms of work and independence were also significantly different amongst diagnostic groups ($\chi^2(6, N=64) = 17.8$, $p < .001$; $\chi^2(1, N=64) = 14.5$, $p < .02$ respectively) (Table 59).

In terms of work, there was a rather even spread of degree of adjustment among individuals with autism. Six out of the 18 individuals in the A group (33%) scored 0, four being in open employment, one in a associate degree program, and one studying in Form 7. The four (22.2%) scoring 1 were actually studying in post-secondary vocational institutes. Among the four (22.2%) scoring 2, three were in skill training centres and 1 in supported employment. Three worked in sheltered workshops. One had never worked. In the AA group, the majority (23 out of 25, 92%) had a score of either 0 or 1. Among the nine (36%) scoring 0, two were studying in university and one in Form 7, while others working in open employment. In the group of 14 (56%) scoring 1, eight were still studying in vocational institutes and six were engaged in low pay work scheme. Two were in supported employment. In the NA group, thirteen out of 21 (62%) scored 0, in which nine were in open employment, two studying in university, and two studying for associate degrees. In the group of seven (33.3%) scoring 1, three were working under low pay scheme and four were in post-secondary vocational courses. One had never been gainfully employed. It appeared that it was those who were diagnosed as still having autism as adults had variable work outcomes and studied at different levels, whereas those diagnosed as having AA or no longer having a diagnosis were better employed or were studying in universities or vocational institutes.

Given having cells with less than five observations in the above analysis, chi-squared test was re-run, comparing the NA group and the ASD group. Results were found to be insignificant (χ^2(4, N=64) =5.92, *p*=.116) (Table 60). It seemed that the contrast between the A group and the NA group was diluted by the combination of the former with the AA group whose association with kinds of work seemed to be more similar to that of the NA group. In sum, the NA group appeared to be better employed, indicating an association between diagnostic continuity at early adulthood with kinds of work.

In terms of independent living, a large majority of the NA group achieved full independence (16 out of 21, 76.2%) whereas 52% (13 out of 25) of the AA group and only 22.2% (4 out of 18) of the A group did so. Four (19%) of NA group, 12 (48%) of AA group and 12 (66.7%) of A group were independent with some assistance.

Given that there were six cells with observations fewer than five in the above analysis, chi square test was re-run on two diagnostic groups and the results were also significant (Table 60) (χ^2(3, N=64) =8.79, *p*=.03). In sum, this analysis and the above both converged to indicate that diagnostic continuity at early adulthood had an adverse impact on independent living. More individuals with autism or atypical autism had difficulties in independent living. Among the groups with diagnosis, the AA group was relatively more independent in living than the A group.

Table 59

Comparison of 'work' and 'independence' score between 3 diagnostic groups

			Diagnosis			
			No Diagnosis	Atypical Autism	Autism	χ^2
Work	0	n(%)	13(61.9%)	9(36.0%)	6(33.3%)	*17.8**
	1	n(%)	7(33.3%)	14(56.0%)	4(22.2%)	
	2	n(%)	0(0.0%)	2(8.0%)	4(22.2%)	
	3	n(%)	1(4.8%)	0(0.0%)	4(22.2%)	
Independence	0	n(%)	16(76.2%)	13(52.0%)	4(22.2%)	*14.5**
	1	n(%)	4(19.0%)	12(48.0%)	12(66.7%)	
	2	n(%)	1(4.8%)	0(0.0%)	1(5.6%)	
	3	n(%)	0(0.0%)	0(0.0%)	1(5.6%)	

Note. *$p \leq .05$

Table 60

Comparison of 'work' and 'independence' score between NA and ASD diagnostic groups

			Diagnosis		
			No Diagnosis	Autism Spectrum Disorder	χ^2
Work	0	n(%)	13 (61.9%)	15 (34.9%)	*5.92*
	1	n(%)	7 (33.3%)	18 (41.9%)	
	2	n(%)	0 (0.0%)	6 (14.0%)	
	3	n(%)	1 (4.8%)	4 (9.3%)	
Independence	0	n(%)	16 (76.2%)	17 (39.5%)	*8.79**
	1	n(%)	4 (19.0%)	24 (55.8%)	
	2	n(%)	1 (4.8%)	1 (2.3%)	
	3	n(%)	0 (0.0%)	1 (2.3%)	

Note. *$p \leq .05$

6.3 Subscales of 3Di and Overall Outcome

The relationship between the diagnostic subscales of 3Di and overall outcome was examined, using the chi-square statistics. Individuals with no impairment (i.e., below threshold) in reciprocal social interaction scale of the

3Di were found to have significantly better overall outcome, respectively defined differently with various levels (χ^2(3, N=64) = 15.6, *p*<.001; χ^2(2, N=64) =9.9, *p<.001*; χ^2(1, N=64) =9.2, *p<.001* respectively) (Table 61). For example, ten out of 18 (55.6%) of those without impairment (non-clinical) had 'near normal' functioning. In the impaired group (clinical), 32 out of 46 (69.6%) had 'fair'/'poor' outcomes.

Table 61

Comparison of overall outcome rating score between non-clinical or clinical groups in reciprocal social interaction skills

			Categorical - Reciprocal social interaction skills		
			Non-clinical	Clinical	χ^2
Overall outcome	Near normal functioning	n(%)	10(55.6%)	5(10.9%)	*15.6****
	Good	n(%)	3(16.7%)	9(19.6%)	
	Fair	n(%)	5(27.8%)	26(56.5%)	
	Poor	n(%)	0(0.0%)	6(13.0%)	
Overall outcome	Near normal functioning / good	n(%)	13 (72.2%)	14 (30.4%)	*9.9***
	Fair	n(%)	5(27.8%)	26(56.5%)	
	Poor	n(%)	0(0.0%)	6(13.0%)	
Overall outcome	Near normal functioning / good	n(%)	13 (72.2%)	14 (30.4%)	*9.2***
	Fair / poor	n(%)	5 (27.8%)	32 (69.6%)	

Note. ***p*≤.01 ****p*≤.001

Individuals with no impairment (below threshold) in the communication scale of the 3Di also had significantly better overall outcomes, respectively defined differently with various levels (χ^2(3, N=64) = 9.86, *p*<.02; χ^2(2, N=64) =7.10, *p*=.02 ; χ^2(1, N=64) =6.94, *p<.001* respectively) (Table 62). For example, six out of ten (60%) of those individuals with impairment (non-clinical) had 'near normal' functioning. In the impaired (clinical) group, 35 out of 54 (over 64%) had 'fair'/'poor' outcome.

Table 62

Comparison of overall outcome rating between non-clinical or clinical groups in social communication skills

			Categorical - Use of language and other social communication skills		
			Non-clinical	Clinical	χ^2
Overall outcome	Near normal functioning	n(%)	6(60.0%)	9(16.7%)	*9.86**
	Good	n(%)	2(20.0%)	10(18.5%)	
	Fair	n(%)	2(20.0%)	29(53.7%)	
	Poor	n(%)	0(0.0%)	6 (11.1%)	
Overall outcome	Near normal functioning / good	n(%)	8 (80.8%)	19 (35.2%)	*7.11**
	Fair	n(%)	2(20.0%)	29(53.7%)	
	Poor	n(%)	0(0.0%)	6 (11.1%)	
Overall outcome	Near normal functioning / good	n(%)	8 (80.8%)	19 (35.2%)	*6.95***
	Fair / poor	n(%)	2 (20.0%)	35 (64.8%)	

Note. **p* ≤.05 ***p*≤.01

Individuals with no impairment (below threshold) in stereotyped behaviours scale of the 3Di had significantly better overall outcomes, respectively defined differently with various levels (χ^2(3, N=64) = 21.1, *p*<.001; χ^2(2, N=64) =21.1, *p*<.001; χ^2(1, N=64) =12.3, *p*<.001 respectively) (Table 63). For example, 25 out of 44 (56.8%) of those individuals without impairment (non-clinical) had ‘near normal’/‘good’ functioning. In the impaired group (clinical), 18 out of 20 (over 90%) had ‘fair’/‘poor’ outcomes.

Table 63

Comparison of overall outcome rating between non-clinical or clinical groups in repetitive/stereotyped behaviours and routines

			Categorical – Repetitive/stereotyped behaviours and routines		
			Non-clinical	Clinical	X^2
Overall outcome	Near normal functioning	n(%)	14(31.80%)	1(5.00%)	*21.1****
	Good	n(%)	11(25.00%)	1(5.00%)	
	Fair	n(%)	19(43.20%)	12 (60.00%)	
	Poor	n(%)	0(0.00%)	6(30.00%)	
Overall outcome	Near normal functioning / good	n(%)	25 (56.8%)	2 (10.0%)	*21.1****
	Fair	n(%)	19(43.20%)	12 (60.00%)	
	Poor	n(%)	0(0.00%)	6(30.00%)	
Overall outcome	Near normal functioning / good	n(%)	25 (56.8%)	2 (10.0%)	*12.3****
	Fair / poor	n(%)	19(43.20%)	18 (90.0%)	

Note. ****p*≤.001

7. Psychiatric Problems

7.1 Epilepsy

Only three individuals reported having epileptic fits appearing during adolescence. They were well-maintained on medication.

7.2 Psychiatric Disturbances other than ASD

Eight of the whole group, constituting 12.5%, had another psychiatric diagnosis other than ASD. Among this group of individuals with psychiatric history, one young man, still studying, had been on Ritalin for his overactivity since childhood. Another three were diagnosed as having early psychosis during late adolescence and were put on medication. Another two attended psychiatric consultation for OCD. Another young man was diagnosed as suffering from anxiety disorder and was prescribed drugs. Finally, one lady, suffering from a brief adjustment disorder, was agitated and emotional in face of changes after leaving school. She was admitted briefly to a psychiatric ward.

7.3 Psychopathology as measured by Chinese MMPI-2 scales

All participants of this study were administered the Chinese MMPI-2. All but 15 answered all questions. Out of the 15, ten missed one item only, three missed less than five, one missed 11 items and the last one missed 13 items. The numbers of missing items were considered in the acceptable range, since Greene (2000) suggested 30 as a number beyond which the MMPI profiles were not interpretable (page 46). All individuals scored below the cut-off of ten in the Chinese Infrequency Scale (ICH) (mean=2.26 , range=0-9) which suggested that the scores did not deviate significantly from the usual responses provided by the original Chinese normative sample. However, using the criteria suggested in the manual of the Chinese MMPI-2 (Cheung, Zheng & Song 2003, p 41), three protocols were considered invalid. One had a VRIN raw score of 15, a TRIN raw score of 14, and an infrequency T score (F) of 67. Another had a VRIN raw score of 15 and a TRIN raw score of 18, although the infrequency T score (F) was 52. A third person had a VRIN raw score below 15, a TRIN raw score of 16, and an infrequency T score (F) of 73. The final sample for analysis of the Chinese MMPI-2 data was hence 61.

Regarding the traditional scales for detecting accuracy of item endorsement, namely, the L (lie) scale, the *F(*infrequency) scale and the K (correction) scale, overall significant elevation was found in the F scale, with a mean of 58.1 and a significant effect size of 0.80 (Cohen's d value). Twenty-six percent of the group also had a T score above the cut-off of 65. There could be several explanations for the high scores in the F scale. Respondents could be malingering or over-reporting symptoms, endorsed items in random careless manner, had difficulty in reading or comprehending items, or had severe psychological distress (Butcher, 1999, p 29; Nichols, 2001, p 45). While reading should not be a problem with the group since all participants of this study had completed at least nine years of education. To what extent they really grasped the meaning of the items was a tricky issue. However, of the 16 individuals who scored above cut-off in the F scale, all except three had a full IQ over 90 (FIQ of one of them was 85 and of the other two was 75). There seemed to be some ground to believe that most of them were able to understand at least the prima facie meaning of the items. Malingering or over-reporting could be counter checked by the presence of elevations in the VRIN and TRIN scales (Nichols, 2001, p 46). These possibilities were quite unlikely in the present group as T scores of the two scales were below 65 for all 16 individuals. Elevation of the F scale had been found to associate strongly with paranoia (Scale 6) and Schizophrenia (Scale 8) and hence could be a rough index of severity of psychological distress (Greene, 2000, p69). Nine out of 16 of the high scorers in the F scale also had high elevations in both Scale 6 and 8. Four had elevation in either Scale 6 or 8. Also, nine out of the 16 had elevated scores in more than ten scales, and only three had no more than two elevated scales. It seemed reasonable to accept all the protocols as valid data and to consider the significant elevations in the F scale as a sign of overall psychological distress in these 16 individuals.

Compared to norms in the Chinese population, our current sample produced group means which were significantly elevated in 14 out of 25 scales (10 Clinical scales and 15 content scales). The mean scores on these 14 elevated scales were listed in Table 64. As shown in Table 65, the most elevated scale was Schizophrenia (Cohen's d = .81), followed by Anxiety (Cohen's d = .75), Paranoia (Cohen's d = .74), Work Interference (Cohen's d = .66), Hypomania (Cohen's d = .61), Obsessiveness (Cohen's d = .53) and Psychasthenia (Cohen's d = .51). Those with significant differences but a smaller effect size were Bizarre Mentation (Cohen's d = .49), Depression (Scale 2) (Cohen's d = .48), Depression (DEP in content scales) (Cohen's d = .37), Low Self-esteem (Cohen's d = .37), Social Discomfort (Cohen's d = .33) and Social Introversion (Cohen's d = .28).

Using T score equal or above 65 as a cut-off for significant elevlation, 16 out of 61 participants of this study (26.2%) had no scales with T scores above cut-off, 27 (42.6%) 1 to 5 elevated scales, 10 (16.4%) 6-10 elevated scales, and 11 (14.8%) 11 to 18 elevated scales (Table 66).

Of the eight individuals who had a psychiatric diagnosis, two had elevations in a large number of scales. An OCD individual had 18 significantly elevated scales and another with a diagnosis of early psychosis had 13 significantly elevated scales. However, severe psychopathology was not apparent in the other six individuals whose number of elevated scales ranged from 0 to 3. While it was understandable that the lady who had a brief adjustment problem did not have elevated scores in any of the scales, it was interesting to note that the young man who had both OCD and early psychosis also had no elevated scales. A lot of denial might be at work in this particular individual.

7.3.1 Chinese MMPI-2 scales and diagnostic status

ANOVA was run to test whether individuals belonging to three diagnostic groups with respect to autism differed in the number of elevated scales and results were not significant (*F(*2, 58) =1.14, *p*=.32) (Table 67), suggesting that there was no difference in the extent of other psychiatric disturbances reported by individuals of different diagnostic groups.

Table 64
Mean scores of MMPI-2 Scales with significant elevations

Clinical Scales	All (n=61)		No Diagnosis (n=20)		Atypical Autism (n=24)		Autism (n=17)	
	M	SD	M	SD	M	SD	M	SD
Depression	54.8	11.0	56.4	12.0	54.4	11.1	53.5	9.9
Paranoia	57.5	14.2	59.0	13.3	55.7	15.8	58.5	13.2
Psychasthenia	55.1	10.6	57.1	10.5	53.2	8.9	55.3	12.8
Schizophrenia	58.2	12.0	55.9	13.1	58.7	10.1	60.1	13.3
Hypomania	56.1	9.9	56.2	11.2	55.7	9.6	56.4	9.1
Social introversion	52.8	12.1	50.7	12.2	54.7	13.2	52.9	10.5

Content Scales	All (n=61)		No Diagnosis (n=20)		Atypical Autism (n=24)		Autism (n=17)	
	M	SD	M	SD	M	SD	M	SD
Anxiety	57.6	14.6	64.0	14.7	53.6	14.6	55.6	12.6
Obsessiveness	55.3	11.2	59.2	10.2	51.9	11.6	55.5	10.7
Depression	53.7	13.5	56.7	14.5	52.3	12.5	52.2	13.7
Bizarre mentation	55.0	12.2	55.2	11.6	54.4	12.7	55.5	12.9
Anger	51.5	13.0	56.0	13.7	51.2	13.6	46.6	10.0
Low self-esteem	53.8	13.1	55.2	14.3	55.5	12.9	49.7	11.5
Social discomfort	53.3	11.2	49.7	9.7	55.3	13.1	54.7	9.3
Work interference	56.7	12.9	60.0	12.1	54.9	12.8	55.3	14.0

Table 65

Effect size of MMPI-2 scales with significant elevations

Clinical Scales	All (61)	No Diagnosis (20)	Atypical Autism (24)	Autism (17)
Depression	0.48***	0.64***	0.44*	-
Paranoia	0.74***	0.89***	0.57**	0.84***
Psychasthenia	0.51***	0.71***	-	0.53**
Schizophrenia	0.81***	0.59**	0.87***	1.01***
Hypomania	0.61***	0.62**	0.57**	0.64**
Social introversion	0.28*	-	0.47*	-

Content Scales	All (61)	No Diagnosis (20)	Atypical Autism(24)	Autism (17)
Anxiety	0.75**	1.39***	-	0.56*
Obsessiveness	0.53**	0.92***	-	0.55*
Depression	0.37*	0.67***	-	-
Bizarre nentation	0.49*	0.52*	0.44*	0.55*
Anger	-	0.59**	-	-
Low self-esteem	0.37*	0.51*	0.55**	-
Social discomfort	0.33*	-	0.53**	0.47*
Work interference	0.66**	0.99***	0.49*	0.53*

Note. **p* ≤.05 ***p*≤.01 ****p*≤.001. Cohen's d: .2-.49= small ES; .50-.79= medium ES; >.80= large ES

Table 66

Frequency of number of elevated MMPI-2 scales in individuals

No of elevated scales with T score above 65	Number of individuals	Percentage of individuals
0	16	26.2%
1-5	26	42.6%
6-10	10	16.4%
11-18	9	14.8%
Total	61	100%

Table 67

Mean no. of elevated MMPI-2 scales in individuals across diagnostic groups

		n	M	SD	*F* value
Diagnosis	No Diagnosis	20	5.9	5.4	1.14
	Atypical Autism	24	3.6	4.7	
	Autistic Disorder	17	3.9	5.8	

To find out whether the diagnostic groups actually differed in scores on various MMPI scales, one-way ANOVA between the three diagnostic groups with respect to autism was carried out on the 14 MMPI-2 scales with significant elevated scores (Appendix 9). After adjustment for multiple testing of 14 scales (the *p* value should be set at .05/14=.0035), no significant differences were found in all scales across the three groups.

In summary, as a group, participants in this study had more psychological disturbance compared to norms. Scales labelled as schizophrenia, anxiety and paranoia were those with the highest elevations (or largest efffect sizes) and the greatest percentages of individuals with T scores above the cut-off. Evidence of significant differences across the three diagnostic groups with respect to autism was lacking in terms of the number of elevated scales and the scores of the elevated scales.

7.3.2 Chinese MMPI-2 scales and overall outcome

Correlations between the number of elevated scales of Chinese MMPI-2 and overall outcome rating as well as its subcategories were all weak and insignificant (Appendix 10). This suggested that the extent of psychiatric disturbances other than autism reported by the participants was not related to both the overall outcome and in various subcategories. In order to examine whether psychological disturbances had an additional contribution to the overall outcome after controlling for autism, regression analyses were run with 14 significantly elevated scales. None of the results were significant, after adjustment for multiple testing (0.05/14 = 0.003) (Appendix 11) . So, although as a group, our present sample had increased psychopathology compared to the Chinese normative population, none of the types of psychopathology represented by the elevated MMPI scales had additional contribution to predict the overall outcome on top of autism .

In view of probable overlapping common factors between the diagnosis of autism and some of the categories of the overall outcome rating, namely, friendship, language and autistic-type stereotypic behaviours, the previous regression analysis was re-run on a revised outcome measure comprising of only the 'work' and 'independence' categories. Insignificant results were once again found after adjustment for multiple testing of 14 MMPI scales (0.003) (Appendix 12).

7.3.3 Chinese MMPI-2 scales and IQ

Correlations between both childhood and current IQs and the number of MMPI elevated scales were not significant (Appendix 10). Nor were correlations between both childhood and current IQs and the scores of the 14 significantly elevated scales (Appendix 13). Chi square analysis was also run to see whether participants of different childhood and current IQ levels might score differently on each of the 14 significantly elevated scales (Appendix 14 & 15). Again, insignificant results were found after adjustment for multiple testing (.05/14 = 0.003). In sum, childhood and current IQs did not seem to be related to the general psychopathology other than autism, as measured by the Chinese MMPI-2.

7.3.4 Chinese MMPI-2 scales and education

ANOVA was run on the numbers of significantly elevated MMPI scales across the three levels of educational attainment. Results were not significant (*F(*2, 58) =1.47, df=2, *p*=.23) (Appendix 16) indicating that individuals with different educational levels did not differ in their numbers of significantly elevated MMPI scales, i.e., in their extent of psychopathology other than autism.

7.3.5 Chinese MMPI-2 scales and occupation

ANOVA was run on the numbers of significantly elevated MMPI scales across two levels of occupation. Results were not significant (*F(*1, 30) =.52, *p*=.47)) (Appendix 16) indicating that skilled or unskilled workers did not differ in their numbers of significantly elevated MMPI scales, i.e., in their extent of psychopathology other than autism.

7.3.6 Comparison with results of study of Ozonoff et al. (2005)

MMPI scale scores of the present study were compared with those of an earlier study by Ozonoff et al. (2005) which was the only study using MMPI-2 with adults with autism to date. The sample was smaller with only 20 participants, slightly older (mean age =23 years versus 21.7 years in the present study) and having slightly higher IQ at 104.7 (versus 96.4 in the present study). Effect sizes were calculated from the magnitude of group differences between the ASD group and a control group in the Ozonoff et al. (2005) study whereas effect sizes in the present study were computed by comparing the T scores of the group against local normative data. The scores on the MMPI-2 scales from the present study and Ozonoff et al.'s study were compared in Table 68, with nine scales in the Ozonoff group and seven in this study having medium to large effect sizes. Findings of both studies suggested that adults with autism probably had more psychological disturbance than their age peers.

Table 68
Mean T scores of MMPI-2 Scales

Scale	Ozonoff et al.. (2006)		Present study	
	Mean T score	Effect size	Mean T score	Effect size
Clinical scales				
1(Hypochondriasis)	52.4	.12	50.3	.03
2(Depression)	57.7	**.91**	54.8	.48
3(Conversion Hysteria)	51.7	.01	51.1	.11
4(Psychopathic)	52.8	.12	52.1	.21
6(Paranoia)	56.5	.21	57.5	**.74**
7(Psychasthenia)	57.4	.39	55.1	**.51**
8(Schizophrenia)	63.3	**.78**	58.2	**.81**
9(Hypomania)	50.4	**.62**	56.1	**.61**
0(Social Introversion)	57.5	**1.14**	52.8	.28
Content scales				
Anxiety	52.5	.32	57.6	**.75**
Fears	48.3	.42	51.4	.14
Obsessiveness	55.0	**.58**	55.3	**.53**
Depression	54.0	.35	53.7	.37
Health Concerns	50.3	.21	51.7	.17
Bizarre Mentation	53.6	.07	55.0	.49
Anger	46.3	.37	51.4	.14
Cynicism	48.8	.16	47.9	-.21
Antisocial Practices	47.7	.00	49.5	-.05
Type A	45.8	.22	47.8	-.22
Low Self-Esteem	54.4	**.60**	53.8	.37
Social Discomfort	58.1	**1.22**	53.3	.33
Family Problems	51.0	.23	50.4	.04
Work Interference	55.0	**.56**	56.7	**.66**
Negative Treatment Indicators	54.6	**.70**	52.3	.23

Note: bold = scales with medium to large effect size

There were however some differences in the order of significance of scales between the two studies. In order of the magnitude of effect sizes, social discomfort (scale SOD) had the largest value (d= 1.22), followed by social introversion(scale 0) (d= 1.14), depression (Scale 2) (d= .91), schizophrenia (scale 8) (d= .78), negative treatment indicators (scale TRT) (d= .70), hypomania (scale 9) (d= .62) and low self-esteem(scale LSE) (d= .60) in the Ozonoff et al. study. The order in the present study was schizophrenia (scale 8) (d= .81), followed by anxiety (scale ANX) (d= .75), paranoia (scale 6) (d= .74), work (scale WRK) (d= .66) and hypomania (scale 9) (d= .61). It appeared that the constellation of psychiatric disturbance in the present study differed from that of the Ozonoff et al study.

7.4 OCIR- a Measure of OCD

The mean OCI-R score for our sample is 15.8 (*SD*=12.6). When the cut-off of 21 (as recommended by Foa et al. in 2002) was used to divide our sample into clinical and non-clinical groups, 18 (28%) (*M*= 32.3, *SD*=10.2) could be considered to have obsessive-compulsive symptoms deserving clinical attention (i.e., clinical), whereas 46 (72%) (*M*=9.3, *SD*=5.5) could be considered non-clinical in terms of obsessive-compulsive symptoms.

There were three individuals who were diagnosed as having OCD and were prescribed medication by psychiatrists. One had the highest OCI-R score of 56, and another scored at 38. Yet, another reported few OCD symptoms, having a score of only six. A likely explanation lay in the fact that the last individual suffered also from early psychosis which could have partly obscured his insight. Indeed, the same individual reported few psychological problems as reflected by the absence of significantly elevated scale scores in MMPI-2.

A closer examination was conducted at the scores of 18 high scorers on different subscales of the OCI-R, namely, hoarding, checking, mental neutralizing, obsessing, ordering and washing. Out of a maximum score of 12 on each scale, the mean scores of these 18 high scorers were 6.9, 6.1, 6.0, 5.6, 4.4 and 3.7 respectively in the subscales of obsessing, ordering, checking, hoarding, mental neutralizing and washing. It appeared that they were relatively less engaged in mental neutralizing and obsessive washing, which were quite common among OCD patients.

7.4.1 OCD and diagnostic status

Results of one-way ANOVA did not find any significant difference in OCI-R scores across the three diagnostic groups with respect to autism (*F(*2, 61) =.16, *p*=.85), nor between NA and ASD group(*F(*1, 62) =.22, *p*=.63) (Appendix 17). Chi-square test also yielded insignificant results both when three diagnostic groups and two diagnostic groups were used (χ^2(3, N=64) =1.27 *p*=.53; χ^2(1, N=64) =.28 *p*=.59 respectively) (Appendix 17), indicating that different diagnostic groups did not differ in the percentages of individuals having obsessive-compulsive symptoms. In other words, diagnostic continuity at early adulthood did not seem to be related to obsessive-complusive symptomatology.

7.4.2 OCD and overall outcome

There was a significant correlation between overall outcome and OCI-R scores (*r*=.26, *p*<.03), although the effect size was in the small to medium range. Given a strong correlation between diagnostic status with respect to autism and overall outcome, it would be of interest to find out whether OCD as a comorbidity might have additional contribution towards the overall outcome of our sample. Regression analysis entering diagnostic status as the first variable before OCI-R was conducted (Table 69). Results were significant (R square change= .06, *df* =1,60 , sign *F* change at .01) Hence, OCD symptomatology had an additional contribution to the variance of overall outcome, even after the effect of autism was taken into account.

Table 69
Regression analysis of OCI-R scores on overall outcome, controlling for diagnostic status

(DV=outcome total)

Model	R Square	Std. Error of the Estimate	Change Statistics				
			R Square Change	F Change	df1	df2	Sig. F Change
1[a]	0.382	2.698	0.381	18.85	2	61	.000
2[b]	0.443	2.584	0.061	6.53	1	60	0.013

Note. [a] Predictors: (Constant), Dx_dummy2, Dx_dummy1
[b] Predictors: (Constant), Dx_dummy2, Dx_dummy1, OCIR_TOT

Furthermore, regression analysis was also re-run on a revised outcome measure based upon the subcategory work and independence only (work-independence). The results were also significant (Table 70). (R square change= .12, *df* =1,60, sign *F* change at .001). Hence, OC symptoms as measured by OCIR also appeared to have a significant contribution to overall outcome based upon work and independent living, on top of autism.

Table 70

Regression analysis of OCI-R scores on work-independence outcome, controlling for diagnostic status

(DV= work-independence)

Model	R Square	Std. Error of the Estimate	Change Statistics				
			R Square Change	F Change	df1	Df2	Sig. F Change
1[a]	.193	1.26	.193	7.299	2	61	.001
2[b]	.319	1.17	.126	11.081	1	60	.001

Note. [a] Predictors: (Constant), Dx_dummy2, Dx_dummy1

[b] Predictors: (Constant), Dx_dummy2, Dx_dummy1, OCIR_TOT

7.4.3 OCD and IQ

Correlations between both childhood and current IQs and OCI-R scores were examined. None was significant, indicating that intellectual functioning, whether childhood or current, had no relationship as to whether a particular individual had obsessive-compulsive symptoms currently (Appendix 17).

CHAPTER FOUR

DISCUSSION

1. Education

1.1 Comparison with Western Studies

With 58% (37 out of 64) individuals in post-secondary education or having attained post-secondary qualifications, the present sample seems to reach a better educational outcome than those high functioning individuals with autism in the studies of Howlin et al. (2000), Rumsey et al. (1985), Newson et al. (1982) and Tantam (1991) (32%, 14%, 11% and 4% achieving similar educational levels, respectively). However, if post-secondary education of the present sample is examined in greater details, such as in the area of tertiary education, the proportion entering or having gone to universities is actually smaller in this sample, being only 9% (6 out of 64) when compared to 50% (8 out of 16) in the study of Szatmari et al. (1989) and 14% (10 out of 70) of the Aperger group of Cederlund et al. (2008).

A far greater proportion (44%) stays in post-secondary vocational education which is the route commonly taken by those who do not do well enough to pursue higher academic qualification. The standard of this vocation education is not likely to be compatible to the college level in Western countries. So the educational attainment of this sample may not appear to be as bright as implied by the figure of 58% post-secondary education.

Furthermore, by the inclusion criteria of this study, all participants in the present study studied in mainstream schools. In fact, according to the education system in Hong Kong, with rare exceptions, all children with normal intelligence would not be permitted to study in special schools. So it is unfair to compare current results, with every participant attending normal schools, to those of studies in countries where even children with normal intelligence can be allowed to attend special schools for their education. For example, a great proportion of participants with normal intelligence in the studies of Howlin et al. (2004), Gilchrist et al. (2001), Szatmari et al. (1989) and Venter et al. (1992) (being 73%, 69%, 50% and 48% respectively) attended special schools. It would not be justified to consider our sample as necessarily having higher educational attainment for attending normal schools, because our children are prohibited by the government policy to attend special schools. Furthermore, whether children with autism can stay in normal schools rests on the amount of support available in the system. For instance, none of the participants in Eaves & Ho's study (2008) (over 80% with a Verbal IQ under 70, i.e., MR) studied in special schools because a great variety of special provisions were offered to the children in mainstream schools. It seems therefore that attendance in normal or special schools can be much influenced by external factors such as the educational policy and the amount of support given to the children with autism in normal schools. So by itself, attendance in normal or special schools may not be a good index of educational attainment of the individuals with autism. In turn, this is making comparison across studies according to such attendance figures difficult.

1.2 Comparison with Age-peers

As a group, individuals with autism in the present study are relatively underachieving, especially in terms of acquiring higher formal qualifications. Specifically, only 9% of the present sample has a university education compared to 26% among their age peers in Hong Kong. No comparison with population statistics in western societies was reported in studies reviewed in the introduction section. However, except for the study of Szatmari et al. (1989), the percentages of high functioning individuals entering university were below 26%, the statistics from the Hong Kong census (14% in Rumsey et al., 1985; 4% in Tantam, 1991; 3% in Venter et al., 1992; 14% in Cederlund et al., 2008). It is hence fair to say that individuals with autism have generally greater difficulty to attain university education than the general population.

In the area of post-secondary vocational qualifications, the present group surprisingly out-performs their age peers, being 44% compared to the population statistic of 17%. A possible explanation may be found in the extra efforts made by parents of individuals with autism in identifying educational alternatives for their children. Whereas most adolescents would have their own ideas about study or work by late teens and may readily give up study at their poor academic results, individuals with autism would still be taken care of by their parents who are anxious about their future. They reckon that more education should help them find jobs in the competitive world. Engstrom et al. (2003) made a poignant observation that parents of children with autism would give much more support to them than was usual for the age. This describes well the mentality and behaviour of the local Chinese parents of children with autism in Hong Kong.

In sum, despite the above caution, the present autistic sample compares favourably with those in studies of other countries in terms of educational attainment. However, when compared to the general population of their age in Hong Kong, they are in fact educationally under-achieved. It is not entirely sure whether this phenomenon can be fully explained by the fact that their IQs are marginally falling short of the median 100 (FIQ=96.4, VIQ=96.2, PIQ=97.2). Nonetheless, our findings do indicate that the participants with better IQs at childhood and at early adulthood are likely to attain higher educational levels.

1.3 Factors Affecting Educational Attainment

Besides IQs, current findings indicate that diagnostic continuity with respect to autism, especially deficits in social skills, is also a hindrance to the educational attainment of the participants. However, psychological disturbances other than autism are not related to educational attainment. It is a common complaint among parents that their children with autism are able to work alone but have the worst experience in any group work or projects involving approaching people. However, the demand for cooperation and collaborative effort usually increases with higher academic study. Also, bullying and rejection for their asocial and sometimes odd behaviours often make school an unpleasant environment and can indirectly affect their motivation for schooling. Furthermore, divergent and creative thinking, much required in higher education, is often lacking in the majority of individuals with autism. Further research on clarifying the nature of difficulties arising from various autistic deficits on educational pursuits would inform the educational system on how best children with autism can learn in schools.

At the same time, the influence of the environment on educational attainment should not be ignored. For instance, parental support and active intervention is postulated as a significant influence to obtain appropriate training for the individuals with autism (Rumsey et al., 1985; Szatmari et al., 1989; Eaves & Ho, 2008). The recent setting up of a 'special education needs' (SEN) category by the Education Bureau of Hong Kong SAR Government, and the package of services attached to such status has helped to introduce more tailored-made intervention activities to assist the children with autism to adjust behaviourally or learn more effectively at school. Evaluation studies should be done to find out the ingredients or strategies most conducive to effective learning of the children with autism. With steady progress in specialized support, it is hoped that children with autism would be on more competitive grounds for higher education in the coming decades.

2. Occupation

2.1 Comparison with Western Studies and Age-peers

Compared to findings of studies reviewed in the introduction section, the employment status of our present sample is relatively more favourable, with 57% in open employment, 18% in some form of supported employment scheme and only 6% in sheltered workshop placement. This employment rate appears to be better even when compared to the best result from the study of Szatmari et al. (1989) in which 44% were in open employment. However, a closer look at the kinds of work participants of the present sample are doing shows predominantly a picture of low-income unskilled jobs, similar to reports of past studies (Rumsey et al., 1985; Ballaban-Gil et al., 1996; Venter et al., 1992). Also, compared to age-peers in the local population, they are under-represented in the white-collar and professional occupations and over-represented in unskilled jobs.

2.2 Factors Affecting Employment

A number of factors can have interplayed together leading to an employment situation which compared favourably to other studies. First of all, near half of the sample is still studying. As discussed above, a number of students may have stayed in the educational system in order to delay facing the world of competitive employment. In fact, six (19%) of the full-time students are 23 years old and above. Had they stopped studying earlier and by virtue of their relatively poorer academic performance, they would have been the group who either could not find a job or might engage in unskilled work. If that were the case, the overall employment picture would appear less positive than the present result.

Family and community support have certainly helped the young adults along. Five individuals comprising of 15% of the total sample are either working for their family or relatives. To some extent, the Youth Work Experience & Training Scheme (YWET) of the Labour Department of the Hong Kong SAR Government has been successful in helping special needs youths, including individuals with autism, find the right employers.

Furthermore, as in Japan at the time of the study by Kobayashi et al. (1992), the vibrant economy in Hong Kong opens a lot of job opportunities during the period of data collection. The community has a great need for a large work force especially in the service industry. The unemployment rate has always been low in Hong Kong. At the time of the research, the unemployment rate was 4.8% for the age range of the individuals under study (Report of the Census & Statistics Department, 2007). Also, in Hong Kong, there is no policy on minimum wage as a result of which jobs with very low wage are available for those willing to take up. Indeed, the majority of our sample actually earns no more than $4,000, which is little more than the monthly Government Public Assistance to unemployed individuals of $3,000 plus.

In other words, the seemingly better employment rate in the present study may not be generalizable to different economic contexts. Individuals are able to find or keep a job because of the generally good job market for low-level work and because they are willing to get an almost nominal wage. Also, the majority of our sample actually work below the levels expected from their educational attainment. In comparison to employment of peers of their age in the general population in Hong Kong, they are by far over-represented in unskilled jobs. In other words, despite that the present sample compares favourably in rate of employment to those of other studies, their occupational attainment is less favourable when compared to their own peers in Hong Kong.

Within the sample, education, diagnostic continuity with respect to autism, and overall outcome are associated with the types of occupation an individual has. Occupation is however unrelated to intellectual functioning and psychological disturbances other than autism. So, though high IQ may be instrumental to higher education, it is not helpful in getting someone a better job. Sadly, the majority of participants in the study, including university graduates, cannot go further to any white-collar jobs. One wonders what really hinder them from getting a job which commensurates with their education and intellectual functioning, the two factors commonly assumed to be predictive of occupation in normal population (Hough & Oswald, 2000).

Shea & Mesibov (2005) succinctly pointed out that while individuals with autism could master the intellectual aspects of jobs, they probably faced great difficulties in handling the organizational aspects (such as time management, priority setting, organizing work materials, and coping with changes in routines) and the social aspects (such as interacting with co-workers appropriately, knowing when to seek help, and what to do during breaks). As an example, an autistic young man lost his job as a speed delivery man because he broke the door of a client when it was closed on him a couple of minutes earlier than closing time according to his watch. Another fought with his superior who with good intention tried to keep him in office to calm down after a heated row between him and a coworker. He perceived that asking him to stay behind, the supervisor was punishing him when the wrong was clearly in the other party.

Shea & Mesibov (2005) recommended the use of Structured Teaching in work settings with intensive support through counseling and clear guidelines and information to both workers and employers (Keel, Mesibov & Woods, 1997). Another supported employment programme, after an 8-year run, reported great success in finding the right jobs which best fit the abilities of individuals with autism (Howlin, Alcock , Burkin, 2005). Supported employment hence seems to open up new opportunities for individuals with autism who are intellectually capable but socially inept.

3. Diagnostic Continuity

Our rate of over 32% (21 out of 64) no longer meeting a full diagnosis of autism in adulthood according to 3Di algorithms compares favourably to the average rate of improvement of 20% in the studies reviewed earlier. Though only seven out of the 32% are below cut-off in all three domains of the 3Di, it constitutes 11% of the whole sample which again is close to the best rate in past studies (12% in the Asperger group in Cederlund et al.'s study, 2008) (Table 3). Our better than average findings concur with the observation that the minority who 'outgrows' ASD are more likely to be high-functioning autistic or Asperger individuals (Boelte & Poustka, 2000; Seltzer et al., 2003; McGovern & Sigman, 2005 and Cederlund et al., 2008).

However, the positive note above should not obscure the other results that indeed, 89% of the current sample still remain impaired in at least one of the three domains of the autistic triad. Of the fourteen individuals without a diagnosis but with deficits (i.e., above cut-off) in at least one of the three symptom domains, 14% are above cut-off in the social domain, 43% in the communication domain, and 9.5% in both communication and repetitive/stereotyped behaviours. Such findings strike a similar note with the findings of many studies in which individuals not bearing a full diagnosis of autism still have social or communicative difficulties (von Knorring et al., 1993, Piven et al., 1996; McGovern & Sigman, 2005; Seltzer et al., 2003; Cederlund et al., 2008).

It is also noteworthy that all those bearing the Atypical Autism diagnosis have scores above cut-off in the social and communication domains, but not in the domain of repetitive/stereotyped behaviours and routines. While the absence of detailed historical data forbids a straightforward interpretation of greater improvement in the repetitive/stereotyped behaviour domain, it bears resemblance to the report by Boelte & Poustka (2000) in which all 12 of their sample (N=93), who were judged to be no longer autistic, were below cut-off in the restrictive and repetitive behaviour domain. In a prospective long-term study, Shattuck et al. (2007) also found greater improvement in verbal communication and stereotyped behaviour and relatively smaller changes in social reciprocity and non-verbal communication. They suggested that social reciprocity was the more central and persistent symptoms of ASD.

In sum, results of this current study echo the conclusions made in many prior research (Piven et al., 1996; Seltzer et al., 2004; McGovern & Sigman, 2005; Shattuck et al., 2007) that there are continuity and discontinuity in the course of development of various autistic symptoms. Seltzer et al. (2004) however cautioned that “changes are seldom substantial enough to move the individual into the normal range of functioning”.

4. Overall Outcome

The overall outcome of the present sample is favourable, compared to those of the past studies, including those with HFA individuals as the targeted samples (Table 71). The proportion of individuals with a ‘good’ outcome at 42% is only slightly inferior to the best results reported by Kobayashi et al. (1992) which had 48% in the ‘good’ outcome category. The percentage in the ‘poor’ outcome category at 9% is also the smallest, compared to results of previous studies. While current results fall in line with the general findings of most studies, especially those with high functioning participants (Szatmari et al., 1989; Howlin et al., 2000; Howlin et al., 2004; Eaves & Ho, 2008; Cederlund et al., 2008), the positive findings in this study need to be examined with care.

Table 71
Comparison of overall outcome ratings of present study with past studies

		% in present study [a]	Average % of all studies reviewed (n=19)	Average % of studies with HFA data (n=10)	% in Kobayashi et al. (1992)	% in Chung et al. (1990) [b]
Outcome Rating	Good	42.2	15.0	25	48	30.3
	Fair	48.4	32.7	42	30	47.0
	Poor	9.4	48.2	34	22	3.2

[a] ‘near normal functioning’ combined into ‘good’ rating
[b] not adding up to 100% because of 1.5% unknown outcome

4.1 Possible Effect of Sampling

The first concern is whether our findings are the result of biased sampling. Is it possible that only families with relatively more adjusted children with autism volunteered to join the study? Only seven (11% of 64) families are not cases of the clinic where the investigator works and come to the study by words of mouth. Among them, only one was functioning in the ‘near normal’ range, another one had a 'good' outcome, but the rest (5 over 7 , 71%) were functioning in the 'fair' range. The clinic cases comprise both of families who keep some contacts with the clinic mainly via parent support groups and those who have not seen any professional from the clinic for at least five years (54% and 46% respectively). The final sample of 64 represented 79% of the total number of cases found in the clinic records (nine were untraceable, four excluded because of poor IQ, and only three were actual refusals). Although it would not be possible to know about the conditions of those not participating in the study, there seems to be no strong ground to believe that they would be particularly poor in adjustment. In actual fact, among the three families who declined to join the research, one is studying in university, one is studying in a foundation course overseas (a bridging program to university), and another one is the first autistic adult who starts giving lectures in public about his growing-up experience as an autistic person. So, at least some of the individuals not included in the study have relatively good outcome. Furthermore, the bulk of families who keep in touch with the clinic would likely be those who worry about their children doing poorly rather than those whose children are doing well. Hence, it would be fair to say that the present sample might not be a group biased towards better functioning.

4.2 Possible Effect of Diagnostic Accuracy

The second concern is about whether the group has been correctly diagnosed in childhood. In mid 1980s and early 1990s when these individuals were assessed, the services for children with autism were just beginning. For instance, over ten years prior 1986, the total number of children with autism referred to the department of psychiatry at one of the largest public hospital, Queen Mary Hospital, was no more than 90 (Chung et al., 1990). The first child psychiatric specialty where the investigator works was only set up in 1993. Given the limited service, it is likely that only those who were obviously very handicapped and who were considered to be really in need of services would be brought to the attention of such rare specialists as child psychiatrists or developmental paediatricians at specialist clinics in mid 1980s and early 1990s in Hong Kong. Hence probably, the present sample is more likely to consist of the more severe group of children with autism and over-diagnosis is less likely to be be a potential bias for this study.

4.3 Possible Effect of Rating Bias

The third concern is about the comparability of the outcome criteria, despite the effort to clearly delineate how a rating should be made with reference to the Lotter criteria. The criteria in all the categories of the present study in fact bear great similarity to those used by Howlin et al.(2000), Howlin et al. (2004) and Eaves & Ho (2008) and are relatively stricter than those of Kobayashi et al. (1992) and Tantam (1991). However, one cannot entirely rule out subjectivity and hence possible differences in assigning scores to certain behavioural characteristics. To understand further what actually constitutes 'good' or 'bad' outcomes in this study, each of the sub-categories would be examined in detail.

4.3.1 Work outcome rating

In the work category, the definitions for each rating adhere closely to those in previous studies (Howlin et al., 2000; Howlin et al., 2004) and the job specifications are generally quite specific with little ambiguity.

However, since almost half of the sample is still studying, one would question whether the assignment based on their current level of education is an accurate prediction of their work ability. A significant relationship is found between education and occupation in the present sample suggesting that individuals with higher education are more likely to engage in skilled than unskilled work. Making an assumption that low pay scheme work (score 1) or supported employment (score 2) are more likely to be associated with unskilled work, it seems logical to assign a score of zero to those in tertiary education, a score of one to those in vocational training and accordingly a score of two to those unable to go beyond secondary education.

It is noteworthy, though, that amongst the nine workers who had post-secondary vocational education, seven (78%) were actually in open employment and only two were in low pay scheme jobs. So, if the majority of working individuals with post-secondary vocational education have a score of zero, assigning a score of 1 to students in post-secondary vocational education represents a poorer prediction of their work ability. Thus, while one cannot be certain that the present scoring system for students serves to reflect work adjustment accurately, it does not seem to have over-inflated the work score of students in the positive direction.

4.3.2 Independence outcome rating

Commuting in a small and dense city like Hong Kong with a very efficient mass transit railroad system (MTR) is not much of a challenge for most of the high functioning individuals with autism. The automated pay card, 'the octopus', can be used not only for traveling, but also for many over-the-counter purchases. This saves a lot of trouble in counting money and getting the right change. Hence independence has been much facilitated by a modern day technologically advanced living environment. Achieving independence in living nowadays may demand much less skills than it did in older days.

4.3.3 Friendship outcome rating

In the area of friendship, definitions of various types of interpersonal relationship are quite clear and very similar to those in recent studies (Howlin and colleagues, 2000 & 2004; Billstedt et al., 2005; Cederlund et al., 2008; Eaves & Ho, 2008). Results are also similar to those reported by Howlin et al. (2004), Eaves & Ho (2008), and Orsmond et al. (2004). It seems that adults with autism of the present sample are comparable to those in previous studies in their social competence as reflected in the quality of friendship.

A point needs to be noted here regarding the availability of computers in affecting social interaction. In Hong Kong, computer addiction is a rather common phenomenon among the younger generation. Hi-tech interactive computer games represent a common platform linking friends together. Even among normal adolescents and perhaps young adults, friendship can be bound by sharing information and by engaging in competitive games. The young participants in this study can be equally, if not more obsessed, with computer games which have the fascinating qualities of being highly technical, repetitive yet competitive, and void of a real need for human contacts. These appeal well to the autistic mind and repertoire. Indeed, described as 'high systemizers' by Baron-Cohen (2003), some actually amass huge knowledge base and skills on computer hardware, on top of mere computer games, and hence are able to share well with their peers in this rather narrow interest. This kind of computer-age friendship, revolving around topics over the computers, would probably be very different from the kind of friendship which requires the ability to share and reciprocate in wider interests and activities. Thus, the 'normal' friendship of this sample should be interpreted in the background of the availability of such modern day 'autistic-friendly' computer technology and devices. Comparison of present results with those of older studies when computers were not as availabe as presently may have unwittingly thrown the present sample in better light.

4.3.4 Stereotyped behaviours outcome rating

While Piven et al. (1996) and Fecteau et al. (2003) noted that parents reported increased ritualistic/repetitive behaviours from childhood to late adolescence or early adulthood, more studies seemed to indicate the otherwise (Rutter et al., 1967; Boelte & Poustka, 2000; Eaves & Ho, 1996; McGovern & Sigman, 2005 ;Shattuck et al., 2007). Thus, despite some inconsistency, the evidence in general seems to point towards reduction in ritualistic/repetitive behaviour, especially in relatively older cohorts. The relatively favourable rating of the present study in terms of stereotyped repetitive behaviours collaborates well with the overall trend of their reduction over time.

One point to note, however, is that a good rating in stereotyped repetitive behaviours in the present study should be understood as a reduction in functional impairment rather than actual reduction of the symptoms. Participants of our study may still have some unusual interests and preoccupations, but they seem to be more conscious of their eccentricity and have learned to hide them away from others. However, not everyone in our sample can do so. In some, their stereotyped, repetitive behaviours can still incur a great deal of impairment in their daily functioning. Sometimes it is their rigid values and inflexible thinking pattern which bring them troubles. For instance, a young man who worked as a cleaner for public toilets in country parks got sacked because he started a heated argument with tourists who tried to enter the toilet where a sign of 'No entry. Toilet being cleaned' was displayed.

4.3.5 Language outcome rating

In the language area, by inclusion criteria of this study, none of the individuals in the sample have a score of 3 which represents someone incapable of talking in complete sentences and mature grammar. This can have inadvertently lowered the total score somewhat leading to a more positive outcome. Also, 'taking 2- to 3-step instructions' may be a demanding task for the mentally handicapped, but probably pose little difficulty for the high functioning group. Currently, it is recognized that a commonly reported difficulty concerns with the individuals with autism who have relatively poor comprehension of emotions and a lack of emotion vocabulary.

Unfortunately, the ability in emotional understanding and expression is not included in the scoring criteria of this study. Without information in this aspect, a favourable rating in the present system may not adequately reflect language competence and thus may have portrayed the individuals with autism in overly positive light. The criteria used in this present study, though having been commonly used in the literature by others, are dated back to Lotter (1974). They should be updated, incorporating assessment on emotional understanding and expression.

4.4 Possible Effect of Cultural Difference

Another obvious question to ask is whether the more positive outcome of our sample is related to cultural difference between the East and the West. Too few studies have been conducted in Asia to provide adequate data for comparison. So far, there are two previous Asian studies done on outcome, one by Kobayashi et al. (1992) in Japan and one by Chung et al. (1990) in Hong Kong. In the process of comparison, attempts are made below to identify any possible common cultural components.

4.4.1 Comparison with Japanese study

Present results are compared to those of a high functioning sub-group (n=46) in the study by Kobayashi et al. (1992), and they are quite similar in a number of ways. The mean age for the whole Kobayashi sample was 21.5 (range: 18-33), whereas that in the present study is 21.7 (range: 18-28). Assuming that those with university/college education would probably belong to the high functioning group, the percentage of individuals with university education in their study would be 13% which is slightly higher than the 9.4% of the present study. Regarding employment, 17 out of 46 (37%) in their study and 29 out of 64 (45%) in this study hold a job. The overall outcome ratings of those of the high functioning sub-group of the Kobayashi et al. study and of this study are respectively 48% and 42% in the 'good' category, 30% and 48% in the 'fair' category, and 22% and 9% in the 'poor' category. The results are in general comparable, except that relatively fewer individuals in this sample are in the 'poor' category. Criteria used are somewhat different in that the Kobayashi research group places relatively more emphasis on employment status and independence in daily living to arrive at a 'Present Adaptive Level (PAL)' rating, while language development is rated separately as 'Present Language Developmental Level (PLDL)'. Possible reasons for the better results reported in the Kobayashi sample, when compared against those in Western studies, are listed as the increase in provision of special education over time, part of the sample being recruited from the community and being more high-functioning, the then buoyant economy in Japan, the presence of a consistent therapeutic environment, and strong parental solidarity in a stable neighbourhood.

In some ways, the present study shares the same environmental characteristics of the Japanese study. As previously discussed, we have a big market for low-level jobs and the unemployment rate is generally low in Hong Kong. We also have social service agencies which actively organize parent groups. Parents have over the years become rather vocal in fighting for services for their children which has a catalytic impact on the reform of the educational system to accommodate the needs of their special children. In as much as Japanese parents, parental solidarity in Hong Kong is well evident in their successful lobbying of improved services for their children with autism. However, such conditions seem less to do with Asian cultural characteristics and are present in Western countries just as well. Anecdotal observations about commitments of parents in helping their children to get the best services and opportunities were made by Rumsey et al. (1985) in USA and Szatmari et al. (1989) in Canada. Engstrom et al. (2003) remarked that where public support was not available, the family often would compensate the shortage by providing more help themselves.

While parent advocacy and solidarity may be universal, there could be subtle cultural differences in the way assistance is rendered. As mentioned in the section about educational pursuits, parents in Hong Kong tend to take up a far more active role in making decisions for their children, even when they are in their adulthood. This transpires not only in educational choice but also in job hunting as well as in general living, as revealed by parents during the parental interviews. Furthermore, almost all the participants of this study still live at home because unmarried children are expected to live with parents and are largely taken care of in everyday living. Whereas Engstrom et al. (2003) expressed concern towards the possible parental interference as a result of narrow parent-child boundary, such relationship seems to take on a protective function in the Asian culture. Such a protective parental style, while not necessarily unique among Asians, may be more prevalent in the Asian culture.

4.4.2 Comparison with local study

When compared to the only local outcome study conducted in Hong Kong (Chung et al., 1990), this study appears to report better overall outcomes. The figures for Chung et al.'s and our studies are respectively 30%, 47%, 21% and 42%, 48%, 9% in the 'good' , 'fair' and 'poor' category. Several factors should be considered in understanding the relatively better results of the present study.

The sample of Chung et al.'s study is at adolescence, and ours is at early adulthood. While one may attribute the improvement to natural maturation and development over time, changes in the development in the service environment and the educational system in the intervening period of almost two decades (Chung and colleagues probably carried out their research in the late 1980s and the present study began in 2007) must not be overlooked. Such environmental changes could have impacted on the children with autism as much as development over time.

A majority of the Chung et al.'s sample (83%) was intellectual impaired at follow-up. As Chung and colleagues found that children with higher IQ and speech before five had better outcome, our present sample with all participants having normal IQs should expectedly have a better outcome.

Despite the differences in outcome, both the present study and that of Chung et al. (1990) give evidence to better outcomes in children with autism in Hong Kong compared to those in Western countries. However, Chung et al. (1990) noted great similarity in characteristics between their sample and those reported in other countries and did not perceive any specific cultural differences. The only cultural component perceived in this current study is what has been raised in the above in relation to the study conducted in Japan by Kobayashi et al. (1992).

4.5 Summary

In summary, the relatively more favourable outcome of the present sample is unlikely to be the result of unrepresentative sampling nor rating biases although there could be room for some refinement in the friendship and language ratings. Contributions from better educational provisions, technical advancement in living environment, popularity of computer games and a possibly culturally specific protective parenting style were implicated. The positive findings, however, should be understood in the light that good outcomes are very much relative to their deficits and should not be interpreted as a measure of 'normality' in comparison to their age peers.

5. IQ Stability

5.1 Stability

Significant increases are found in the group mean FIQ and VIQ in a sub-group of participants whose childhood IQs are known. The increase in VIQ from childhood to adulthood corresponds with results of the studies by Mawhood et al. (2000) and Howlin et al. (2004) (refer to Table 4). There is a 10-point rise (from 85.8 to 95.9) in the present sample, which is somewhere in between the 16-point rise (from 66.5 to 82.3) in Mawhood et al.'s study (2000) and the 8-point rise in Howlin et al.'s study (2004). While PIQ dropped in these two studies, changes in PIQ in this sample are not immediately apparent, given that the means of childhood and adult PIQs are very close (97.2 vs 96.8). Whereas the majority of the present sample with a change in VIQ level (16 out of 18 , 89%) shows improvements, the change in PIQ level is more varied with 40% of individuals having level shifts (8 out of 20) falling into a lower level and 12 out of 20 (60%) going up to a higher level (Table 35).

When stability is examined in terms of IQ level changes, 58% and 53 % of this sample are found to stay in the same VIQ and PIQ level respectively.

At first sight, these figures appear to be lower than those reported in the studies of Eaves & Ho (1996) and Howlin et al. (2004). Eaves & Ho (1996) reported 88-95% stability in those with IQ>70, 88-91% in those with IQ<30, and less than 40% in those with IQ between 50-69. Results are not quite comparable to findings of the present results as the levels defined by Eaves & Ho(1996) ranged from profound MR to normal IQ and information about the variation in IQ levels beyond IQ=70 is not available.

More comparable data in a finer level change is available in Howlin et al.'s study (2004). In their sample, 63% (22 out of 35) with childhood PIQ in the range of 70-99 stayed the same and 40% (4 out of 10) of individuals with childhood PIQ equal and above 100 remained in the same level. In the present sample, 64% (9 out of 14), 55.6%(10 out of 18) and 36.4% (4 out of 11) remain in the same PIQ level in the below average (≦89) , average (90-109) and above average range (≧110) respectively. Results are strikingly similar between the current study and the study of Howlin and colleagues. So, the overall picture from other studies and the present study is one of great stability in terms of group mean IQs and even greater stability in the sub-divisions of IQ levels in the normal range.

5.2 Changes

Despite an overall stability, some of the individuals in the present study are found to have made great gains or losses in IQs. Thirty one percent (12 out of 39) of the present sample has increase in verbal IQ by more than 15 points, compared to 44% (4 out of 9) in the group of Mawhood et al. (2000) and 6.6% (5 out of 76) among the adolescents in Eaves & Ho' study (1996).

Out of the 12 improvers, four individuals have a rise of VIQ for 30 and more points. There is no great drop in VIQ both in the present study and in the Mawhood group and only 2.6% (2 out of 76) of the individuals in Eaves & Ho's study moved down by more than 20 points. More fluctuation is however apparent in performance IQ, with 21% (8 out of 39) of the present sample dropping by over 15 points and 13% (5 out of 39) having an increase over 15 points. One individual even has an increase of 30 points and another, a drop of 31 points. In the group of Mawhood et al. (2000), greater proportion of individuals (44%, 8 out of 18) was recorded to have a drop over 15 points in performance IQ but none had increase in performance IQ of more than 15 points. Great changes in performance IQ only took place among the mentally handicapped in Eaves & Ho's group. So, results indicate that there could be a subgroup of individuals who demonstrate greater changes in intelligence from childhood to adulthood. But the sample sizes of studies mentioned above are relatively small. Only results from a larger sample would help to identify a sufficient number of such individuals in order to study why this subgroup has such a great rise and fall of intelligence over time.

5.3 Stability and Childhood IQ

Howlin et al. (2004) did not find a signifcant relationship between stability and childhood PIQ but noted that there was greater movement in terms of IQ changes in the lower IQ level (IQ=50-69). A significant relationship is however found between stability and childhood PIQ in the present study ,as those who have lower childhood PIQ are more likely to change for the better and those with higher childhood scores tend to become worse. A similar trend is noted also with childhood VIQ but the relationship is statistically insignificant probably due to a small number of individuals who deteriorate (being only 2 out of 39). This could perhaps be a natural phenomenon of regression to the mean pattern. On the other hand, it could be the result of the differential attention given to the less capable in the school system. Or, parents with children of lower childhood intelligence may look for more services and training for their children. However, the differential attention hypothesis cannot explain why the IQ of those with initially higher IQ moves downward. Hence, at the moment, there seems to be no obvious explanation to the effect of childhood IQ on the changes of IQ over time.

5.4 Summary

In conclusion, findings of the present study concur with results of previous studies that IQ is largely stable across time but there seems to be a trend in improvement in verbal IQ in the present sample and a pattern of variability in the performance IQ. While Howlin et al. (2004) had great reservation about marked changes in IQ from childhood to adulthood, some might attribute significant improvement in IQ to intensive early interventions (Lovass, 1993; McEachin, Smith & Lovass, 1993). The absence of detailed information on intervention or training of the present sample forbids any conjecture in this direction. Besides, choice of different instruments could affect the magnitude of changes (Magiati & Howlin, 2001) and as discussed earlier, comparing data from different tests should take into consideration of the inherent differences in the testing instruments even amongst the Wechsler scales. Answers for the increase in verbal IQ and relative variability in performance IQ would have to be found in long-term prospective studies measuring childhood IQs with tests that could find comparable data among adult instruments. Furthermore, testing should be conducted in more frequent occasions along the developmental pathway in order to provide more data to plot the progress chart.

6. Psychiatric Problems

6.1 Epilepsy

Epilepsy developed in three individuals with onset in adolescence, making up a percentage of 4.7%. When compared to data of the studies under review, it falls between the 2.6% in the study of Piven et al. (1996) and 9% in that of Venter et al. (1992). It is also lower than the 8% reported by Amiet, Gourfinkel-An, Bousamondo, Tordjiman, et al. (2008) in autism without learning disability. But it is much higher than the prevalence of 0.15% reported in the normal population in a study done recently in Hong Kong (Fong et al., 2003). In a survey of 242 ASD children under 13 years of age in Hong Kong, Wong (1993) found a rate of 6.5%. In the light of increased incidence of epilepsy during adolescence (Rutter, 1970; Volkmar & Nelson, 1990), the rate reported by Wong could be higher if projected to adulthood. The rate in the present sample is relatively lower. A possible explanation for the lower rate may be found in the fact that the sample of Wong's study consisted of children with mixed intellectual functioning and there is evidence that epilepsy is more associated with mental retardation amongst individuals with autism (Amiet et al., 2008; Canitano, 2007; Danielsson, Gillberg, Billstedt, Gillberg, et al., 2005).

In sum, this study and others converge to indicate that there is a special comorbidity between epilepsy and autism; epilepsy does not co-exist with autism by random chance. If it does, the rate of epilepsy in autism should not be higher than the base rate in the general population. The reasons for this special comorbidity between the two disorders await further research.

6.2 Psychiatric Disturbances other than ASD

6.2.1 Comparison to previous outcome studies

With eight out of 64 individuals having a psychiatric diagnosis, the rate of 12.5% in the present study was not high compared to psychiatric rates reported in previous studies (ranging from 10% in Howlin et al., 2000 to 77% in Eaves & Ho, 2008). The lifetime prevalence of psychiatric disorders in a community survey done in mid 1980s in Hong Kong (Chan, Wong, Lee, Chan-Ho et al., 1993) is 15.7% for males aged 18-24 years. The rate in the present sample is quite similar. There are more variations when rates of individual disorders are compared. Rates of anxiety disorder and phobias, OCD, affective disorders and schizophrenia in Chan et al.'s sample were 9.4%, 2.7%, 5.0% and .68% respectively (versus 1.6%, 4.7%. 0% and 4.7% respectively in the present sample). Overall, the rates of psychiatric disturbance do not seem to deviate markedly from the general population. Individual rates would be discussed in the following sections.

Depression, one of the most commonly reported comorbid disorders in autism and Asperger syndrome (Ghaziuddin et al., 2002; Green et al., 2000; Stewart et al., 2006) is conspicuously absent in the present sample. Reasons for such absence could be several. Difficulties in understanding and expressing emotions had been mentioned as the obstacles for adults with autism to present depressive symptoms (Stewart et al., 2006; Leyfer et al., 2006). Could it be possible that the Chinese individuals in this sample have even greater problems in reporting symptoms than others? The conclusion made by Parker et al. (2001) in their review about depression among Chinese that Chinese tended to express distress somatically is supported by a study of Hong Kong Chinese adolescents by Stewart et al. (2002). Hence, that Chinese individuals with autism in the present study could have somatized their problems leading to under-diagnosis could not be entirely ruled out. As the diagnosis of depression often relies heavily on parental report (Stewart et al., 2006), would it be possible that Chinese parents also take on the somatic symptoms and pursue different treatment? Furthermore, there have been reports of aggression (Kim et al., 2000) or self-injurious behaviours (Long et al., 2000) associated with depressive episodes. Could depression be masked beneath behavioural problems among individuals in the present sample? So far, no parents had expressed concerns about aggressive or behavioural problems over the period when they were interviewed. On the other hand, would it be possible that their depressive symptoms are not severe enough to be detected by others to warrant a psychiatric referral? Furthermore, could it be simply that the present sample of individuals with autism experiences less depression than their counterparts in Western countries? In fact, results from their self-report on the MMPI-2 questionnaire did not find significant endorsement on symptoms of depression.

The foregoing discussion brings out the problems of identifying depression amongst individuals with autism, whether they are Chinese or not.

Given the intrinsic difficulty of their expression of emotional states and the often overlap of autistic symptoms with presentation of depression (e.g., social withdrawal), there may be a need for developing specific tools for the assessment and measurement of depression in autistic people.

The rate of psychosis at 4.7% (3 out of 64 individuals) seems to be higher than the rate of schizophrenia at .6% which was reported by Volkmar & Cohen (1991). The clinical presentations of the three cases of early psychosis in this study however depict quite a different picture from the typical symptoms of a full-blown schizophrenia. One individual was put on medication after a single episode of psychotic symptoms in the form of vague report of hearing voices and feeling agitated with congested thoughts when he lost his job. He had been well maintained since then without developing a full-blown condition. Another developed delusional symptoms against fellow students whom he reported as long-time bullies. He had very rigid ideas about right and wrong and easily got carried away by his theories and would become very emotional in conflicting situations. Symptoms aggravated so much that parents could not control him and hence sought psychiatric consultation. Medication had helped in keeping him from over-reacting. In this young man, it was sometimes hard to differentiate his subjectively true experience from a lack of reality base as judged by an outsider. A third young man was found to speak about strange ideas on top of the development of severe obsessive symptoms in the form of excessive cleanliness and repetitive speech and questioning. He had magical thinking such as believing that he would be as successful as a certain Korean singer who was a transsexual if he could undergo a sex change operation. He also pleaded his mother to give him several million dollars so that he could migrate to the USA and become a changed person, well and happy after ten years. His incessant disturbance towards his mother and frequent suicidal threats led to several hospital admissions and subsequent sedation. Again, is the psychosis an extreme form of their obsessive beliefs and rigid but crooked logic? Tantam (1991) and Howlin (2007) had cited some examples in which the reports of idiosyncratic experiences and preoccupations of an autistic person could be misleading and possibly treated as some first rank symptoms. Could psychotropic drugs be a solution to the chaos created in the family as a result of extreme obsession and rigidity? It is doubtful whether the experience of these three young men can truly indicate the rate of occurrence of schizophrenia among adults with autism in Hong Kong. Perhaps, more effort should be applied to carefully document what exactly constitutes a psychotic experience among individuals with autism and how it might be differentiated from their extreme autistic rigid and illogical thinking.

Three individuals were diagnosed as having OCD, constituting to 4.7% of the sample whereas one individual was treated for anxiety symptoms, constituting to 1.6%. Compared to the figures from the outcome studies under review (2.3 % and 50% for OCD , 4.7% and 50% for anxiety in Tantam, 1991 and Eaves & Ho, 2008 respectively) and to those reported in Lainhart (1999) (1.5% to 29% for OCD and 7% to 84% for anxiety), figure from the present study falls near the lower end. Could the relatively low rate be the result of under-reporting, or under-detection by professionals who tend to regard psychiatric problems as part of the presentation of autistic disorders or simply a genuine reflection of relatively good mental health among the individuals with autism?

So far, the rates reported are derived from clinic records and information volunteered by parents. The accuracy of information cannot be verified regarding those reporting psychiatric problems and those who do not. To actually find out whether individuals suffer from any psychiatric disorder, a systematic psychiatric interview needs to be performed as it was done in the study of Hutton et al. (2008). One final point, the sample size is far too small to be representative of the occurrence of psychiatric illness in the community. Systematic sampling as done in community surveys or epidemiological studies and application of detailed psychiatric assessment with special modifications to circumvent the difficulty of individuals with autism would be needed to arrive at meaningful data of the comorbid conditions of autism.

6.2.2 MMPI-2 profile of subgroup with psychiatric history

Although only two of the eight individuals with a psychiatric diagnosis were noted to have severe general psychopathology as reflected by their high scores on a large number of scales of the MMPI-2 and two indicated little psychological disturbance, others actually reported distress in various MMPI-2 scales quite relevant to their psychiatric problems. For instance, the individual on Ritalin had significant elevation on the Hypomania scale. Another individual who suffered from insomnia and anxiety had elevation in the Fears scale in which high scores could be related to sleep disturbance, low self-esteem and social discomfort. Another individual who was in open employment with medication for psychosis scored high on Health Concerns and Anger. He also had a high F (infrequency) score which could be related to significant psychological distress. The other young man suffering from OCD with anxiety features had elevated score on F scale, Anxiety , Obsession and Anger. It appears that at least for this subgroup of individuals with an established psychiatric diagnosis, MMPI-2 yields a corresponding picture of psychological distress. To some degree, such results provide support to the validity of MMPI-2 as an instrument for detecting general psychopathology in community samples.

6.2.3 Comparison with results of study of Ozonoff et al. (2005)

As indicated in section 7.3.6, scales with the largest effect size in the Ozonoff et al. study (2005) were social discomfort, social introversion, depression, schizophrenia, negative treatment indicators, hypomania and low self-esteem. The order in the present study was schizophrenia, followed by anxiety, paranoia, work and hypomania.

Referring to the correlates of the scales that are most often elevated, Ozonoff et al. (2005) seemed to have summarized three main themes. Firstly, drawing inference from the elevated mean score in the clinical scale 2 (depression), they suggested that unhappy moods and dysphoria could be a behavioural phenotype of adults with autism with normal intelligence. Secondly, a constellation of behaviours such as discomfort in social situations, social anxiety, shyness and social introversion was considered to be consistent with the social difficulties of adults with autism. Lastly, the correlates of rigidity, inflexibility and resistance to change associated with high scores in Scale 0 (introversion) were deemed as fitting well with the clinical picture of autistic disorder. They also took note of the significant group differences in scale 8 (schizophrenia) and Anxiety and suggested that they were reflective of social alienation and general maladjustment and possible comorbid anxiety disorders in their group of participants.

In the present study, however, depressive moods and social difficulties which seemed to emerge as the main behavioural phenotypes in the study by Ozonoff et al. (2005) are not as prominent. Instead, anxiety is more evident as the dominant mood problem. High scorers report tension, somatic problems, sleep difficulties, indecisiveness and poor concentration (Butcher, 1999). Schizophrenia, with the largest effect size in the present study, is deemed as the single most difficult scale to interpret in isolation as a variety of factors could result in elevated scores (Greene, 2000). Greene suggested that it should be regarded as a composite measure of general distress and negative emotionality. Correlates of behaviours associated with high scorers on the schizophrenia, anxiety and paranoia scales converge on a picture of social alienation, suspiciousness, over-sensitivity, tendency to be argumentative and prone to blame others. High scorers on Paranoia tend to be moralistic and rigid, overemphasizing on rationality (Graham,1993). In a similar vein, an egocentric self-righteousness could be present.

It seems that the difficulties depicted in the present study represent the other side of the coin of the social handicaps of individuals with autism. Distress seems to have resulted not so much from social isolation or withdrawal but more from frustration of not coping with society when their rigid thinking and moralistic beliefs come to a clash with people around them.

Problems resulting from their inflexibility and inability to accurately decipher social rules and emotional cues in turn could lead to bullying and ridicule which often end with guardedness and eventual conflict and rejection. As mentioned above, participants of this sample studied in normal schools because in Hong Kong there is no special school provision to those with normal intelligence. So they are staying in the mainstream community and thus have more social contacts with others. Hence, they have greater chance of experiencing frustration and distress from social interactions with normal peers.

Medium effect sizes are found in the obsessiveness scale and scale 9 (psychasthenia). Correlates of high scorers in these two scales suggest the presence of obsessive thoughts and ruminations, difficulty in decision making and concentration as well as tension, worry and other anxiety symptoms. Interestingly, both scales relate to depression (clinical scale 2 and content scale DEP). Hypomania (scale 9) is also significantly elevated with a medium effect size. While there is likelihood that some individuals could experience general dissatisfaction with life, somatic problems and feelings of hopelessness as high scorers of depression scales might do (Butcher, 1999), others could be found with impulsivity, superficiality in social relationships, hostile and irritable qualities as indicated in high scorers of hypomania (Greene, 2000).

It is interesting to note that with similar functioning and social handicap, the group of individuals with autism in the present study could experience psychological distress quite differently from counterparts in Ozonoff et al.'s study. What factors could have led to such differences is intriguing? Could they have belonged to different subtypes of autistic disorder, such as being 'active but odd' or 'aloof', or passive', as described by Frith (2003)? Could it be possible that they live in an environment of varying friendliness and acceptance such that their experiences of relating to people are different? Could it be possible that unhappiness are more externalized or transformed into irritability, tension and agitation in individuals of this sample? More information about the actual characteristics of the two groups, such as, individual IQ, education, employment, diagnosis in adulthood, overall outcome ratings etc. would be required for these questions to be answered. The diversity in the way individuals with autism respond to social stress urges for more in-depth study of how their autistic deficits impact on their social relationship and in turn affect their well-being.

To conclude, general distress and psychopathology is evidently more prevalent among adults with autism with normal intelligence than their peers. Anxiety, social alienation, over-sensitivity, hostility and suspiciousness towards the external world are more evident than the picture of social difficulties in the form of social discomfort and withdrawal. Depressive symptoms, though present are less prominent in the present group of individuals. The manifestation of psychopathology could be affected by the idiosyncratic autistic deficits as well as by environmental factors. Further research is called for to investigate on the association between symptoms and types of comorbidity.

6.3 Obsessive Compulsive Disorder and ASD

6.3.1 OCD rate in the sample

The rate of 4.7% occurrence of OCD in the present sample is slightly higher to the rates of 2% in the study of Tantam (1991) and 3% in Hutton et al. (2008) as well as the local rate of 2.7% reported by Chan et al. (1993). However, much higher rates had been reported in other studies (25% in Russell et al., 2005; 37% in Leyfer et al., 2006; 50% in Eaves & Ho, 2008). The variations seem to be related to differences in sampling method, symptom definitions and assessment instruments (Simonoff et al., 2008; Russell et al., 2005; Matson & Nebel-Schwalm, 2007). Overall, rates are by far higher than the prevalence rate of 1.1% reported by Torres et al. (2006) who drew from data of the British National Psychiatric Morbidity Survey of 2000. So once again as in the case of epilepsy, there seems to be a special comorbidity between OCD and autism and the former does not co-exist with autism by random chance. If it does, the rate of OCD in autism should not be higher than the prevalence rate in the general population. The reasons for this special comorbidity between the two disorders would require further research.

6.3.2 OCI-R measures

With reference to the cut-off score of 21 in OCI-R, 28% of individuals of the present study seemed to have reported significant number of symptoms suggestive of an OCD. However, the overall group mean OCI-R score is 15.8 (SD=12.6) which is lower than 18.8 (SD=11.1), the mean of the control group in Foa et al.'s study (2002). When the cut-off score is 21, the test has a sensitivity of 65.6% and a specificity of 63.9%, so,the chance of misdiagnosis is over 30%. Hence, unless a valid diagnosis by formal psychiatric assessment could be done, it would be premature to assume that a large proportion of ASD individuals in the present sample also has OCD. Beside, a crude examination of the frequency of scores in subscales among the 18 high OCI-R scorers reveals that less distress is reported in obsessional washing and mental neutralizing (which is about numbers and mental counting) which are the more typical OCD symptoms. Would it be likely that the obsessive concerns indicated in the OCI-R questionnaire are akin to the repetitive and ruminative behaviours which they experience as part of their autism? Such hypothesis would question the high comorbidity of OCD and autism as nothing more than a diagnostic confusion. This is a serious issue deserving close scrutiny.

6.3.3 The issue on comorbidity

Indeed, repetitive routines and rituals which constitute to the core characteristics of autism are noted to be very similar to some of common symptoms of OCD (Szatmari et al., 1989; Bejerot, 2007), which could have contributed to the higher rate of OCD found among the autistic population. Concern about whether OCD can be separate from ASD has been debated. While McDougle et al. (1995) concluded from their findings that the repetitive behaviours and characteristics of ASD were different from symptoms typical of OCD, Russell et al. (2005) replicated their study with more high functioning adults with autism and held that obsessive compulsive symptoms were more common among ASD.

A group of researchers had pursued investigation over the possibility of a common genetic substrate between OCD and ASD (Bejerot et al., 2001;

Hollander et al., 2003; Micali et al., 2004; Bejerot, 2007). On top of the overlap between ASD and OCD, they also found that parents or relatives in families with ASD children were more likely to have OCD traits or OCD (Hollander et al., 2003; Micali et al., 2004). Bejerot et al. (2001) identified autistic traits in 20% of 64 OCD patients. This led Bejerot (2007) to propose that ASD could be placed on a continuum of OCD so that OCD with ASD should be considered a sub-type of OCD.

Even if a common neurobiological basis of ASD and OCD could be identified, questions remain about whether obsessive compulsive symptoms in ASD are separable from those of OCD and that OCD could be considered a comorbid condition of ASD. So far, a lot of studies had not addressed the ego-dystonic aspect of OC symptoms. Although repetitive behaviours could be anxiety relieving for some ASD people, a lot could derive pleasure out of them. They may not have a sense of senselessness as OCD patients do. They are more likely frustrated by being stopped to engage in the routines than by having to go through the routines. Hence, Green et al. (2000) would probe the autistic child on whether the sense of senselessness or resistance would be present. Matson et al. (2007) further suggested that typical acts of OCD such as hand-washing, responsiveness to interventions typically effective for OCD and a core set of OCD symptoms above and beyond the typical obsessive symptoms of ASD should be present for OCD to be considered a distinct comorbid condition. Detailed structured or clinical interview by experienced and skilled clinicians has to be carried out to arrive at reliable judgment. Until such skilled differential diagnosis is practised, reports documenting the high comorbidity between OCD and autism must be viewed with caution.

7. Differences among Diagnostic Groups

Results show that individuals no longer having a diagnosis (NA) according to the algorithms of the 3Di are more likely than those still with an ASD diagnosis, either atypical or classical autism (AA and A), to attain post-secondary education, engage in skilled work and be rated as functioning in the near normal range of overall outcome adjustment. In terms of the sub-categories of outcome, the NA group is superior to the ASD group in areas of work, friendship, independence, language and autistic type stereotypic behaviours.

In the area of intellectual functioning, the mean FIQ, VIQ and PIQ of the NA group are over 100, being 101.48, 102.05 and 100.86 respectively whereas those of both the AA and the A group fall below 100, being 93.9, 93.5 and 95.5 respectively. Significant differences between the NA and ASD group are found in both full IQ and verbal IQ but the differences in performance IQ is not significant though all point to a better IQ in the NA group.

The positive picture of the NA group does not however persist into the area of general psychopathology other than autism. The NA group is found to be similar to the ASD group in their presentation of psychological disturbance in terms of significant elevations in scales of the MMPI-2 as well as in their report on obsessive compulsive symptoms in the OCI-R.

When the NA group appears to surpass the ASD group in a number of outcome indices, it is easy to infer that they are doing so well that they are no longer affected by their diagnosis. One however must not forget that in fact as a group, they are still achieving worse than their normal peers in education and occupation. With group mean IQs over 100, only 9.5% (2 out 21) of the NA individuals have attained a university education which is far below the 26.6% among their age peers in the population (Census and Statistics Department, HKSAR, 2006). Whereas over 29% of their normal peers are in professional or managerial positions (Quarterly Report on General Household Survey, Census and Statistics Department, 2007), only three individuals hold a semi-professional job constituting to just 14.3%. Clearly, even the NA group is functioning below the expected level of their average intelligence.

Despite the apparent better outcome adjustment, majority of the NA group (68%) is still impaired in at least one of the three categories of autistic deficits, according to parents' report of their autistic conditions in 3Di. Eleven out of 21 individuals are still handicapped in communication, three in the area of social reciprocity and two much affected by the stereotyped behaviours and routines. From the individuals' responses to the friendship category in the interview about their outcome adjustment, majority (57%) is unable to have normal friendship, out of which 38% has only limited friendship and 19% has no friends or at best some acquaintances only. This is a fitting picture to the caution made by Tantam (1991) that amelioration of the symptoms should not be taken too optimistically and should be weighed against the often poor social adjustment.

8. IQ and Outcome Measures

8.1 Comparison of Current and Childhood IQ as Indicators

It should be noted that the sample of individuals with known childhood IQs is only about two-thirds of the whole group (47/64, 74.4% for FIQ and 43/64, 67.2% for VIQ and PIQ). Because of the small sample size, no attempt was made to compare this group with known childhood IQ with the rest of the group over various characteristics. Hence, whether this sub-group is similar to the rest of the group is not ascertained. Yet, there are no strong grounds to believe that they would be biased in any direction since the knowledge of the earlier IQ results simply rests on whether clinicians had kept a good record or not. Nonetheless, results derived from this sub-group of sample should be considered in the light of such limitation.

For ease of discussion, results of analyses using current IQs and childhood IQs as predictor variables are compared and summarized in Table 72. It is evident that they largely share similar relationships with various outcome measures. This is somewhat expected as childhood IQs are strongly correlated with current IQs and overall, they remain stable from childhood to early adulthood. Results of regression analyses of IQs on overall outcome rating show that current VIQ and PIQ do not have significant contribution to the variance after childhood VIQ and PIQ are controlled for. It is quite clear that there is great overlap between current and childhood IQs.

Table 72

Relationship of current and childhood IQs with various outcome measures and 3Di subscales

Outcome Measures	Current IQ			Childhood IQ		
	FIQ	VIQ	PIQ	Childhood FIQ	Childhood VIQ	Childhood PIQ
Education	Sign.	Sign.	Sign.	Sign.	Sign.	Sign.
Occupation	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.
Diagnostic Status	Sign.	Sign.	N-sign.	Sign.	Sign.[a]	N-sign.
3Di subscales: social	Sign.[a]	Sign.	N-sign. (χ^2) Sign.(ANOVA)	N-sign.	N-sign.	N-sign.
3Di subscales: communication	Sign.	Sign.	N-sign.	Sign.	Sign.	N-sign.
3Di subscales: autistic type behaviours	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.
Outcome rating: Total	Sign.	Sign.	Sign.	Sign.	Sign.	Sign.
Outcome rating: Work	Sign.	Sign.	Sign.	Sign.	N-sign.	N-sign.
Outcome rating: Friendship	Sign.	Sign.	Sign.	Sign.	Sign.	Sign.
Outcome rating: Independence	Sign.	Sign.	Sign.	Sign.	N-sign.	N-sign.
Outcome rating: Stereotype	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.
Outcome rating: Language	Sign.	Sign.	Sign.	Sign.	N-sign.	N-sign.
General psychopathology in terms of No. of elevated MMPI scales	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.
OCI-R score	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.	N-sign.

[a] Significance close to p=.05

8.2 Current IQ as an Indicator of Adult Outcome

Among the 11 outcome studies reviewed in this study which addressed the relationship between IQ and outcome measures, only three reported on the association of IQ at follow-up with adult outcome measures (Venter et al., 1992; Howlin et al., 2004; Eaves & Ho, 2008). Results all pointed to the superiority of verbal IQ in the prediction of overall outcome (Eaves & Ho, 2008), social outcome measures (Howlin et al., 2004) and academic achievement (Venter et al., 1992) over performance IQ which usually has a less strong correlation. Findings of the present study to certain extent echo their results as current VIQ has significant relationship with education, diagnostic status, social and communication domains, overall outcome ratings and outcome ratings relating to work, friendship, independence and language. Performance IQ also has significant relationship with all the above but fails to associate with diagnostic status and the corresponding domains. The importance of VIQ as a strong correlate to outcome measures seems plain enough as it is heavily relied upon both in the pursuit of education and in daily interaction with people which is the prerequisite to survival both in the work and social arena of one’s life. It is also inherently linked with language abilities and the deficiency in language is the very core deficit of ASD. Better verbal IQ could hence be associated with milder severity in ASD core symptoms which then result in more appropriate social and communicative behaviours and hence better adjustment.

8.3 Childhood IQ as an Indicator of Adult Outcome

Findings from the current study support the well established status of childhood IQ as one of the best predictor of outcome alongside language before five (Lotter, 1974b; Gillberg & Steffenburg, 1987, Venter et al., 1992). Most studies, however, had participants with a wide range of intellectual functioning from severe mental retardation to above average intelligence (Ballaban-Gil et al., 1996; Billstedt et al., 2007; Shattuck et al., 2007). But few studies investigated whether childhood IQ might still be a predictor among individuals with intelligence over and above the non-retarded range. The two studies addressing this question (Venter et al., 1992; Szatmari et al., 2003) gave support to the predictive value of language and intelligence in the group of individuals with autism with normal IQ. However, most of their participants were still in teenage with a mean age of 13 to 14 years.

This study has been unique for investigating the impact of childhood IQ on a group of young adults with autism of normal intelligence and aged beyond 18 years and all childhood IQ data were scores from Wechsler scales. Results are generally in line with those done with groups including individuals of MR range. Comparison of findings is made difficult when some studies did not have a clear specification of the type of IQ, be it verbal or non-verbal (Gillberg & Steffenburg, 1987; Ballaban-Gil et al., 1996; Billstedt et al., 2007) and others might use a composite measure to determine the intelligence (Szatmari et al., 2003; Shattuck et al., 2007). Attempts would be made below to compare findings of the present results with studies where verbal and non-verbal IQs are specified (Venter et al., 1992; Szatmrai et al., 2003; Howlin et al., 2004; Eaves & Ho, 2008).

8.4 IQ and Educational Attainment

Both current IQs and childhood IQs prove to be significant predictors of educational attainment. The mean childhood IQs of those who have or are pursuing tertiary education are all above 100 (childhood FIQ=106, childhood VIQ=100 and childhood PIQ=111) whereas those with lower educational attainment score below 100 (Table 45). With a younger sample, Venter et al. (1992) found early non-verbal IQ before five a significant predictor of achievement scores. Childhood verbal IQ was not recorded as most of their cases were non-verbal at childhood testing. With the same sample, Venter et al. (1992) found verbal IQ at follow up to be a strong predictor of achievement. So, the availability of childhood IQ scores makes it possible for the present study to demonstrate a strong case for the predictive power of early intelligence on educational attainment by early adulthood.

8.5 IQ and Occupation

Both current and childhood IQs have no predictive value on the type of work an autistic individual takes up in the present study. Among the five individuals of both current and childhood IQs above 100 who are working, only one is an accounting clerk, three are in the service industry and one is a delivery driver. One of them actually has an childhood FIQ score of 140 and he is barely able to work as a program assistant in a social welfare agency. Clearly, jobs corresponding to their intellectual functioning are not open to them. It seems that other factors could have a greater impact on their employment condition other than IQs. Their social and communicative difficulties could be more handicapping to their finding and keeping a job, as illustrated by the experience of a young man who could never defend himself in arguments with colleagues and got sacked for losing his temper all too frequently. Another often went off to take detours on the Mass Transit Railway (MTR) and became chronically late in delivering goods. Consequently, he was the first one to be laid off when business shrank.

8.6 IQ and Diagnostic Continuity

Both current and childhood full IQ and verbal IQ are found to predict diagnostic continuity in adulthood. In other words, symptoms of those with a better full and verbal IQ in either childhood or adulthood are more likely to be abated enough to be considered no longer an autistic case clinically. In particular, among the three areas of autistic deficits, current full and verbal IQ are significantly related to reciprocal social interaction skills and language and communication skills while childhood full and verbal IQ are only significantly related to the area of language and communication skills. IQs, current or early measures, do not seem to differ whether individuals remain impaired in the repetitive/stereotyped behaviour domain. The predictive value of IQ seems less strong compared to results of some previous studies. For instance, in the study of Billstedt et al. (2007) early IQ was a strong predictor of outcomes in areas of both social interaction and communication whereas in McGovern & Sigman (2005) and Shattuck et al. (2007), higher IQ participants showed larger reduction in impairment in all areas of autistic symptoms, namely, verbal communication, social reciprocity and repetitive behaviours and stereotyped interests. However, such results referred to groups with majority in the MR range and hence might not be comparable to individuals of the present sample. Howlin et al. (2004) found significant differences in the parental ratings on the social use of language between groups of individuals with autism which were differentiated by whether their childhood performance IQ was above or below 70. With nearly half of the sample not scorable on verbal tests, they compared those with speech before 5 with those without and found a significant relationship with overall social rating. In the study of Venter et al. (1992) where participants were mainly in the normal range of intelligence, early non-verbal IQ (again, early verbal IQ was not available) and follow-up verbal IQ were found to be strong predictors of adaptive scores as measured by Vineland Adaptive Behaviour Scales (VABS).

Using factor analysis on standardized scores of tests tapping various verbal and non-verbal skills to investigate their contribution to outcome measures in terms of social and communication skills as measured by VABS and autistic symptoms as measured by Autism Behaviour Checklist (ABC), Szatmari et al. (2003) found that early language and non-verbal skills were important predictors of social and communication outcomes but poor predictors of autistic symptoms in a group of 21 normal IQ adolescents with mean age of 13 years.

Putting all the findings together, while there are no study apart from the present study which look at the predictive relationship of IQ on diagnostic continuity, those examining the effect of IQ on the 3 areas of autistic deficits seem to yield variable results. Apparently, as there is a common difficulty to obtain verbal IQ score from young children with autism, a lot of studies have to rely on early non-verbal IQ as outcome predictors. The lack of an early verbal IQ measure should not however be evidence that verbal IQ has no predictive value on later outcome. The present study gives evidence to a strong relationship between verbal IQ and communication skills and to a lesser extent to reciprocal social interaction. The association does not come as a surprise since language is intrinsically linked to verbal abilities. Good verbal abilities would definitely be assets to individuals who need to overcome their communication difficulties in everyday life.

The weak relationship of both current and childhood PIQ to autistic impairments in the present study is also expected as performance IQ is not linked to any intrinsic deficits of ASD as verbal IQ does. Hence, the strong predictive power of non-verbal skills found by Szatmari et al. (2003) is puzzling. There seems to be no simple explanation to such relationship and Szatmari and colleagues made guess on possible connection between nonverbal skills and executive function or better attention skills. Indeed, although the predictive power of IQ on the prognois of autism is documented in various study, the underlying mechanism accounting for this predictive ability has not been properly addressed and deserves further study and investigation.

8.7 IQ and Overall Outcome

All IQ measures, both current and childhood correlate significantly with the overall outcome rating in the positive direction. Regression analysis using only childhood verbal and performance IQ as predictors finds unique though not too strong variance in explaining overall outcome over and above that of current verbal and performance IQ. In other words, childhood IQs are strong predictors of adult overcome in terms of ratings on several areas of adjustment. At the level of individual subscales, all current IQs and childhood full IQ are significantly correlated with work, friendship, independence and language but not with the stereotyped behaviour subscale. Friendship correlates significantly with childhood verbal and performance IQ.

Childhood IQ as a predictor of outcome adjustment concurs with results of previous studies (Lockyer & Rutter, 1969; Lotter, 1974b; Gillberg & Steffenberg, 1987; Howlin et al., 2004; Eaves & Ho, 2008). While most of the studies have samples with mixed level of intelligence ranging from MR to normal IQ, the present study demonstrates that a significant relationship exists between childhood IQ and outcome within a group of high functioning adults.

In contrast to the findings of Howlin et al. (2004) where no difference was found in social outcome rating between a group of individuals with a childhood PIQ over 100 and another group with childhood PIQ between 70 to 99, the outcome of individuals with childhood IQs over 100 is significantly better than those with childhood IQs below 100 according to results of ANOVA of the present study. Whereas none of the individuals with 'very good' outcome in Howlin and colleagues' sample had a childhood PIQ over 100, majority of the individuals with childhood IQs over 100 actually function in the near normal/good outcome range (73% for childhood FIQ; 78% for childhood VIQ and 63% for childhood PIQ). Hence, childhood IQs remain a robust predictor among high functioning individuals with autism as they do in the group with mental retardation. The reasons for the discrepant findings between the present study and those of Howlin et al. (2004) are not immediately apparent. Given the small sample size in both studies (both under 45), perhaps future research with a bigger sample would offer further insight to this issue.

Despite the forgoing optimistic findings, one must take note that there remains a small proportion of individuals with IQs above 100 who actually function with a fair to poor outcome (ranging from 22% to 37%). Hence, the message that normal childhood intelligence is no guarantee of good adult outcome is somewhat correct and care and intervention would be as much needed in the really bright as in the not as bright.

8.8 IQ and General Psychopathology

Finally, both and current childhood IQ are not related to psychological disturbances other than autism. This seems probable especially in a group of individual with normal intelligence. Studies had shown an association of learning disabilities with schizophrenia (Mortensen, Sorensen, Jensen et al., 2005) and mental disorders (Hassiotis, Strydom, Hall, Ali et al., 2008; Cooper, Smiley, Morrison et al., 2007). Lainhart & Folstein (1994) also found that individuals with autism with a comorbid affective disorder were more likely to be in the MR range of intellectual functioning. While there seems to be an association between MR and psychiatric disturbance in autism, so far, when IQ falls in the normal range, such association between intelligence and psychopathology is not found in previous studies. Hutton et al. (2008) reported that the group of adults with autism detected with new psychiatric disorders and the rest of the sample without psychiatric disturbance did not differ in a number of individual characteristics including intellectual abilities. Howlin (2005) summarized findings from several studies to indicate that the incidence of such psychiatric problems was not higher in the higher functioning individuals than the less able counterparts. Hence, one could assume that individuals with autism are just likely to experience psychological disturbance regardless of their level of intellectual functioning at least among those with normal intellectual functioning .

8.9 Summary

To summarize, current IQs have stronger associations with various outcome measures than childhood IQs. Great overlap is expected as they are highly correlated. There is a possibility that the predictive power of the childhood IQs is limited to certain extent by the small sample size. Despite that, childhood verbal IQ is found to be a strong predictor of several adult outcome measures including education, diagnostic status, and overall outcome rating. Childhood performance IQ is also found to be a predictor though having less strong association than verbal IQ. Psychiatric disturbance is expectedly unrelated to IQ measures. For statistically significant results to have useful and relevant clinical applications, the mechanism and pathway by which predictors impact on different outcome measures deserve greater attention and more research effort.

9. Associations among Outcome Measures

As the method of investigation of this research is a cross-sectional design, it would be beyond the scope of the present study to identify childhood predictors of adult outcome. It would however be informative to examine the intercorrelations among different outcome measures. Overlaps are expected as some underlying factors necessarily affect a person in different aspects. Relationships among these measures may shed light on how interventions may be strategically designed to effect optimal adjustment.

All outcome measures are in general significantly related to certain extent except for the measure of general psychopatholgy. Strongest associations are found between overall outcome ratings and diagnosis, three domains of autistic deficits, education, occupation and current IQs. Even all subcategories of overall outcome except autistic type stereotypic behaviours, namely, work, independence, friendship and language, are highly correlated with the social and communicative domains of the 3Di and current IQ scores.

Thus, a global picture of an autistic individual with the best overall outcome ratings would likely be one who no longer bears a diagnosis of ASD, functions in the above average range of intelligence, has at least post-secondary education, engages in skilled work if they are working, is able to master basic independent living, manages money simply, communicates with people adequately and has some friends to share and go out with.

Looking from a less positive angle, analyses of scores on the Chinese MMPI-2 and the OCI-R suggest that as a group they could experience more general psychopathology than their age peers and a certain proportion could be distressed by obsessive compulsive symptoms. The scale scores of MMPI-2 and the OCI-R are unrelated to most of the outcome measures.

However, OC symptoms are also found to be significantly related to the overall outcome rating as well as to an outcome rating combining work and independence together. It is interesting to note that the correlation between

OCI-R scores and the stereotyped and repetitive behaviours scores of the 3Di is weak lending some evidence to an independent relationship between OC symptoms and the more autistic stereotypic and ritualistic behaviours. Both are however strongly related to overall outcome thus providing independent contribution to overall outcome. Could there be some indication that at least in the present sample, the OC symptoms are genuine comorbid symptoms distinct from the autistic obsessive and ritualistic characteristics? The measures in this study are however too crude for making such claims. As discussed earlier, the differentiation requires further research with clear definitions and identifications of the obsessive or compulsive behaviours of individuals with autism and proper diagnosis via a comprehensive psychiatric interview. Regarding the association between overall outcome and OC symptoms, it is difficult to decide on a causal relationship in either direction although it seems more logical to assume that OC symptoms could affect work and study performance and daily living. Also, OC symptoms seem to have a strong biological basis and hence less likely a direct result of adjustment or stress.

10. Conclusion

Most outcome research in the past studied children of autism with mixed level of intelligence, some even with majority in the mentally handicapped range. This study is unique in its focus on a group of high functioning individuals diagnosed of autism in childhood. They belong to a neglected subset in the population with autism, since most previous efforts in research and services are devoted to those individuals with both autism and mental retardation. As they constitute 80% of the population with the latest, expanded diagnostic construct of ASD (Council of Royal College of Psychiatrists, 2006), their adjustment deserves more exploration. With better cognitive abilities, are they able to overcome their autistic handicaps and survive well enough as ordinary people? The present study has attempted to provide some initial data on this group of individuals.

Sadly, there is in fact no good news about this high-functioning group despite a more favourable outcome compared to results of past studies where samples are often mixed in levels of intellectual functioning. They are far from having successfully overcome their handicaps and living normally as their peers. Only 11% of the sample can be considered as no longer impaired in the triad of autistic deficits. Compared to their normal peers, they are underachieving in both education and employment. On a composite rating of several areas of adjustment, no more than 50% are found to attain a good outcome. Indeed, 58% fall in the fair to poor outcome category.

It is apparent that even high-functioning individuals with autism are basically not able to grow out of their handicaps. As they are part of the group of individuals with the expanded diagnostic construct of ASD who have normal intelligence, the continuity of symptomatic behaviours and psychosocial impairments into adulthood among them confirms the necessity of a conferment of a diagnosis to them. In other words, this adult outcome has supported the expansion of the diagnostic construct of autism from the previous narrowly-defined “infantile autism” to the currently broader, more inclusive “autism sprectrum disorder” (ASD).

The continuity of autistic handicaps from childhood to adulthood among the high-functioning individuals evidences that good cognitive ability, albeit a good prognostic predictor, is not a 'cure' for their deficits. Hence, ASD children who have normal intelligence by majority are likely to share similar neurodevelopmental substrates with those of infantile autism with mental handicap. Further research should be done to throw light on whether they adopt different developmental paths and hence have different manifestation of adjustment problems.

Nonetheless, results of the present study echo the general conclusions of many outcome studies that there are both continuity and discontinuity in the development of individuals with autism from childhood to adulthood. Whereas some expressed more pessimism stating that the improvement would not be substantial enough to enable them to lead a 'normal' independent life (Ballaban-Gil, et al., 1996; Piven et al., 1996; Seltzer et al., 2003; Seltzer et al., 2004), a measured note of optimism was held by others (Szatmari et al., 1989; Venter et al., 1992) where samples consisted mainly of high-functioning individuals. In some way, the present results share a little of the optimism. Shea and Mesibov (2005) had aptly summarized their review by observing that "from the perspective of normal development and the independent adulthood that parents wish for their children, autism is a serious disability that usually does not permit those results. On the other hand, compared to their severely atypical early development, over time, many showed improvements in skills and socially acceptable behaviours"

Discontinuity and continuity are in fact expected in all research comparing psychopathology between childhood and adulthood. The question is inevitably raised over how biological, psychological and environmental factors interplay with one another in normal and abnormal development across the life span. Often, outcome research tend to focus on quantifying the association among the various factors and few investigate about the mechanisms underlying continuity and discontinuity (Rutter et al., 2006). The cross-sectional design of the present study precludes any investigation of mediating process among outcome predictors. But current findings suggest several areas of interest which deserve further study into how certain factors would bring about different paths of development.

Firstly, childhood verbal IQ, found to be a significant predictor in the present study, and performance IQ or a measure of non-verbal skills, which is also found to be significantly associated with outcome in Howlin et al. (2004) and Szatmari et al. (2003), should be closely studied to understand how they separately influence adult adjustment. Such research should shed empirical insight on early education and treatment. Actually, there may be several pathways by which intelligence can bring about positive outcome:

a) good IQ offering direct cognitive advantages for better learning and mastery of people skills;
b) good IQ leading to good school results and acceptance by peers;
c) school success bringing about self-esteem and self-efficacy;
d) good IQ resulting in more self-awareness and corresponding

self-adjustment; leading to greater reduction of inappropriate social behaviours;

e) IQ sharing same neurobiological platform underlying some areas of developmental deficits.

A well-planned prospective study to test out the forgoing hypotheses would be the first step to the understanding of the mechanism underlying change processes.

Secondly, the present study attributes the relative improvement in friendship and independent skills to the facilitation of the technological advances of modern living and leisure. So, it implicates that the improvement is not so much an actual amelioration of autistic deficits in the individuals but rather a result of accommodation of their deficits in the environment. Such assumption should be tested by comparing outcomes of autistic city-dwellers with Chinese adults with autism living in a more underdeveloped place in China.

Thirdly, development in educational provisions is hypothesized to facilitate better educational attainment which in turn is strongly related to general outcome, diagnostic status and occupation, according to present results. But what actual ingredients in the educational system are impacting on what aspects of the autistic deficits and what areas of adjustment have yet to be elucidated. Provision of the Special Education Needs (SEN) policy in the current educational system in Hong Kong could amount to variable services depending on the decision of a particular school. It could encompass speech therapy, special allowance in homework assignment or exam time, individualized education plan, social skill group, buddy or big brother system or regular interviews by the school social worker in various combination and quantity and duration. Systematic study of these programs on the development of children with autism is urgently needed to identify a pool of interventions which are target-specific and cost-effective.

Fourthly, as Seltzer et al. (2004) suggested, it would be of immense value to devote more research effort in studying the small group of individuals who seemed symptom free as adults (Seltzer et al., 2004). Such a minority of individuals is also identified in our present study. Both the impact of external factors such as school, family, intervention environment and individual factors such as intelligence, severity and constellation of autistic deficits should be examined. Moreover, the presence of specialized skills and competence as suggested by Kanner (Howlin, 2007) and a placid temperament (Wing, 1981) could be evaluated with respect to their contribution to success in adulthood.

Last but not the least, there is a need to examine the diagnostic concept and criteria of autism in adulthood. As a chronic disability with early onset, autism is considered to have greater continuity over time compared to other childhood disorders (Maughan & Kim-Cohen, 2005). Piven et al. (1996) argued from their findings that current criteria for autism according to diagnostic system such as DSM III or DSM IV failed to adequately address later-age developmental changes in some adults. They pointed out that for instance the term ‘residual autism’ was a misnomer reflecting a lack of knowledge of the expected changes in continuities and discontinuities of the disorder. Also, some criteria in DSM IV were more relevant to children (e.g.

imitative play appropriate to developmental level) and could not be applied to adults. Without criteria accommodating for the developmental changes in the manifestation of autistic characteristics, results of comparison across time could be misleading. Hence, establishing criteria which assume a developmental perspective taking into account trajectorial changes over time is paramount to future outcome research.

11. Limitations of the Study

Firstly, the sample pool of individuals with autism is drawn from one clinic only and there are four other similar centres, though of a smaller scale, in Hong Kong. Recruitment from the community was not very successful as only seven families volunteered. The difficulties encountered in recruitment are quite common and at times unavoidable under limited resources. However, as the centre where the investigator is working is one of the most established and also the largest child psychiatric team in Hong Kong, it should have covered a reasonably large proportion of the adults with autism. In section 4.1, discussion has been made on the possible bias of the present sample, and there is little evidence that our current sample is biased toward some end.

The second limitation is related to inherent properties of a cross-sectional design in which much of the information is current rather than historical. Thus, no cause-and-effect relationship can be assumed amongst the current set of conditions. Because of possible variability in diagnostic practices across professionals, accuracy and consistency of the initial diagnoses offer limited use for comparison with adult diagnoses. Fortunately, childhood IQs are available in a sub-group of the sample and provide consistent results as those in previous studies. With better documentation and more uniform practices in diagnosis, future prospective follow-up studies should provide us with insight on the relationship of early measures and adult outcome.

The third limitation is concerned with properties of the measuring instruments. Information collected via the interview schedule on overall outcome, though with adequate interrater reliability, may not be exhaustive enough as sometimes responses from either the parent or the autistic individual were accepted and only a few consisted of information from both parents and individuals. In retrospect, interview should be done with both parents and individuals to have more comprehensive data as information might not always concur.

For ease of comparison with past studies, the rating scale of different areas of overall outcome is designed according to the Lotter criteria (1974a) and adapted with close resemblance to those used in the Howlin studies (Howlin et al., 2000 & 2004). Yet, it seems to be inadequate to tap crucial information which could better reflect on specific outcome measures. As an example, difficulty was experienced in assessing the quality of friendship in terms of the degree of reciprocity and mutual responsiveness by the mere report of parents who were often not able to observe how their grown children interact with their peers and from the information supplied by the individuals with autism who seemed unable to elaborate on the details of interaction. A better assessment on friendship should involve observation of the individuals in relating to friends as done in the study of Bauminger et al. (2007). Alternatively, a questionnaire such as the Friendship Questionnaire designed by Baron-Cohen and Wheelwright (2003) could be considered for use. The measure of language competence also requires fine tuning to be a more useful reflection of communication skills in real life situations. In particular, the comprehension and expression of emotions could be another dimension to add to language competence to better tap their ability in verbal communication.

Self-report questionnaires are well known for yielding relatively high rate of psychopathology. Findings from the Chinese MMPI-2 and OCI-R could at best be taken as rough guide to the psychological distress experienced by the sample. Individual clinical interview would have to be conducted to actually ascertain the presence of any psychiatric disorder. Furthermore, since no local norms are available for the OCI-R, the cut-off score for determining significant OC symptoms might not be an optimal threshold. Besides, with a sensitivity of 65% and a specificity of 64% attached to the recommended cut-off score of 21, (Foa et al., 2002), there is a likelihood of false positives among the 28% of the sample who scored above cut-offs. Again, a detailed psychiatric interview would be necessary to ascertain disorder level disturbance.

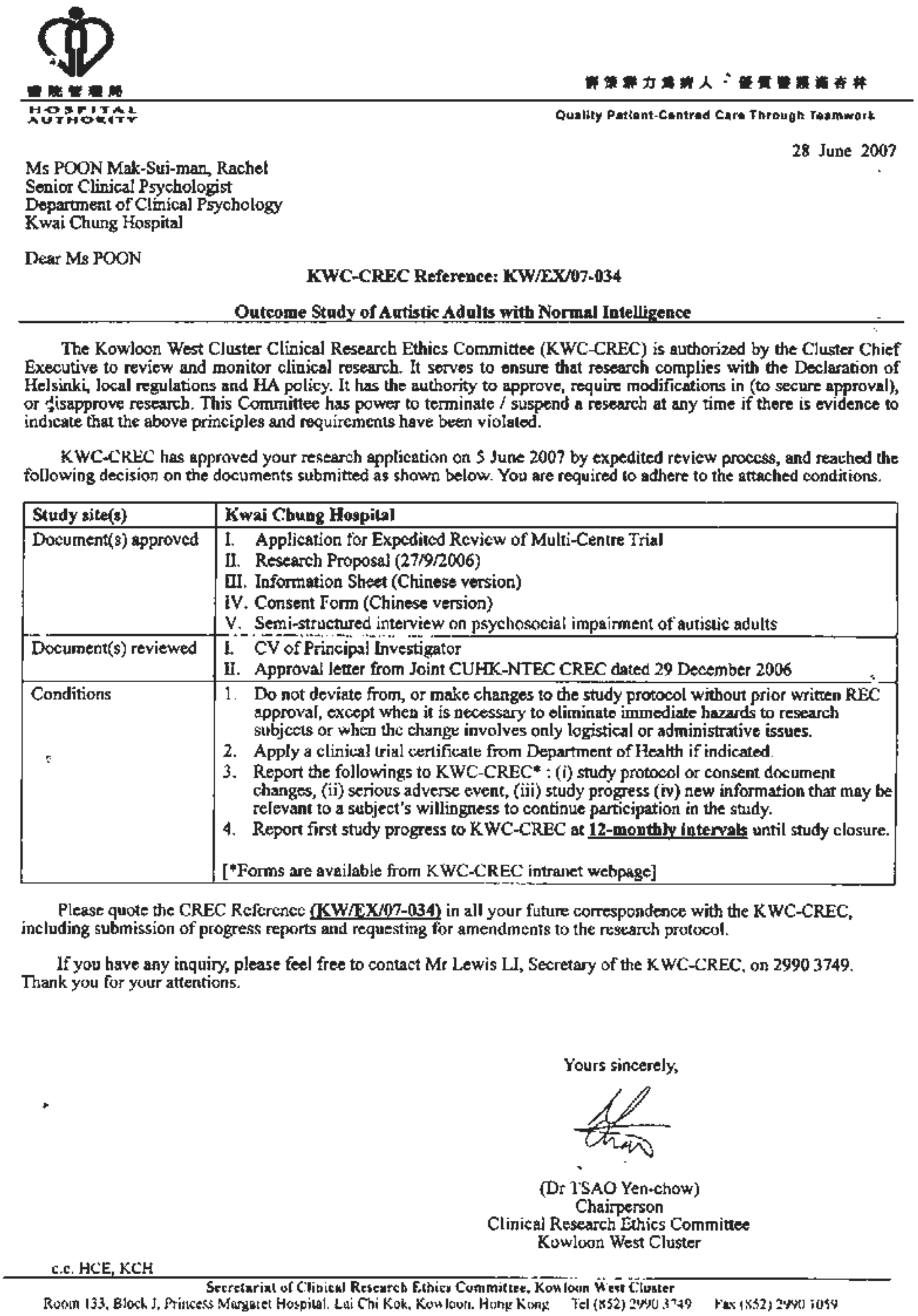
Despite that 3Di has been claimed to be applicable to adults (Skuse, personal communication), it does occasionally contain a few items which are partly based on observations of behaviours in childhood and hence are not too appropriate for assessing the autistic deficits in the life of an adult autistic person. For instance, the invitation to play in another child's house and the presence of imaginary talks between toy figures are clearly indicative behaviours of social functioning in childhood but definitely irrelevant to the adult social world. On the other hand, the pervasive handicap often reported among adults with autism as a result of rigid and sometimes eccentric logic, inflexible application of well-learned social rules and inadequate repertoire to handle more complex emotional situations might worth expansion as criteria for assessing social deficits. In resonance to the view of Piven et al. (1996), Fecteau et al. (2003) suggested that developmental changes should be regarded as integral to the developmental trajectory of autism and not as a change of diagnosis from autism to other less well defined subtype of autism such as PDDNOS. If this perspective were to be taken, one may have to review the applicability of algorithms of the 3Di to the adult individuals with autism.

Lastly, a developmental perspective on outcome studies (Seltzer et al., 2004) also cautioned about the generalizability of results across life span. As the current sample consists mainly of young adults, it would not inform on the conditions of older cohorts or younger cohorts to come in time. For one obvious reason, the experiences of the older cohorts would probably fall in the 'first generation autism' and those in the later cohorts would likely be in the 'third generation autism' (terms used by Kobayashi et al., 1992 to describe people in successive eras with progressing availability of services and support). Studies which compared symptoms of a younger and an older cohort using either a cross-sectional design (Seltzer et al., 2003) or longitudinal design (Shattuck et al., 2008) both found changes in the degree of improvement and manifestation of symptoms over time. Seltzer et al. (2003) suggested three processes which might explain cohort differences: developmental changes in symptoms, improved services available to younger cohorts and changes in diagnostic practices. Prospective research at different time-lines might be able to provide information on the developmental course of autism in lifespan and trace the possible differences in symptom manifestation at different stages.

Despite the forgoing limitations, this study has provided the first ever picture of the outcome of young adults with autism with normal intelligence in a cosmopolitan Chinese city. It resonates with previous western outcome studies in finding both continuities and discontinuities in adults with autism even in Asian countries. Although the outcome adjustment is relatively more optimistic perhaps due to technological advances of a modernized city like Hong Kong, autism remains a long-term disability with an adverse impact on their educational and occupation attainment, which call for continuous support and accommodation in the environment. In particular, there is a dire shortage of services specially targeted towards adults which is badly out of pace with the growth of special services for school age children in various countries (Howlin et al., 2004; Eaves & Ho, 2008) and even more so in Hong Kong.

APPENDICES

Appendix 1 : Ethical Approval Letter



醫院管理局
HOSPITAL
AUTHORITY

群策群力為病人，優質醫護滿杏林
Quality Patient-Centred Care Through Teamwork

28 June 2007

Ms POON Mak-Sui-man, Rachel
Senior Clinical Psychologist
Department of Clinical Psychology
Kwai Chung Hospital

Dear Ms POON

KWC-CREC Reference: KW/EX/07-034

Outcome Study of Autistic Adults with Normal Intelligence

The Kowloon West Cluster Clinical Research Ethics Committee (KWC-CREC) is authorized by the Cluster Chief Executive to review and monitor clinical research. It serves to ensure that research complies with the Declaration of Helsinki, local regulations and HA policy. It has the authority to approve, require modifications in (to secure approval), or disapprove research. This Committee has power to terminate / suspend a research at any time if there is evidence to indicate that the above principles and requirements have been violated.

KWC-CREC has approved your research application on 5 June 2007 by expedited review process, and reached the following decision on the documents submitted as shown below. You are required to adhere to the attached conditions.

Study site(s)	**Kwai Chung Hospital**
Document(s) approved	I. Application for Expedited Review of Multi-Centre Trial II. Research Proposal (27/9/2006) III. Information Sheet (Chinese version) IV. Consent Form (Chinese version) V. Semi-structured interview on psychosocial impairment of autistic adults
Document(s) reviewed	I. CV of Principal Investigator II. Approval letter from Joint CUHK-NTEC CREC dated 29 December 2006
Conditions	1. Do not deviate from, or make changes to the study protocol without prior written REC approval, except when it is necessary to eliminate immediate hazards to research subjects or when the change involves only logistical or administrative issues. 2. Apply a clinical trial certificate from Department of Health if indicated. 3. Report the followings to KWC-CREC* : (i) study protocol or consent document changes, (ii) serious adverse event, (iii) study progress (iv) new information that may be relevant to a subject's willingness to continue participation in the study. 4. Report first study progress to KWC-CREC at **12-monthly intervals** until study closure. [*Forms are available from KWC-CREC intranet webpage]

Please quote the CREC Reference **(KW/EX/07-034)** in all your future correspondence with the KWC-CREC, including submission of progress reports and requesting for amendments to the research protocol.

If you have any inquiry, please feel free to contact Mr Lewis LI, Secretary of the KWC-CREC, on 2990 3749. Thank you for your attentions.

Yours sincerely,

(Dr TSAO Yen-chow)
Chairperson
Clinical Research Ethics Committee
Kowloon West Cluster

c.c. HCE, KCH

Secretariat of Clinical Research Ethics Committee, Kowloon West Cluster
Room 133, Block J, Princess Margaret Hospital, Lai Chi Kok, Kowloon, Hong Kong Tel (852) 2990 3749 Fax (852) 2990 3059

Appendix 2 : Invitation Letter

自閉症人士的成年狀況之研究

誠邀自閉症成年人參加

是項研究是由香港中文大學臨床心理博士學生潘麥瑞雯及碩士學生陳曉所負責的。目的是想了解一些曾被診斷爲患有自閉症的人士長大後適應社會的情況。

自閉症的診斷及服務早於 80 年代由當時的醫務衛生署精神科開拓, 至今已有二十多年的歷史。在這段期間, 世界各地針對自閉症的研究及討論非常蓬勃, 對自閉症的理解日益進步。隨著診斷尺度的變化, 人們發現擁有正常智力的自閉症兒童實在不少於有智障的自閉症兒童, 而其中不乏曾就讀一般主流學校。他們在社交的適應, 或面對的問題, 相信與身處特殊學校的兒童非常不同。他們長大後, 亦會比智障的自閉症人士有更大的機會融入社會。在這方面, 究竟他們面對甚麼困難, 甚麼援助最能幫助他們, 至今還沒有任何有系統的認識。

有鑑於此, 我們決定作一項全面的研究, 希望盡量接觸一群從主流學校畢業的自閉症人士, 透過問卷調查及深入訪問, 去了解他們現時的生活情況。研究結果將會傳達有關部門, 希望喚起社會對這一群特別的人士的關注, 給予適當的服務, 使他們能發揮所長, 成爲社會的一分子。

研究對象

我們誠邀

1. 十八歲或以上;
2. 曾斷定或懷疑患有自閉症或亞氏保加症;
3. 曾就讀主流學校的人士參加是項研究。

參加者會被邀請參與一個智力評估及接受一個訪問。智力評估是採用魏氏成人智力量表第三版(中文版)。該評估之目的在於協助研究者得知參加者能力的分佈，從而理解他們的強弱及對其適應的影響。而訪問則會採用會談對話的形式，給予參加者自由發揮的機會，務求取得他們真正的看法及感受。評估會分二至三次進行, 每次大約需要二至三個小時。

同時, 我們亦會訪問自閉症人士的家長,訪問會依據一項稱爲 3Di 的問卷向家長作出提問。該問卷是由英國倫敦佳士醫院制作評核，現由中文大學一群同事翻譯爲中文版。問卷用作從家長經驗中了解自閉人士從小有的困難。訪問大概需要一至兩個小時。

研究對參加者的影響

參加者不會因參加是項研究而得到任何報酬，但我們會把評估結果簡單告訴予參加者及家長。而參加者的評估結果亦會增加我們對自閉症人士的成年狀況的認識。

參加者可能會在評估時覺得疲倦，又或在回答一些私人問題時覺得尷尬。參加者可把不安告之研究員，他們亦有權利隨時終止評估。研究員亦會因應參加者的狀況而作出相應的調整。

私隱

如非得到參加者的同意，是項研究的所有個人資料均獲絕對保密，只有研究員才能翻閱，不會向任何人披露。

參加方法

如有興趣參加是項研究，或作進一步了解，歡迎致電 9826-6108 或電郵致 chanmandy@cuhk.edu.hk 予陳曉小姐，或致電 23849974,電郵致 poorachel@gmail.com 予潘麥瑞雯女士。

~懇請踴躍參加是項研究!~

籌備日期: 二ＯＯ六年六月一日　　有效日期至: 二ＯＯ七年十二月三十一日

Appendix 3 : Consent Form

參加研究同意書

頁一 (共一頁)

自閉症患者的成年狀況

你現被邀請參加一項由香港中文大學臨床心理博士學生潘麥瑞雯及碩士學生陳曉所負責的研究。我們會爲你進行智力評估及訪問。智力評估是採用魏氏成人智力量表第三版(中文版)。該評估之目的在於協助我們認識你的能力的分佈。而訪問則會採用會談對話的形式。研究會分二至三次進行, 每次大約需要二至三個小時。

危險及不安

你可能會在評估或訪問時覺得疲倦, 又或在回答一些私人問題時覺得尷尬。你可把不安告之研究員, 他們亦有權利隨時終止評估或訪問。研究員亦會因應參加者的狀況而作出相應的調整。

利益

你不會因參加是項研究而得到任何報酬, 但我們會把評估結果簡單告訴你。評估結果亦會增加我們對自閉症人士的成年狀況的認識。

私隱

如非得到你的同意, 是項研究的所有個人資料均獲絕對保密, 只有研究員才能翻閱, 不會向任何人披露。

參與及退出

你可以隨時退出是項研究, 而且不會帶來任何不良的後果。雖然我們很希望你能回答所有問題, 你仍然有權利隨時拒絕回答某些問題。

簽署

我本人______________________________ (參加者姓名) 明白以上所述研究的過程,並同意參加是項研究。

參加者簽署	見証人姓名/見証人簽署	日期

籌備日期: 二 OO 六年六月一日

有效日期: 二 OO 七年十二月三十一日

Appendix 4 : Interview Form

姓名： 中_______________ 出生日期：______________ 年歲：______________
英_______________ 性別：________

□ 工作能力

學歷： 初中程度 □ 高中程度 □ 預科程度 □
專上教育: 證書課程: ________________ 正在就讀 □ 已完成 □
文憑課程：________________ 正在就讀 □ 已完成 □
高級文憑課程: ______________ 正在就讀 □ 已完成 □
副學士課程: ______________ 正在就讀 □ 已完成 □
學位課程：________________ 正在就讀 □ 已完成 □

其他訓練： 技能訓練學校 □
匡智松嶺訓練中心 □
明愛樂務訓練中心 □
其他：______________________

就業情況: 從未就業 □
待業中 □ 曾做過的工作：________________________________
就業中 □
現在的工作：________________ 爲期：________________
性質： 自僱 □ 公開就業 □ 輔助就業 □
全職 □ 非全職 □
月薪 □ 日薪 □ 時薪 □
每月工資： $0 - $2000.. □

$ 2000 – 少於$4000.................................. □

$ 4000 – 少於$6000.................................. □

$ 6000 – 少於$8000.................................. □

$ 8000 – 少於$10000................................ □

$ 10,000 或以上... □

□ 交友能力

1 他有沒有朋友？他和朋友一起時會做些甚麼？

2 他從哪兒認識他的朋友？舊同學？同事？參加活動認識的朋友？

3 他與人的接觸是被動式的，限於一些機構或別人安排的活動? 還是他會主動？

4 他通常怎樣和他們聯絡？他有沒有朋友的電話號碼或電郵地址？他會否與朋友傾電話？會否在網上傾談？

5 他與他的朋友聯絡有多頻密？他會否主動找朋友進行活動？有沒有朋友找他外出？

6 他有沒有異性朋友？有沒有和人拍拖？

□ 獨立技能

1. 他能否獨立外出，安全回家？

2. 他懂得爲自己烹調簡單的食物嗎？舉些例子？

3. 若他感覺身體不適時，他會怎樣做？

4. 他會怎樣處理自己的髒衣服？

5. 他有沒有攜帶家門鎖匙在身上？

6. 他有沒有銀行戶口？他能否自己去提款或存款？

7. 他有沒有自己購物？例如食物，衣服，日常用品，或喜歡的玩意？

8. 他有沒有儲錢買自己喜歡的東西或做一些自己喜歡的事?

□ 自閉固執及重覆行爲

1. 他記存了大量的資料。(例如，全世界的首都名稱，或很多恐龍的名字。)？

2. 他有一些過份濃厚的特別興趣，(例如，地圖、巴士、電腦或恐龍)，他寧願選擇相關活動而不選其他。

3. 有沒有一段時間他曾經沉迷於一些其他小孩不會感興趣的奇怪東西？(例如，如八達通、傳單、地圖)

4. 他曾否經過一個階段不斷重覆一模一樣的詞語或語句，而打斷他是幾乎不可能的。他會要求你重覆一些說話，若被拒絕，他便會發脾氣?

5. 他有沒有曾經一絲不苟地依一些奇特的方法去做事或要你做事-例如，依特定的次序來吃碟上的食物，或臨睡前要完成一些冗長的程序才去睡覺？當程序被打亂時，他會不會不高興？

6. 他有沒有曾經對一些會轉的東西有不尋常的興趣，例如，洗衣機、風扇、車輪？

7. 他會否因爲生活小節，程序或物件安放位置的變動而煩躁不安？

□ **溝通能力**

1. 別人是否喜歡和他交談? 或覺得和他交談是否有趣？

2. 當他和人交談時，他有沒有經常轉換到自己喜歡或令人意想不到的話題，而不跟別人的話題？

3. 他是否從來沒有或很少主動和別人交談，及不會主動說出發生了什麼事？

4. 他能否記得一些複雜的指令？例如，「入房，把髒衣服後拿出來，再放進洗衣籃中」。

5. 他喜歡與別人閒談嗎？多數是甚麼主題，可否舉個例子？

6. 他對別人的話題有沒有興趣？他會否就著別人的話題發問或作出反應？

□ **總分**

Appendix 5 : Interview Form (English)

Name Chinese______________ d.o.b.____________ age____________
English______________ sex：_______

☐ **Work**

Education Level Form 3 ☐ Form 5 ☐ Form 6 and above ☐

Post-secondary Certificate course ____________ Studying ☐ Finished ☐

Diploma course______________ Studying ☐ Finished ☐

Higher diploma course ____________ Studying ☐ Finished ☐

Associate degree ____________ Studying ☐ Finished ☐

University degree______________ Studying ☐ Finished ☐

Other training Skill training centre ☐

Pine Hill Training center ☐
Lok Mo Training centre ☐
Others____________________

Employment Never worked ☐
Unemployed ☐ Past jobs：______________________________
Employed ☐
Current job________________ Starting since______________
Nature Self-employed ☐ Open employment ☐ Supported employment ☐
Full-time ☐ Part-time ☐
Monthly wage ☐ Daily wage ☐ Hourly wage ☐

Monthly wage
$0 - $2000………………………………………….. ☐
$ 2000 – <$4000…………………………….. ☐
$ 4000 – <$6000…………………………….. ☐
$ 6000 – <$8000…………………………….. ☐
$ 8000 – <$10000…………………………… ☐
$ 10,000or more………………………………….. ☐

☐ **Friends**

1. Does he have friends ? What would he do when he is with friends ?

2. Where does he know his friends ? Former classmates ? Colleagues ? Friends he comes to know in activities?

3. Is he passive in social contact, limited to activities arranged by agencies or others? Or, would he take initiative to approach people?

4. How does he contact his friends? Any use of phone number, email addresses? Would he chat with friends over the phone or on the internet?

5. How often would he have contact with his friends? Would he take the initiative to approach them? Would people ask him to go out with them?

6. Does he have any female friends? Has he ever had a steady relationship?

☐ **Independence**

1. Can he go out by himself and return home safely?

2. Can he cook simple food for himself? Give some examples.

3. If he does not feel well, what would he do?

4. What would he do with his dirty linens?

5. Does he carry with him door keys?

6. Does he have a bank account? Can he make transaction at ATM machines?

7. Can he make purchases by himself? E.g. purchasing food, clothing, household items or things he likes

8. Has he been saving up money to buy favourite things or for favourite activities?

☐ **Autistic type stereotyped and repetitive behaviours**

1. Does he have a large store of factual information? (for example, knowing all the capitals of the world or the names of many kinds of dinosaur)

2. Does he have one or more over-riding particular interests (e.g., maps, buses, computers or dinosaurs), and will prefer activities involving these to anything else?

3. Was there ever a time when he had a preoccupation with something odd or even bizarre which would NOT be of interest to most children? (e.g.,: octopus, flyers, maps)

4. Did he go through a phase of endlessly and exactly repeating a word or phrase? Interrupting him might not be possible. He might insist that you should say something over and over again, and refusal could provoke a tantrum.

5. Was there ever a time when he had to do things, or have you do things, in some precise yet odd ritual- for e.g. eating the food on his plate in a particular order, or a protracted goodnight ritual. Did he get upset if the ritual was disrupted?

6. Has he ever seemed unusually interested in, and absorbed by, things that spin, such as the washing machine, a fan, or the wheels on a toy car?

7. Would he be upset when there are changes in routines, schedules or placements of household items?

☐ **Language**

1. Do people find that conversation with him can be enjoyable and interesting?

2. Does he often turn the conversation to a favourite theme or go off in unexpected directions rather than following what the other person wants to talk about?

3. Does he seldom or never starts up a conversation, and doesn't volunteer information about what has happened?

4. Can he remember complex commands such as 'go upstairs, get your dirty washing, bring it down and put it in the laundry basket'?

5. Does he like to chat with people? About what topics? Cite some example.

6. Is he interested in other people's topics? Can he respond to or ask questions about other people's topics?

☐ **Total**

Appendix 6 : Definition of Educational Attainment

Educational Attainment （教育程度）:

(a) Definition of Highest level attended (最高就讀程度):

Highest level attended is the highest level of education **ever attained** by a person in school or other educational institution, regardless of whether he had completed the course. Only formal courses are counted as educational attainment. A formal course shall be one that lasts for at least one academic year, requires specific academic qualifications for entrance (except sub-degree / degree / post-graduate courses offered by the Open University of Hong Kong) and includes examinations or specific academic assessment procedures.

(b) Classification of Educational attainment

No schooling （未受教育）*:* Including those who had never attended a formal course.

Pre-primary （學前教育）*:* Including all classes in kindergartens and child care centres.

Primary （小學）*:* Including Primary 1 - 6 in all schools.

Lower Secondary （初中）*:* Including Secondary 1 - 3 in all schools.

Upper Secondary （高中）: Including Secondary 4 - 5 or equivalent in all schools, Project Yi Jin and craft level.

Sixth form （預科）*:* Including Secondary 6 - 7 or equivalent in all schools.

Post-secondary (Diploma/Certificate) (專上教育（文憑/證書課程）) : Including Diploma/ Certificate courses in Vocational Training Council/ Clothing Industry Training Authority/ Construction Industry Training Authority/ Open University/ School of Professional and Continuing Education of University/ former Polytechnics/ other statutory or approved Post-secondary Colleges/ other colleges providing post-secondary courses/ former Teacher Colleges/ commercial schools, Nurse training courses/ Dental training courses/ Distance learning courses/ other courses at diploma/ certificate level

Post-secondary (Sub-degree course) （專上教育（副學位課程））*:* Including all Higher Certificate/ Higher Diploma/ Professional Diploma/ Associate Degree/ Pre-Associate Degree/ Endorsement Certificate/ Associateship or equivalent courses in Universities/ Vocational Training Council, other sub-degree courses in Universities funded by University Grants Committee, Higher Certificate/ Higher Diploma/ Professional Diploma/ Associate Degree/ Pre-Associate Degree or equivalent courses in former Polytechnics/ other statutory or approved Postsecondary Colleges, Higher Diploma/ Professional Diploma/ Associate Degree/ Pre-Associate Degree or equivalent courses in other colleges providing postsecondary courses, sub-degree courses in Hong Kong Institute of Education, Sub-degree level nurse training courses/ dental training courses, Distance learning sub-degree level courses and other sub-degree level courses

Post-secondary (Degree course) （專上教育（學位課程））*:* Including all first degree, taught postgraduate and research postgraduate courses in local or nonlocal institutions.

Extracted from 2006 Population By-census

Appendix 7 : Definition of Occupation

Occupation （職業）: This refers to the kind of work a person performed during the seven days before the reference moment.

Managers and administrators*（經理及行政人員）*:
Including administrators, commissioners and directors in government service; consuls; councillors; directors, chief executive officers, presidents, general managers, functional managers, branch managers and small business managers in industry, commerce, import and export trade, wholesale and retail trade, catering and lodging services, transport, electricity, gas, water and other services and agricultural and fishery sectors.

Professionals*（專業人員）*:
Including qualified professional scientists, doctors, dentists and other medical professionals; architects, surveyors and engineers; vice-chancellors, directors, academic staff and administrators of university, post-secondary college; principals and teachers of secondary school; statisticians; mathematicians; system analysts and computer programmers; lawyers and judges; accountants; business consultants and analysts; social workers; translators and interpreters; news editors and journalists; writers; librarians and members of religious orders.

Associate professionals*（輔助專業人員）*:
Including science technicians, nurses and midwives, dental assistants and other health associate professionals; architectural, surveying and engineering technicians; optical and electronic equipment controllers; ship pilots and air traffic controllers; principals and teachers of primary school and kindergarten/nursery; statistical assistants; computer operators; law clerks; accounting supervisors; public relation officers; sales representatives; designers; estate managers; social work assistants; superintendents, inspectors and officers of the police and other discipline services; performers and sportsmen.

Clerks （文員） *:* Including stenographers, secretaries and typists; bookkeeping, finance, shipping, filing and personnel clerks; cashiers and tellers; receptionists and information clerks.

Service workers and shop sales workers （服務工作及商店銷售人員）
: Including air hostesses and travel guides; house stewards; cooks and waiters; baby-sitters; hairdressers and beauticians; rank and file staff of the police and other discipline services; transport conductors and other service workers; wholesale and retail salesman in shops; shop
assistants and fashion models.

Craft and related workers （工藝及有關人員）*:*
Including miners and quarrymen; bricklayers, carpenters and other construction

workers; metal moulders; blacksmiths; machinery, electric and electronic instrument mechanics; jewellery workers and watch makers; potters; typesetters; bakers, food and beverage processors; painters; craft workers in textile, garment, leather, rubber and plastic trades and other craft workers.

Plant and machine operators and assemblers **（機台及機器操作員及裝配員）***:*
Including well drillers and borers; ore smelting furnace operators; brick and tile kilnmen; sawmill sawyers; paper makers; chemical processing plant operators; power-generating plant and boiler operators; asbestos cement products makers; metal finishers and electroplaters; dairy and other food processing machine operators; printing machine operators; machine operators for production of textile, rubber and plastic products; assemblers; drivers; seamen and other plant and machine operators.

Elementary occupations **（非技術工人）***:*
Including street vendors; domestic helpers and cleaners; messengers; private security guards; watchmen; freight handlers; lift operators; construction labourers; hand packers; agricultural and fishery labourers.

Skilled agricultural and fishery workers; and occupations not classifiable **（漁農業熟練工人及不能分類的職業）***:*
Including farm workers, animal husbandry workers and fishermen, and occupations unidentiafiable and inadequately described

Extracted from General Household Survey, Q4 2007, of Census and Statistics Department

Appendix 8 : Occupation and Different Current and Childhood IQ Levels

			Occupation		
			Skilled work	Unskilled work	χ^2
Current FIQ	Below Average	n(%)	4(28.6%)	10(71.4%)	*2.94*
	Average	n(%)	7(46.7%)	8(53.3%)	
	Above Average	n(%)	3(75%)	1(25%)	
Current VIQ	Below Average	n(%)	4(26.7%)	11(73.3%)	*4.48*
	Average	n(%)	6(46.2%)	7(53.8%)	
	Above Average	n(%)	4(80%)	1(20%)	
Current PIQ	Below Average	n(%)	4(33.3%)	8(66.7%)	*1.05*
	Average	n(%)	7(43.8%)	9(56.3%)	
	Above Average	n(%)	3(60%)	2(40%)	
Childhood FIQ	Below Average	n(%)	5(38.5%)	8(61.5%)	*1.65*
	Average	n(%)	4(50%)	4(50%)	
	Above Average	n(%)	3(75%)	1(25%)	
Childhood VIQ	Below Average	n(%)	4(28.6%)	10(71.4%)	*3.88*
	Average	n(%)	4(66.7%)	2(33.3%)	
	Above Average	n(%)	1(100%)	0	
Childhood PIQ	Below Average	n(%)	4(57.1%)	3(42.9%)	*1.75*
	Average	n(%)	2(25%)	6(75%)	
	Above Average	n(%)	3(50%)	3(50%)	

Appendix 9 : Summary of ANOVA Results Comparing Scores in Elevated MMPI-2 Scales of 3 Diagnostic Groups

	Sum of Squares	df	Mean Square	F	Sig.
Clinical Scales					
2(Depression)	82.148	2	41.074	.331	.719
6(Paranoia)	132.842	2	66.421	.323	.725
7(Psychasthenia)	166.450	2	83.225	.739	.482
8(Schizophrenia)	174.493	2	87.247	.598	.554
9(Hypomania)	6.201	2	3.101	.031	.970
0(Social Introversion)	171.625	2	85.812	.579	.564
Content Scales					
Anxiety	1275.098	2	637.549	3.198	.048
Obsessiveness	587.263	2	293.632	2.472	.093
Depression	264.258	2	132.129	.723	.489
Bizarre Mentation	14.874	2	7.437	.048	.953
Anger	808.747	2	404.373	2.495	.091
Low Self-Esteem	390.707	2	195.354	1.151	.323
Social Discomfort	399.276	2	199.638	1.626	.205
Work Interference	321.130	2	160.565	.964	.387

Appendix 10 : Pearson Correlations Between MMPI Scales and Outcome Ratings and IQ

Pearson correlations between outcome ratings and number of significantly elevated MMPI scales

		No. of elevated MMPI scales	
	N	Pearson Correlation	Sig. (2-tailed)
Total Outcome Rating	61	.01	.94
Work	61	.12	.35
Friendship	61	.01	.94
Independence	61	-.04	.78
Stereotype	61	.08	.56
Language	61	-.16	.24

Pearson correlations between IQs and number of significantly elevated MMPI scales

		No. of elevated MMPI scales	
	N	Pearson Correlation	Sig. (2-tailed)
Full IQ	61	.08	.51
Verbal IQ	61	.12	.35
Performance IQ	61	.01	.91
Full IQ (childhood)	42	.03	.87
Verbal IQ (childhood)	36	-.03	.88
Performance IQ (childhood)	36	-.20	.25

Appendix 11 : Summary of Regression Analyses of MMPI-2 Scale Scores on Overall Outcome Controlling for Diagnostic Status

Model	R Square	Change Statistics				
		R Square Change	F Change	df1	df2	Sig. F Change
Clinical Scales						
2(Depression)	0.41	0.04	3.92	1	57	0.05
6(Paranoia)	0.38	0.00	0.25	1	56	0.62
7(Psychasthenia)	0.40	0.02	1.67	1	57	0.20
8(Schizophrenia)	0.39	0.01	1.05	1	57	0.31
9(Hypomania)	0.38	0.00	0.42	1	57	0.52
0(Social Introversion)	0.39	0.01	0.73	1	56	0.40
Content Scales						
Anxiety	0.39	0.01	1.28	1	57	0.26
Obsessiveness	0.38	0.01	0.50	1	57	0.48
Depression	0.38	0.01	0.49	1	57	0.49
Bizarre Mentation	0.38	0.01	0.49	1	57	0.49
Anger	0.38	0.02	0.15	1	57	0.709
Low Self-Esteem	0.39	0.01	0.83	1	57	0.37
Social Discomfort	0.42	0.04	3.91	1	57	0.05
Work Interference	0.39	0.01	1.05	1	57	0.32

Note. DV= overall outcome ratings; Predictors: diagnosis, respective MMPI scales scores

Appendix 12 : Summary of Regression Analyses of MMPI-2 Scale Scores on Outcome (work+independence) Controlling for Diagnostic Status

Model	R Square	Change Statistics				
		R Square Change	F Change	df1	df2	Sig. F Change
Clinical Scales						
2(Depression)	0.27	0.06	5.28	1	57	0.02
6(Paranoia)	0.22	0.01	0.42	1	56	0.52
7(Psychasthenia)	0.23	0.02	1.55	1	57	0.2
8(Schizophrenia)	0.23	0.01	1.05	1	57	0.31
9(Hypomania)	0.21	0.00	0.17	1	57	0.68
0(Social Introversion)	0.22	0.01	0.82	1	56	0.37
Content Scales						
Anxiety	0.23	0.02	1.28	1	57	0.26
Obsessiveness	0.21	0.00	0.19	1	57	0.66
Depression	0.22	0.01	0.43	1	57	0.52
Bizarre Mentation	0.22	0.01	0.68	1	57	0.41
Anger	0.23	0.02	1.64	1	57	0.21
Low Self-Esteem	0.23	0.02	1.18	1	57	0.28
Social Discomfort	0.25	0.04	3.18	1	57	0.08
Work Interference	0.24	0.03	1.85	1	57	0.18

Note. DV= overall outcome*(work+independence)* ratings; Predictors: diagnosis, respective MMPI scales scores

Appendix 13 : Correlations between IQs and Significantly Elevated MMPI Scales

Pearson Correlation between Current IQs and significantly elevated MMPI scales

	Full IQ	Verbal IQ	Performance IQ
Clinical Scales			
2(Depression)	-.12	-.00	-.21
6(Paranoia)	.03	.06	-.02
7(Psychasthenia)	-.03	.00	-.07
8(Schizophrenia)	-.08	-.06	-.08
9(Hypomania)	.10	.08	.11
0(Social Introversion)	.07	.04	.08
Content Scales			
Anxiety	-.01	.09	-.11
Obsessiveness	.17	.17	.12
Depression	.14	.15	.08
Bizarre Mentation	-.06	-.02	-.09
Anger	.15	.14	.13
Low Self-Esteem	.23	.17	.24
Social Discomfort	.03	-.00	.06
Work Interference	.11	.12	.07

Pearson Correlation between childhood IQs and significantly elevated MMPI scales

	Full IQ (childhood)	Verbal IQ (childhood)	Performance IQ (childhood)
Clinical Scales			
2(Depression)	.00	.10	-.18
6(Paranoia)	-.01	-.01	-.09
7(Psychasthenia)	.06	.06	-.01
8(Schizophrenia)	-.07	-.04	-.16
9(Hypomania)	-.17	-.28	-.08
0(Social Introversion)	.01	.01	-.04
Content Scales			
Anxiety	-.04	.04	-.16
Obsessiveness	-.03	-.02	-.07
Depression	.03	.01	-.03
Bizarre Mentation	-.04	.00	-.14
Anger	.07	.06	.03
Low Self-Esteem	.06	.04	.01
Social Discomfort	.01	.05	-.04
Work Interference	-.05	.03	-.18

Appendix 14 : Summary of Comparisons of Proportions of Clinical versus Non-clinical Cases in MMPI-2 Scales among 3 Current IQ Levels

		Full IQ level				Verbal IQ level				Performance IQ level			
Clinical scales		Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) n (%)	χ^2	Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) n (%)	χ^2	Above average (n=12) n (%)	Average (n=30) n (%)	Below average (n=19) n (%)	χ^2
2 (Depression)	T<65	10 (91%)	22 (69%)	15 (83%)	2.843	9 (82%)	24 (75%)	14 (78%)	.223	11 (92%)	22 (73%)	14 (74%)	1.806
	T≧65	1 (9%)	10 (31%)	3 (17%)		2 (18%)	8 (25%)	4 (22%)		1 (8%)	8 (27%)	5 (27%)	
6(Paranoia)	T<65	8 (73%)	23 (72%)	12 (71%)	.017	8 (73%)	24 (75%)	11 (65%)	.587	9 (75%)	20 (69%)	14 (74%)	.208
	T≧65	3 (27%)	9 (28%)	5 (29%)		3 (27%)	8 (25%)	6 (35%)		3 (25%)	9 (31%)	5 (26%)	
7(Psychasthenia)	T<65	9 (82%)	25 (78%)	15 (83%)	.217	9 (82%)	26 (81%)	14 (78%)	.107	10 (83%)	23 (77%)	16 (84%)	.504
	T≧65	2 (18%)	7 (22%)	3 (17%)		2 (18%)	6 (19%)	4 (22%)		2 (17%)	7 (23%)	3 (16%)	
8(Schizophrenia)	T<65	8 (73%)	21 (66%)	16 (89%)	3.230	8 (73%)	22 (69%)	15 (83%)	1.274	9 (75%)	21 (70%)	15 (79%)	.493
	T≧65	3 27%)	11 (34%)	2 (11%)		3 (27%)	10 (31%)	3 (17%)		3 (25%)	9 (30%)	4 (21%)	
9(Hypomania)	T<65	9 82%)	24 (75%)	17 (94%)	2.947	8 (73%)	26 (81%)	16 (89%)	1.230	10 83%)	23 (77%)	17 (82%)	1.310
	T≧65	2 (18%)	8 25%)	1 (6%)		3 (27%)	6 (19%)	2 (11%)		2 (17%)	7 23%)	2 (18%)	

Appendix 14 (continued)

		Full IQ level				Verbal IQ level				Performance IQ level			
		Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) n (%)	χ^2	Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) n (%)	χ^2	Above average (n=12) n (%)	Average (n=30) n (%)	Below average (n=19) n (%)	χ^2
0(Social Introversion)	T<65	8 (73%)	28 (90%)	16 (89%)	2.285	8 (73%)	28 (90%)	16 (89%)	2.285	9 (75%)	27 (90%)	16 (89%)	1.779
	T≧65	3 (27%)	3 (10%)	2 (11%)		3 (27%)	3 (10%)	2 (11%)		3 (25%)	3 (10%)	2 (11%)	
Content Scales													
Anxiety	T<65	7 (64%)	21 (66%)	14 (78%)	.964	7 (64%)	22 (69%)	15 (83%)	.235	9 (75%)	20 (67%)	13 (68%)	.280
	T≧65	4 (36%)	11 (34%)	4 (22%)		4 (36%)	10 (31%)	3 (17%)		3 25%)	10 (33%)	6 (32%)	
Obsessiveness	T<65	7 (64%)	25 (78%)	14 78%)	1.004	7 (64%)	26 (82%)	13 (72%)	1.509	9 (75%)	22 (73%)	15 (79%)	.199
	T≧65	4 (36%)	7 (22%)	4 (22%)		4 (36%)	6 (19%)	5 (28%)		3 (25%)	8 (27%)	4 (21%)	
Depression	T<65	9 (82%)	22 (69%)	16 (89%)	2.815	9 (82%)	23 (72%)	15 (83%)	1.028	10 (83%)	22 (73%)	15 (79%)	.541
	T≧65	2 (18%)	10 (31%)	2 (11%)		2 (18%)	9 (28%)	3 (17%)		2 (17%)	8 (27%)	4 (21%)	
Bizarre Mentation	T<65	9 (82%)	27 (84%)	14 (78%)	.339	9 (82%)	27 (84%)	14 (78%)	.339	11 (92%)	24 (80%)	15 (79%)	.960
	T≧65	2 (18%)	5 (16%)	4 (22%)		2 (18%)	5 (16%)	4 (22%)		1 (8%)	6 (20%)	4 (21%)	
Anger	T<65	7 (64%)	26 (82%)	16 (89%)	2.791	7 (64%)	27 (84%)	15 (83%)	2.374	10 (83%)	22 (73%)	17 (82%)	2.003
	T≧65	4 (36%)	6 (18%)	2 (11%)		4 (36%)	5 (16%)	3 (17%)		2 (17%)	8 (27%)	2 (18%)	

Appendix 14 (continued)

		Full IQ level				Verbal IQ level				Performance IQ level			
		Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) N (%)	χ^2	Above average (n=11) n (%)	Average (n=32) n (%)	Below average (n=18) n (%)	χ^2	Above average (n=12) n (%)	Average (n=30) n (%)	Below average (n=19) n (%)	χ^2
Low Self-Esteem	T<65	7 (64%)	24 (75%)	17 (94%)	4.410	7 (64%)	25 (78%)	16 (89%)	2.609	7 (58%)	23 (77%)	18 (95%)	5.969
	T≧65	4 (36%)	8 (25%)	1 (6%)		4 (36%)	7 (22%)	2 (11%)		5 (42%)	7 (23%)	1 (5%)	
Social Discomfort	T<65	8 (73%)	27 (84%)	15 (83%)	.784	8 (73%)	27 (84%)	15 (83%)	.784	9 (75%)	26 (87%)	15 (79%)	.960
	T≧65	3 (27%)	5 (16%)	3 (17%)		3 (27%)	5 (16%)	3 (17%)		3 (25%)	4 (13%)	4 (21%)	
Work Interference	T<65	7 (64%)	25 (78%)	13 (72%)	.920	7 (64%)	26 (82%)	12 (67%)	1.978	8 (67%)	24 (80%)	13 (68%)	1.196
	T≧65	4 (36%)	7 (22%)	5 (28%)		4 (36%)	6 (18%)	6 (33%)		4 (33%)	6 (20%)	6 (32%)	

Appendix 15 : Comparisons of Proportions of Clinical versus Non-clinical Cases in MMPI-2 Scales among 3 Childhood IQ Levels

		Childhood Full IQ level				Childhood Verbal IQ level				Childhood Performance IQ level			
Clinical scales		Below average (n=22) n (%)	Average (n=16) n (%)	Above average (n=6) n (%)	X^2	Below average (n=23) n (%)	Average (n=14) n (%)	Above average (n=3) n (%)	X^2	Below average (n=13) n (%)	Average (n=17) n (%)	Above average (n=10) n (%)	X^2
2 (Depression)	T<65	15 (68%)	10 (62%)	5 (83%)	.873	15 (65%)	11 (79%)	2 (67%)	.756	8 (62%)	12 (71%)	8 (80%)	.922
	T≧65	7 (32%)	6 (38%)	1 (17%)		8 (35%)	3 (21%)	1 (33%)		5 (38%)	5 (29%)	2 (20%)	
6(Paranoia)	T<65	18 (86%)	10 (62%)	4 (67%)	2.791	14 (64%)	13 (93%)	3 (100%)	5.090	11 (85%)	11 (69%)	8 (80%)	1.089
	T≧65	3 (14%)	6 (38%)	2 (33%)		8 (36%)	1 (7%)	0 (0%)		2 (15%)	5 (31%)	2 (20%)	
7(Psychasthenia)	T<65	16 (73%)	12 (75%)	4 (67%)	.153	16 (70%)	12 (86%)	3 (100%)	2.243	9 (69%)	12 (71%)	10 (100%)	3.879
	T≧65	6 (27%)	4 (25%)	2 (33%)		7 (30%)	2 (14%)	0 (0%)		4 (31%)	5 (29%)	0 (0%)	
8(Schizophrenia)	T<65	17 (77%)	10 (62%)	4 (67%)	1.019	15 (65%)	12 (86%)	3 (100%)	3.031	10 (77%)	11 (65%)	9 (90%)	2.186
	T≧65	5 (23%)	6 (38%)	2 (33%)		8 (35%)	2 (14%)	0 (0%)		3 (23%)	6 (35%)	1 (10%)	
9(Hypomania)	T<65	22 (100%)	10 (62%)	5 (83%)	9.740	20 (87%)	11 (79%)	3 (100%)	1.052	13 (100%)	13 (77%)	8 (80%)	3.460
	T≧65	0 (0%)	6 (38%)	1 (17%)		3 (13%)	3 (21%)	0 (0%)		0 (0%)	4 (23%)	2 (20%)	

Appendix 15 (continued)

		Childhood Full IQ level				Childhood Verbal IQ level				Childhood Performance IQ level			
		Below average (n=22) n (%)	Average (n=16) n (%)	Above average (n=6) n (%)	X^2	Below average (n=23) n (%)	Average (n=14) n (%)	Above average (n=3) n (%)	X^2	Below average (n=13) n (%)	Average (n=17) n (%)	Above average (n=10) n (%)	X^2
0(Social Introversion)	T<65	20 (91%)	12 (80%)	4 (67%)	2.267	19 (83%)	13 (93%)	3 (100%)	1.299	11 (85%)	15 (88%)	9 (90%)	.164
	T≧65	2 (9%)	3 (29%)	2 (33%)		4 (17%)	1 (7%)	0 (0%)		2 (15%)	2 (12%)	1 (10%)	
Content Scales													
Anxiety	T<65	14 (64%)	10 (62%)	4 (67%)	.033	19 (83%)	9 (64%)	3 (100%)	1.791	7 (54%)	11 (65%)	8 (80%)	1.701
	T≧65	8 (36%)	6 (38%)	2 (33%)		4 (17%)	5 (36%)	0 (0%)		6 (46%)	6 (35%)	2 (20%)	
Obsessiveness	T<65	17 (77%)	10 (62%)	4 (67%)	1.019	16 (70%)	10 (72%)	3 (100%)	1.245	9 (69%)	12 (71%)	8 (80%)	.383
	T≧65	5 (23%)	6 (38%)	2 (33%)		7 (30%)	4 (29%)	0 (0%)		4 (31%)	5 (29%)	2 (20%)	
Depression	T<65	16 (73%)	11 (69%)	4 (67%)	.118	17 (74%)	11 (79%)	3 (100%)	1.050	9 (69%)	13 (77%)	9 (90%)	1.416
	T≧65	6 (27%)	5 (31%)	2 (33%)		6 (26%)	3 (21%)	0 (0%)		4 (31%)	4 (23%)	1 (10%)	
Bizarre Mentation	T<65	18 (82%)	12 (75%)	5 (83%)	.326	18 (78%)	12 (86%)	3 (100%)	1.023	9 (69%)	14 (82%)	10 (100%)	3.707
	T≧65	4 (18%)	4 (25%)	1 (17%)		5 (22%)	2 (14%)	0 (0%)		4 (31%)	3 (18%)	0 (0%)	
Anger	T<65	19 (86%)	11 (69%)	5 (83%)	1.828	20 (87%)	9 (64%)	3 (100%)	3.606	10 (77%)	15 (88%)	7 (70%)	1.423
	T≧65	3 (14%)	5 (31%)	1 (17%)		3 (13%)	5 (36%)	0 (0%)		3 (23%)	2 (12%)	3 (30%)	

Appendix 15 (continued)

		Childhood Full IQ level				Childhood Verbal IQ level				Childhood Performance IQ level			
		Below average (n=22) n (%)	Average (n=16) n (%)	Above average (n=6) N (%)	X^2	Below average (n=23) n (%)	Average (n=14) n (%)	Above average (n=3) n (%)	X^2	Below average (n=13) n (%)	Average (n=17) n (%)	Above average (n=10) n (%)	X^2
Low Self-Esteem	T<65	19	11	3	3.848	18	12	3	1.023	11	14	8	.084
		(86%)	(69%)	(50%)		(78%)	(86%)	(100%)		(85%)	(82%)	(80%)	
	T≧65	3	5	3		5	2	0		2	3	2	
		(14%)	(31%)	(50%)		(22%)	(14%)	(0%)		(15%)	(18%)	(20%)	
Social Discomfort	T<65	19	13	4	1.235	19	13	2	1.572	11	14	9	.291
		(86%)	(%)	(67%)		(83%)	(93%)	(67%)		(85%)	(82%)	(90%)	
	T≧65	3	3	2		4	1	1		2	3	1	
		(14%)	(%)	(33%)		(17%)	(7%)	(33%)		(15%)	(18%)	(10%)	
Work Interference	T<65	16	11	4	.118	15	12	3	3.031	8	13	9	2.476
		(73%)	(69%)	(67%)		(65%)	(86%)	(100%)		(62%)	(77%)	(90%)	
	T≧65	6	5	2		8	2	0		5	4	1	
		(27%)	(31%)	(33%)		(35%)	(14%)	(0%)		(38%)	(23%)	(10%)	

Appendix 16 : Relationship between MMPI Scales and Education and Occupation

Number of significantly elevated MMPI scales and educational levels

		n	M	SD	*F* value
Education	Secondary	26	4.04	5.37	1.47
	Post-secondary vocational	26	5.54	5.72	
	Post-secondary academic	9	2.22	1.86	

Number of significantly elevated MMPI scales and occupation

		n	M	SD	*F* value
Occupation	Skilled work	14	5.00	6.08	.52
	Unskilled work	18	3.61	4.79	

Appendix 17 : Relationship between OCI-R and Diagnosis and IQ

OCI-R scores across 2 or 3 diagnostic groups

		n	M	SD	*F* value
Diagnosis	No disorder	21	14.8	9.5	*.16*
	Atypical autism	25	16.9	15.1	
	Autism	18	15.7	12.5	
Diagnosis	No Diagnosis	21	14.8	9.5	*.22*
	Autism Spectrum Disorder	43	16.4	13.9	

OCI-R status of 2 or 3 diagnostic groups

			OCIR		
			Non-clinical	Clinical	χ^2
Diagnosis	No disorder	n(%)	16 (34.8%)	5 (27.8%)	*1.27*
	Atypical autism	n(%)	16 (34.8%)	9 (50.0%)	
	Autism	n(%)	14 (30.4%)	4 (22.2%)	
Diagnosis	No diagnosis	n(%)	16 (76.2%)	5 (27.8%)	*.28*
	Autism spectrum disorder	n(%)	5 (23.8%)	13 (72.2%)	

Pearson correlation between OCI-R scores and IQs

		FIQ	VIQ	PIQ	FIQ (childhood)	VIQ (childhood)	PIQ (childhood)
OCIR Total scores	Pearson Correlation	.02	.12	-.11	.02	.11	-.07
	Sig. (2-tailed)	.85	.31	.39	.88	.48	.66
	N	64	64	64	45	39	39

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