Long-Term Functional Outcomes in Israeli Adults Diagnosed in Childhood with Attention Deficit Hyperactivity Disorder

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ABSTRACT: **Background:** Childhood attention deficit hyperactivity disorder (ADHD) is a chronic health problem with significant risk for long-term morbidity in adulthood.

Objectives: We examined long-term outcomes of ADHD in a population-based sample of childhood ADHD cases prospectively assessed as adults.

Methods: Long-term outcomes for 70 adults who were diagnosed with ADHD during childhood were examined and compared with data on the general population.

Results: Most subjects admitted to persistence of ADHD-related symptoms in adulthood, despite discontinuation of regular medical treatment and follow-up. Areas most severely affected by past and ongoing symptoms included driving performance and incidence of motor vehicle accidents, and rates of marriage stability over time. Relatively unaffected were occupational and academic achievements and military service.

Conclusions: There is a need for outreach and better services for adults who were previously diagnosed with ADHD. This condition remains a marker of a certain degree of risk regarding marital stability, interpersonal relations and driving habits.

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KEY WORDS: attention deficit hyperactivity disorder (ADHD), adult outcome, marital stability, driving performance, choice of profession

Attention deficit hyperactivity disorder (ADHD) is the most prevalent childhood neurodevelopmental disorder with a prevalence of 5%–8% [1,2]. Once considered a functional impairment of childhood, ADHD is now widely considered to have long-range implications for affected individuals, covering their entire life span [3-5]. Between 40% and 80% of affected individuals in childhood exhibit symptoms during adolescence [6], of whom 49–66% continue to exhibit symptoms into adulthood [7]. Estimates place 4–4.4% of the American adult population as suffering from ADHD [6].

To date there have been relatively few surveys of the long-term implications for functional status among Israeli adults who had previously been diagnosed with ADHD in childhood [8]. The aim of the present study was to clarify the status of these adults by means of a structured survey. Included in the study were adults who had been diagnosed as children at the neurodevelopmental clinic of a tertiary referral medical center in the central region of the country. Examined were the subjects' educational level, employment status, army service, marital status, and driving record including involvement in motor vehicle accidents. Included also was the subjects' perception of the effectiveness of the therapy they received for ADHD.

SUBJECTS AND METHODS

A telephone survey was conducted for adults over the age of 21 who had been diagnosed as having ADHD during childhood, approximately 15–30 years earlier. As children they were evaluated and followed for a variety of presenting complaints in the aforementioned clinic. In the subjects chosen for follow-up ADHD was the primary diagnosis; they did not have additional complicating neurological or psychiatric diagnoses other than learning disorders or behavioral dysfunction that may have complicated their developmental course. The questionnaire was composed of questions designed to elicit data in the areas of family and medical background, prior treatment, as well as ongoing adaptive functional status. The data accumulated were compared with general population statistics.

The survey encompassed the following: demographic data, medical diagnosis and treatment of ADHD, education, military or alternative public service, employment, driving record and marital status. Past complete medical files of 644 patients were retrieved from the medical records of the hospital and patients were included on a non-selective basis. During the years 1983–1998, a total of 1000 children had been diagnosed

as having ADHD. Of those, current working phone numbers for 388 patients could be located, from which 101 actual patients were identified. This study design was reviewed and approved by the Medical Ethics Board of our Medical Center.

Thirty-one subjects refused to participate, leaving a total of 70 (69.3%) who were willing to answer the questions regarding past and current medical and functional status: 68 answered questions by telephone and 2 by email (70 in total).

RESULTS

Current demographic factors and symptoms are shown in Table 1. Of the respondents questioned, 16 (23%) were female and 54 (77%) male. Age ranged between 24 and 40 years (31.4 ± 3 2 years mean ± SD); 41 were single (59%), 24 were married (34%) and 5 (7%) were divorced.

CURRENT SYMPTOMS

None of the respondents reported treatment with medication for ADHD after the age of 18. Forty-six respondents (66%) indicated ongoing difficulties due to at least one item on the ADHD-related symptom checklist. The most common symptoms reported were: concentration difficulties in learning or reading (n=30, 43%), hyperactivity (n=22, 31%), impulsivity (n=21, 30%), and difficulty completing tasks (n=18, 26%) [Table 1]. Two respondents reported, on their own initiative, symptoms that did not appear in our list. One mentioned a symptom of "being disconnected" (probably meaning short intervals of lack of concentration with loss of awareness of what was happening in the vicinity, without evidence of seizure disorder). The other reported difficulty concentrating at work.

Twenty-four subjects (34%) reported having no symptoms at all, whereas 46 (66%) reported having at least one symptom: 22 (31.4%) reported having one symptom, 10 (14.2%) two symptoms, 7 (10%) three symptoms, and 7 (10%) having all four symptoms listed [Table 1].

EDUCATION

The length of schooling ranged between 8 and 22 years. Six subjects (9%) completed 8–11 years, 28 (40%) completed exactly 12 years, 12 (17%) had 13–14 years of education, 14 (20%) completed 15–16 years, and 10 (14%) had more than 16 years education. Thirty (43%) attained their high school diploma, 14 (20%) completed only part of their matriculation requirements, and 26 (37%) never even began the testing process in fulfillment of their graduation requirements. The percentage receiving a high school diploma (43%) is similar to the rate for the general population in Israel: 44.4% in 2008 and 45.3% in 2001 [9,10].

Sixteen (23%) continued on to post-secondary college or university studies, and 17 (24%) to technical or non-academic professional studies, 8 (11%) completed both academic and non-academic technical studies, and 29 (42%) had neither academic nor technical training. Fifteen percent of those who began post-secondary studies did not complete their degree or course of study. Eleven (16%) achieved a B.A. degree, 3 (4%) an M.A., and one (1.5%) a Ph.D. degree. Two of those with an M.A. degree are currently doctoral students and the third has two M.A. degrees. A total of 15 (22%) have an academic degree. An additional 6 (9%) are currently studying for their B.A. degree. Another 6 (9%) have a pre-engineering or technical certificate, and 3 (4%) have a full engineering diploma.

The fields of study for those pursuing higher education included economics, law, computer science, engineering, chemistry, education, special education, criminology, psychology, government and society, history and international relations, philosophy, accounting, business administration, literature, communications, geography, and electronics.

Table 1. Long-term outcomes for children with attention deficit hyperactivity disorder/attention deficit disorder (ADHD/ADD)

		No. (%)
Demographic characteristics	No. of completed questionnaires	70 (100)
	Gender Male Female	 54 (77) 16 (23)
	Familial status Married Single Divorced Widowed	 24 (34) 41 (59) 5 (7) No reports
	Mean number of offspring For those 29 respondents who were married	 1.4
Current symptoms	No. of respondents	70 (100)
	At least one symptom	46 (66)
	Difficulties concentrating during learning or reading	30 (43)
	Hyperactivity	22 (31)
	Impulsivity	21 (30)
	Difficulties completing tasks	18 (26)
No. of symptoms per person	No symptoms at all	24 (34)
	At least one symptom	46 (66)
	One symptom	22 (31.4)
	Two symptoms	10 (14.2)
	Three symptoms	7 (10)
	All four symptoms	7 (10)

MILITARY SERVICE

Military service in Israel is compulsory at age 18 for both genders. Forty-five subjects (64%) completed their entire military service, 5 (7%) served partially and 20 (29%) were exempt [Table 2].

Table 2. Military service

	Type	No. (%)
Length of service	Full service Partial service Exemption	45 (64) 5 (7) 20 (29)
Males	Full service Partial service Exemption	40 (74) 5 (9) 9 (17)
Females	Full service Partial service Exemption	5 (31) 0 11 (69)
Army rank	Private Corporal Sergeant Staff sergeant Sergeant major	3 (6) 5 (10) 15 (30) 26 (52) 1 (2)
Military role*	Combatant Professional role Clerk/Secretary Command role Driver Cook Technical jobs: mechanic, vehicle electrician, aircraft technician, night vision systems technician Guards Disciplinary personnel: police officer, non-commissioned disciplinary officer Supplier or storekeeper	13 (26) 12 (24) 6 (12) 5 (10) 4 (8) 4 (8) 4 (8) 4 (8) 3 (6) 2 (4)

*The percentages are over 100% because some respondents changed roles during their service and performed two or more different roles, and some served as both combatant and commanding officer

PROFESSIONAL EXPERIENCE

The respondents were asked about their current and previous occupations. Forty-two (60%) reported previous occupations (some of them temporary jobs after the army or during studies); 28 (40%) reported no previous work experience before their current employment, some even holding two jobs concurrently. Occupations chosen by our cohort are listed in Table 3.

DRIVING RECORDS

Forty-nine examinees (70%) had a driver's license. Only 38% of females held a driver's license, compared to 80% of the males [Table 4]. In 2008, the national percentage of adults (aged 25–44 years) with a driver's license was 79–80% [11].

ACCIDENTS AND OFFENSES

The majority of respondents reported no history of traffic offenses, or a small number (2–3) of past traffic violations [Table 4]. Of those who held a license, 21 (43%) were involved in at least one accident as drivers [Table 4].

DISCUSSON

Only 23% of the participants were female, as compared with 40% in reported adult cohorts with ADHD [12]. This study appeared to underreport the female prevalence of ADHD since it relied on a cohort culled from what was originally a pediatric age group sample, where females are normally less prevalent than males due to relatively fewer externalizing behaviors in childhood [13]. Fewer girls than boys are referred for ADHD treatment, but they have a similar pattern of impairment and receive similar treatment [14].

Table 3. Chosen occupations

	No. of respondents	%
Business, management	11	16
Computers	11	16
Technical, mechanical	9	13
Sales	8	11
Store management, supermarket shelf stacking	8	11
Unemployed	7	10
Renovations, building	6	9
Child care	5	7
Teacher, educational worker	5	7
Student	4	6
Driver	4	6
Clerk, secretary, shop salesperson, security guard, cook, engineer, lawyer, accountant	3	4
Alternative medicine therapist, homemaker, waiter, busboy, gardener, farmer	2	3
Cosmetician	1	1
Miscellaneous	16	23

Table 4. Driving licenses and driving performance

	No. (%)
Holding a driving license	49 (70%)
Not holding a driving license	21 (30%)
Males with license	80%
Females with license	38%
Age at receipt of license Range (years) Average	 17–30 18.9
No. of practical driving tests Range Average Three tests or less Four tests and more	 1–10 3 35 (71%) 14 (29%)
No. of theoretical practical driving tests Range Average Three tests or less Four tests or more Had no recall	 1–20 2.1 43 (88%) 5 (10%) 1 (2%)
Traffic legal proceeding Involved in traffic trial for traffic offenses Involved once Involved twice	 16 (33%) 14 2

The ratio of boys to girls in the pediatric age can reach up to 10:1, decreasing to 1.5:1 in adulthood at which time patients seek diagnosis and treatment at their own initiative and are not referred by parents or teachers due to maladaptive behaviors [13].

In the total study population 59% were single and 41% were married (with 7% of the total eventually divorcing). The percentage of single adults in this group is higher than in the general peer population. However, this was a relatively young cohort, ranging between 24 and 40 years of age (mean 32 years). Nevertheless, compared with statistics for a comparable non-selected age group, relatively fewer of those with diagnosed ADHD in childhood were married. Divorce rates for this particular cohort were higher than in the comparable age group in the general population (17% vs. 11.6%). According to the 2009 Israel Central Bureau of Statistics (CBS) data [15], among Jewish couples who married in Israel during the years 1998–2000, the cumulative divorce rate in the first 7 years was 11.6%. Furthermore, there was no control group in our study. In view of the fact that the CBS does not publish information on the percentage of married and single males and females according to age groups in the general population, we were unable to compare the unmarried rate of our study population to that of the general population.

Sixty-six percent of our respondents continued to suffer from at least one ADHD symptom in adulthood. This percentage is similar to comparable figures in the literature (49–66%) [16]. Such symptoms included concentration difficulties in learning or reading (n=30, 43%), hyperactivity (n=22, 31%), impulsivity (n=21, 30%), and difficulty completing tasks (n=18, 26%).

None of the respondents reported receiving medical treatment for ADHD since discontinuation of their follow-up in the pediatric hospital clinic. The reasons given were varied and may stem from: (i) lack of perceived need (symptoms having supposedly passed, symptoms had been moderated, or the patient had learned to adapt to the symptoms, (ii) lack of awareness of the existence of hospital and community-based clinics specifically designed to treat ADHD in adulthood, or (iii) resistance to medical treatment due to social stigma and fear of side effects. Preoccupation with daily life may have provided a distraction from pondering about their symptoms. Furthermore, our respondents may have believed that their symptoms could not be alleviated.

The number of years of schooling varied extensively: 43% had a full high school diploma after finishing the minimal format of matriculation exams, favorably comparable with the percentage in the general population in Israel; 21.5% attained an academic diploma: 16% a B.A., 4% an M.A., and 1.5% a Ph.D. degree, also favorably comparable with general population data.

Altogether, 83% of males and 31% of the females served in the army, a percentage similar to that in the general population; and 74% of the males who were drafted completed their full military service, which is the same percentage as the general population [17]. According to surveys conducted by the Israeli CBS between 2002 and 2005, 57% of the total Jewish population served in the army annually. The recruitment rate is 76% for males and 39% for females.

The professions chosen by our cohort are numerous and diverse, and include professions that require a high degree of concentration such as university professorships, system analysts, archaeologists, chemical engineers, financial coordinators, entertainment and event organizers, and sports instructors for rappelling (where lack of concentration could have fatal consequences). Despite the diversity in occupations, we observed several trends: 16% of the respondents are working or worked in a profession that involves management or business. It is quite possible that these fields are suitable and attractive to people with ADHD as they require a certain level of vigilance, speed and the ability to make quick decisions and take calculated risks, flexibility in transitioning from one task to the next and dividing attention between tasks simultaneously. Similarly, 11% were working in sales, which is also an occupation that requires a high level of energy, articulateness, personal charm (that children with ADHD may have developed as a compensatory mechanism for educational failures and their tendency to get into trouble), and does not require formal learning and academic degree. Sixteen percent worked at some point in their lives with computers. It is possible that this area also attracts people with ADHD due to the required creativity, flexibility and speed. Also essential are a high level of interest and personal motivation to learn, often outside of the formal classroom setting; 13% worked in a technical profession (blue collar workers) such as mechanics, plumbers and electricians which was apparently due to difficulty in completing formal academic tasks in school. Technical professions do not require a formal high school diploma for acceptance into vocational training or certification by the respective regulatory agencies and workers' unions. It is interesting that many of the aforementioned jobs were temporary areas of employment, as is common in the job market, especially with young people transitioning between different career and life stages. Ten percent of the participants were unemployed at the time they completed the questionnaire (95% confidence interval 3–17%), which is similar to the percentage in the general population (7.6% at the time the telephone survey was conducted) [18]. Four respondents (6%), perhaps due to having ADHD, were drawn to occupations related to treating ADHD itself: one in remedial diagnostics, one in special education, and two (3%) in alternative medicine. Two respondents (3%) worked as inventors (car alarm development, research and development of catheters) – a profession that requires immense creativity and unconventional "out of the box" thinking.

Seventy percent of the study population (38% females and 80% males) have a current driving license, a rate similar to that in the general population. According to CBS data, as

of 2007, 75% of the population aged 25–54 had a driving license. Twelve percent of the drivers had 10 or more traffic offenses, and 33% were summoned to appear in traffic court for a traffic offense; 43% of the drivers have been involved in at least one car accident as drivers, a rate significantly above the general population average. Winston et al. [19] and Narad et al. [20] showed that individuals with ADHD are at increased risk for negative driving outcomes. Narad et al. further observed that texting significantly impairs driving performance and highlighted the need for education and enforcement of regulations against texting while driving [20]. The study by Vaa [21] provides some support for the hypothesis that the relative accident risk of ADHD drivers with comorbid Oppositional Defiant Disorder, and/or Conduct Disorder and/or other conduct problems, is higher than that of ADHD drivers without these comorbidities.

LIMITATIONS

The sample size was relatively small, no enquiries were made regarding comorbidity, and there was no control group from the general population, making it difficult to compare the results to those of the general population. Despite these limitations, several important generalizations can be made within the context of the studied cohort.

- ADHD may persist into adulthood despite the fact the subjects were not in regular follow-up or on medication, even among relatively "successful" patients
- Regular medical follow-up and treatment was not conducted for previously treated children with ADHD
- Statistics on integration into the work place, academic status, social adjustment, military service and driving records resemble data for the general population
- Top level functioning in the military is influenced by ADHD functional status (note the absence of high ranking officers in this cohort)
- Driving records were sub-average compared to the general population
- Marriage and divorce rates were abnormally high in this cohort compared to general population figures.

CONCLUSIONS

There is a need for outreach and better services for adults who were previously diagnosed with ADHD. Attention deficit hyperactivity disorder remains a marker for a certain degree of risk for personal, academic, work-related and military service achievement.

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