

Cost Effectiveness of ADHD Treatment from Childhood to Adulthood

Asher Ornoy^{1*} and Avia Spivak²

¹Department of Medical Neurobiology, Hebrew University Hadassah Medical School, Israel

²Department of Economics, Ben Gurion University, Israel

ARTICLE INFO

Received Date: December 27, 2018

Accepted Date: January 07, 2019

Published Date: January 11, 2019

KEYWORDS

ADHD
Childhood
Adulthood
Cost

Copyright: © 2019 Ornoy Asher et al., Neurological Disorders & Epilepsy Journal. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation for this article: Asher Ornoy and Avia Spivak. Cost Effectiveness of ADHD Treatment from Childhood to Adulthood. Neurological Disorders & Epilepsy Journal. 2019; 2(1):119

Corresponding author:

Asher Ornoy,
Department of Medical Neurobiology,
Hebrew University Hadassah Medical
School, Israel,
Email: ornoy@cc.huji.ac.il

ABSTRACT

There are well known behavioral complications of ADHD at childhood adolescence and adulthood, among them are: learning difficulties resulting in lower education attainments, increased rate of car and other accidents, increased prevalence of substance abuse, misconduct and imprisonment. These complications can be prevented or alleviated by early diagnosis of ADHD and effective treatment. In this mini-review we describe some of the literature regarding the complications of ADHD at adulthood and summarized some data on the cost of treatment and the cost of the different complications in several countries, among them Germany, the Netherlands, Israel, the US and Europe. The cost of treating ADHD for every economy is substantially high, but the cost due to loss of income resulting from lower education attainments and those imposed by the different complications is even higher. Since early diagnosis and appropriate treatment of ADHD is very effective in reducing the different symptoms and complications at adulthood, enabling a better education and income and diminishing the different complications at adulthood, it seems important to diagnose and offer comprehensive treatment to children with ADHD and continue this treatment through adulthood.

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a neurobehavioral disorder defined by the Diagnostic Statistical Manual 5 (DSM 5) as a "persistent disorder of inattention and/or hyperactivity –impulsivity that interferes with functioning or development" [1]. At childhood, ADHD seems to be more prevalent in males, but seemingly not at adulthood [2-4]. Diagnosis is usually made at school age; in the more severe cases symptoms may be recognized earlier [5] and in less severe, especially in children with inattention, later [1]. The prevalence of ADHD varies among populations ranging between 3-12% [2,3]. In Israel, for example, it seems to occur in 9.5% among Jewish school age children and only 7.35% among Arab school age children [6].

The diagnosis of ADHD is based on typical behavioral problems demonstrating inattention and/or, impulsivity and/or, hyperactivity and often a variety of additional behavioral and psychiatric problems [7]. Different questionnaires have been developed for the screening and diagnosis of ADHD that can be used by teachers, parents and professional for diagnostic purposes [5,7]. As the behavioral deviations must be present in at least two settings (i.e.in children at school and at home, in adults at home and at work), behavior should be recorded in at least two settings. Thus, for example, if we use The Conner's or DSM 5 questionnaires, they should be filled out by

the teacher and the parents [7]. If screening is carried out by the teacher at school, the parents should fill out the questionnaires too.

ADHD is basically a neurobehavioral disorder of childhood. However, in about half of the cases it extends into adulthood [3,8]. People with ADHD have a variety of psychiatric and other comorbidities, amongst them are learning difficulties, oppositional defiant disorder, conduct disorder, anxiety and depression [1,3,5]. There is also an increased tendency for substance abuse (alcohol, heavy smoking and illicit drugs), more involvement in car and other accidents as well in crimes and law violation. Generally, the rate of these misbehaviors among adults with ADHD is about 3 times higher than in people without ADHD [9-14]. The more severe cases exhibit more of these complications, especially if untreated.

The severity of ADHD and the presence of psychiatric comorbidities, especially obsessive-compulsive disorder and conduct disorder, are also important predictors for ADHD persistence into adulthood. The male to female ratio of adults with ADHD is reduced, almost approaching one [8].

Generally, early diagnosis and treatment may improve the different long-term complications of ADHD, especially if treatment continues into adulthood.

COMPLICATIONS OF ADHD DURING ADOLESCENCE AND ADULTHOOD AND THEIR POSSIBLE ALLEVIATION

Criminal acts

Many studies have shown a high tendency to disobey rules, perform crimes and get arrested with the rate of criminal acts and imprisonment being about 3 times higher compared to adults without ADHD [14-17]. Moreover, the studies examining the rate of ADHD among males and females in prison found that almost 50% of males and 30% of females have ADHD and more than half of those with ADHD also have learning difficulties [18-20]. Although There seem to be no studies proving the benefit of early treatment of ADHD on the reduction of the rate of criminal acts, most studies have shown that early diagnosis and treatment of ADHD improves behavioral problems and antisocial behavior [17,21,22]. Improvement of antisocial behavior will certainly reduce the rate of law disobeying [21,22].

Substance use and abuse

Lee et al. found [23] that children with ADHD have at adulthood a 2-3-fold higher risk for nicotine, marijuana and cocaine abuse and a general odds ratio for illicit drugs dependence (substance use disorder) of 2.64 compared to non-ADHD. Among adults with substance abuse, the rate of ADHD was found to be 15.2%, over 3 times the rate found in adults without substance abuse. Other studies reached similar conclusions [24,25]. Lugoboni et al., [26] found among 1057 heroin dependent persons that 19.4% of these patients screened positive for ADHD. This is 3-4 times higher than the rate in non-addicted adults. Mannuzza et al., [27] found that early age of initiation of treatment alleviates (prevents) subsequent substance abuse. Similar conclusions were reached by other investigators. Moreover, in persons with substance abuse who also have ADHD, there is poor treatment adherence unless ADHD is treated as well [26].

Involvement in car accidents

More car accidents in persons with ADHD probably stem from reduced attention and the tendency not to follow rules. Several investigators have shown, using the Driving Behavior Questionnaire, that those with ADHD performed more violations of road rules and more car accidents [11]. Barkley et al. found [28,29] that 40% of adolescents with ADHD have at least 2 accidents by the age of 30, as opposed to only 6% in controls and the severity of accidents is higher. Similarly, increased rate of road accidents were described by other investigators [30,31]. Pharmacological treatment was found to significantly decrease the rate of such accidents [9,32-34].

Learning difficulties

Learning difficulties and ADHD are interconnected as about 50% of children with ADHD, especially those with inattention, have learning disabilities and about half of the children with learning difficulties have ADHD [35,36]. Although children with ADHD have normal intelligence, their scores are lower with 10-15 points compared to their peers. Moreover, children with ADHD scored lower on achievement tests even when controlling for IQ [37,38]. Children with ADHD are at high risk for school dropout. For example, Barbaresi et al., [39] found that the likelihood of ADHD children to drop out from high school is 2.7 times higher than in children without ADHD. At adulthood, a lower proportion of Persons with ADHD will graduate from Universities. Mannuzza et al., [27] found that only 9% of people

with ADHD have a Bachelor's degree as opposed to 34% in the controls and only 1% had Master's degree compared to 6% in people without ADHD. Similar findings were reported in a survey by Biederman and Faraone [2]. Low education in adults has a very significant impact, significantly reducing their average income. This is in addition to poorer social adaptation. Optimal treatment of ADHD children often alleviates the learning difficulties, mainly due to improved attention and short-term memory [40,41]. Ornoy et al., [42] found that the most effective treatment for improving learning abilities is a combination of stimulants and use of corrective educational methods. Similar improvement in learning abilities by pharmacological treatment was also demonstrated by other investigators. Improved educational achievements also have benefits in reducing crime rate and in decreasing accidents and drug dependence. Hence, early diagnosis and effective treatment increases these educational achievements by about 50%.

COST OF ADHD AND COST EFFECTIVENESS

In order to persuade health authorities and governments of the importance of early diagnosis and long-term treatment of ADHD, it is essential to examine the cost effectiveness of such a policy. If the economic benefit is high, the chances for implementation of such a policy are also high.

There are several studies calculating the cost or cost effectiveness of ADHD treatment. Many published studies calculated the cost of treating ADHD, including the cost of diagnosis, of pharmacological treatment as well as the cost of the increased use of medical services due to different medical complications (i.e. increased proneness to trauma and abuse). Fewer studies calculated the extra cost of reduced education and more involvement in car and other accidents or crime [43].

Cost and cost effectiveness in Israel

We recently calculated the cost of optimal treatment of a person with ADHD from childhood to the age of 65 years, the age of retirement, presuming 55 years of treatment and 40 years of income from productive work. This was done in order to calculate economic benefits of early diagnosis at childhood and effective treatment throughout life. Based on the studies mentioned above, we estimated that the success of comprehensive treatment is about 50%. Hence, a benefit of treatment of only 50% was used for all our calculations. Our

calculations of economic gain from treatment were assigned individually, and should be multiplied by the presumed number of adults with ADHD to calculate the economic gain for the country's economy. We can assume, based on the prevalence of ADHD in school age children, that 3%-4% of adults in Israel (and elsewhere) have ADHD.

We used in our calculations the data on the different comorbidities, as described above, assuming that their rate in the Israeli population of children and adults with ADHD are similar to those described in the literature. Quantitative evaluation of the cost effectiveness was carried out using the method of Cost-Benefit analysis described by Mishan [44]. Costs and benefits were calculated in terms of US Dollars (USD). When the outcome has probability smaller than one, the procedure was to multiply by it, i.e. taking the expected value of the cost and the benefit. The costs and benefits are those incurred by society as a whole, including the ADHD patients as well as others.

As expected, the cost of lower educational achievements was the major cost in our calculations. Based on the success of Israeli high school and University education on the one hand and the reduced educational achievement of adults with ADHD on the other hand, we found that the average annual income loss due to reduced education of a person with ADHD is about 3,700 USD and for 40 years it is about 148,000 USD. Similarly, the annual extra loss from the increased involvement in car accidents is about 3,000 USD and for 40 years it is about 120,000 USD. The extra annual cost for higher involvement in crimes is about 350 USD and for 40 years it is: 14,000 USD. The extra cost for drug abuse over 40 years is 3,500 USD. Hence, the total loss per person with ADHD is about 285,500 USD.

In addition, the total cost for early diagnosis and optimal treatment of ADHD for 55 years (Medications plus educational and psychosocial support) is about 41,000 USD. Thus, the cost effectiveness calculated by dividing the total extra cost of 285,500 to 41,000 is 7.0 and, assuming a 50% success rate of treatment, it is 3.5. It follows that screening, early diagnosis and treatment of ADHD from our data is highly cost effective.

It is important to add that in these calculations we did not take into account the enormous social impact of untreated ADHD on

the individual family and society, which has significant additional disadvantages and costs.

Cost and cost effectiveness of treating ADHD in other countries

Several investigators have calculated the loss in income of an untreated person with ADHD by summarizing the relevant studies published in the US and in Europe.

Schlander et al., [45] evaluated the cost of medical care (health care utilization) of children and adolescents in the region of Nordbaden, Germany in 2003. He estimated that the cost on medical care of a person with ADHD is more than 2.5 times higher than the cost of a person without ADHD. He evaluated the direct cost to be in 2003 about 260 million Euro. This is in addition to a relatively high indirect cost. The same investigators then estimated [46] that the long-term treatment with long-acting stimulants is highly cost-effective.

The cost of treatment of children and adolescents with ADHD for the year 2005 in the US was calculated by Pelham et al., [47] from 13 published studies. They found that the health care cost was 14,576 USD/individual and for the US it was 42.5 billion USD. They did not calculate the cost of increased crime, substance abuse or involvement in car and other accidents, or the loss of income because of lower education.

Doshi et al., [48] summarized the data of the annual cost in the US among adults with ADHD from 19 studies published between 1990-2011, and found that the excess annual cost on children and adults with ADHD in the US (excessive expenses on medical care and loss of productivity) was 143 to 266 Billion USD. About two thirds of the cost was on adults with ADHD, especially due to loss of productivity. Indeed, the productivity and income loss in the adults with ADHD was 87-138 Billion USD annually.

Birnbaum et al., [49] calculated for the year 2000 the excess cost in the US of ADHD treatment for persons aged 7-44 years, compared to non – ADHD people, considering direct health care cost (medical care and cost of prescription drugs) as well as work loss cost imposed on the family. They calculated that the excess cost was 31.6 Billion USD. Of this, the cost of the ADHD pharmacological treatment was relatively small, only 1.6 billion USD, and 12.1 billion USD was for all other medical care. The loss of income due to lower education was not calculated.

Le et al., [50] estimated the productivity losses of adults with ADHD in Europe and in the Netherlands from studies published between the years 1990-2013. They found that the annual cost for an individual with ADHD ranged from 9,860 Euro to 14,483 Euro. In the Netherlands, the annual cost was 1.4-1.53 Billion Euro; about half of it was on education. They also found that productivity loss in adults with ADHD in Europe was 143-339 Billion Euros. All authors summarized their findings stating that ADHD, if untreated, is a significant economic burden upon any economy.

It is obvious from the data presented that the highest contribution to the cost is the lower income and loss of productivity that stems from the fact that people with ADHD have a lower education.

We have to presume that good medical, educational and psychosocial supportive treatment, especially during childhood, can significantly improve school performance of the ADHD children, thus increasing their future level of education and income [51].

CONCLUSION

There are many serious complications of ADHD influencing daily life of the affected person and its family. Hence, the cost of ADHD for the economy is not only due to treatment but mainly resulting from lower educational achievements, higher involvement in crime, car accidents and substance abuse. Early diagnosis and successful, long-term, treatment reduces the extent of these complications resulting in a high benefit cost ratio. Hence, routine screening at school, early diagnosis and treatment are of prime importance. This can easily be done by the use of DSM 5 questionnaire or by other screening/diagnostic questionnaires filled out by the teachers, and if ADHD is suspected, also by the parents. This will enable the treating physicians to carry out proper diagnosis and offer appropriate long-term follow up and treatment. Treatment should be comprehensive including medication, parental guidance, psychosocial and psychotherapeutic support as well as remedial learning. It seems that such an approach is highly cost effective and, in addition, will improve the educational, social and behavioral achievements of persons with ADHD and may also have a preventative role in relation to different psychiatric complications such as conduct disorder or depression.

REFERENCES

1. American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). American Psychiatric Publishing Washington DC. 59-74.
2. Biederman J, Faraone SV. (2006). The effects of attention deficit/hyperactivity disorder on employment and household income. *MedGenMed.* 8: 12.
3. Thapar A, Cooper M. (2016). Attention deficit hyperactivity disorder. *The Lancet.* 387: 1240-1250.
4. Williamson D, Johnston C. (2015). Gender differences in adults with attention-deficit/hyperactivity disorder: a narrative review. *Clin Psychol Rev.* 40: 15-27.
5. Yochman A, Ornoy A, Parush S. (2006). Co-occurrence of developmental delay among preschool children with Attention Deficit-Hyperactivity Disorder. *Develop Med Child Neurol.* 48: 483-486.
6. Fogelman Y, Vinker S, Guy N, Kahan E. (2003). Prevalence of and change in the prescription of methylphenidate in Israel over a 2-year period. *CNS drugs.* 17: 915-919.
7. Ornoy A, Ovadia M, Rivkin D, Milstein E, Barlev L. (2016). Prevalence of ADHD among 7-9 years old children in Israel. A comparison between the Jewish and Arab populations. *Isr. J Psych.* 53: 3-8.
8. Fayyad J, De Graaf R, Kessler R, Alonso J, Angermeyer M, et al. (2007). Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *Br J Psychiatry.* 190: 402-409.
9. Cox DJ, Merkel RL, Penberthy JK, Kovatchev B, Hankin CS. (2004). Impact of methylphenidate delivery profiles on driving performance of adolescents with attention-deficit/hyperactivity disorder: a pilot study. *J Am Acad Child Adolesc Psychiatry.* 43: 269-275.
10. Dalsgaard S, Mortensen PB, Frydenberg M, Thomsen PH. (2013). Long-term criminal outcome of children with attention deficit hyperactivity disorder. *Criminal Behavior and Mental Health.* 23: 86-98.
11. Groom MJ, van Loon E, Daley D, Chapman P, Hollis C. (2015). Driving behavior in adults with attention deficit/hyperactivity disorder. *BMC Psychiatry.* 15: 175.
12. Retz W, Rösler M. (2009). The relation of ADHD and violent aggression: What can we learn from epidemiological and genetic studies? *Int J Law Psychiatry.* 32: 235-243.
13. Simon N, Rolland B, Karila L. (2015). Methylphenidate in adults with attention deficit hyperactivity disorder and substance use disorder. *Curr Pharm Des.* 21: 3359-3366.
14. Mannuzza S, Klein RG, Moulton JL 3rd. (2008). Lifetime criminality among boys with attention deficit hyperactivity disorder: a prospective follow-up study into adulthood using official arrest records. *Psychiatry Res.* 160: 237-246.
15. Rösler M, Retz W, Yaqoobi K, Burg E, Retz-Junginger P. (2009). Attention deficit/hyperactivity disorder in female offenders: prevalence, psychiatric comorbidity and psychosocial implications. *Send to Eur Arch Psychiatry Clin Neurosci.* 259: 98-105.
16. Rösler M, Retz W, Retz-Junginger P, Hengesch G, Schneider M, et al. (2004). Prevalence of attention deficit-/hyperactivity disorder (ADHD) and comorbid disorders in young male prison inmates. *Eur Arch Psychiatry Clin Neurosci.* 254: 365-371.
17. Koisaari T, Michelsson K, Holopainen JM, Maksimainen R, Päivänsalo J, et al. (2015). Traffic and Criminal Behavior of Adults with Attention Deficit-Hyperactivity with a Prospective Follow-Up from Birth to the Age of 40 Years. *Traffic Inj Prev.* 16: 824-830.
18. Einat T, Einat A. (2008). Learning disabilities and delinquency: a study of Israeli prison inmates. *Int J Offender Ther Comp Criminol.* 52: 416-434.
19. Einarsson E, Sigurdsson JF, Gudjonsson GH, Newton AK, Bragason OO. (2009). Screening for attention-deficit hyperactivity disorder and co-morbid mental disorders among prison inmates. *Nord J Psychiatry.* 63: 361-367.
20. Young S, Thome J. (2011). ADHD and offenders. *World J Biol Psychiatry. Suppl 1:* 124-128.
21. Harpin V, Mazzone L, Raynaud JP, Kahle J, Hodgkins P. (2016). Long-Term Outcomes of ADHD: A Systematic Review of Self-Esteem and Social Function. *J Atten Disord.* 20: 295-305.
22. Shaw M, Hodgkins P, Caci H, Young S, Kahle J, et al. (2012). A systematic review and analysis of long-term outcomes in attention- deficit /hyperactivity disorder: effects of treatment and non-treatment. *BMC Med.* 10: 99.

23. Lee SS, Humpreys KL, Flory K, Liu R, Glass K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: a meta-analytic review. *Clin Psychol Review*. 31: 328-341.
24. Dalsgaard S, Mortensen PB, Frydenberg, Thomsen PH. (2014). ADHD, stimulant treatment in childhood and subsequent substance abuse in adulthood- a naturalistic long-term follow-up study. *Addictive behavior*. 39: 325-328.
25. Willens TE, Adamson J, Monuteaux MC, Faraone SV, Schillinger M, et al. (2008). Effect of prior stimulant treatment for attention-deficit hyperactivity disorder on subsequent risk for cigarette smoking, alcohol and drug use disorder in adolescents. *Arch Ped Adolesc Med*. 162: 916-921.
26. Lugoboni F, Levin FR, Pieri MC, Manfredini M, Zamboni L, et al. (2017). Co-occurring Attention Deficit Hyperactivity Disorder symptoms in adults affected by heroin dependence: Patients characteristics and treatment needs. *Psychiatry Res*. 250: 210-216.
27. Mannuzza S, Klein RG, Bessler A, Malloy P, LaPadula M. (1993). Adult outcome of hyperactive boys. Educational achievement, occupational rank, and psychiatric status. *Arch Gen Psychiatry*. 50: 565-576.
28. Barkley RA, Murphy KR, Dupaul GI, Bush T. (2002). Driving in young adults with attention deficit hyperactivity disorder: knowledge, performance, adverse outcomes, and the role of executive functioning. *J Int Neuropsychol Soc*. 8: 655-672.
29. Barkley RA, Cox D. (2007). A review of driving risks and impairments associated with attention-deficit/hyperactivity disorder and the effects of stimulant medication on driving performance. *J Safety Res*. 38: 113-128.
30. El Farouki K, Lagarde E, Orriols L, Bouvard MP, Contrand B, et al. (2014). The increased risk of road crashes in attention deficit hyperactivity disorder (ADHD) adult drivers: driven by distraction? Results from a responsibility case-control study. *PLoS One*. 9: e115002.
31. Vaa T. (2014). ADHD and relative risk of accidents in road traffic: a meta-analysis. *Accid Anal Prev*. 62: 415-425.
32. Fuermaier AB, Tucha L, Evans BL, Koerts J, de Waard D, et al. (2017). Driving and attention deficit hyperactivity disorder. *J Neural Transm (Vienna)*. 124: 55-67.
33. Chang Z, Quinn PD, Hur K, Gibbons RD, Sjölander A, et al. (2017). Association between medication use for attention-deficit/hyperactivity disorder and risk of motor vehicle crashes. *JAMA Psychiatry*. 74: 597-603.
34. Biederman J, Fried R, Hammerness P, Surman C, Mehler B, et al. (2012). The effects of lisdexamfetamine dimesylate on the driving performance of young adults with ADHD: a randomized, double-blind, placebo-controlled study using a validated driving simulator paradigm. *J Psychiatr Res*. 46: 484-491.
35. Fried R, Petty C, Faraone SV, Hyder LL, Day H, et al. (2016). Is ADHD a Risk Factor for HighSchool Dropout? A Controlled Study. *J Atten Disord*. 20: 383-389.
36. Pondé MP, Cruz-Freire AC, Silveira AA. (2012). Relationship between learning problems and attention deficit in childhood. *J Atten Disord*. 16: 505-509.
37. Barkley RA. (2002). Major life activity and health outcomes associated with attention-deficit/hyperactivity disorder. *J Clin Psychiatry*. 12: 10-5.
38. Arnold LE, Hodgkins P, Kahle J, Madhoo M, Kewley G. (2015). Long-Term Outcomes of ADHD: Academic Achievement and Performance. *J Atten Disord*.
39. Barbaresi, William J, Katusic, Slavica K, Colligan, et al. (2007). Long-Term School Outcomes for Children with Attention-Deficit/Hyperactivity Disorder: a Population-Based Perspective. *Journal of Developmental & Behavioral Pediatrics*: 28: 265-273.
40. Kuriyan AB, Pelham WE Jr, Molina BS, Waschbusch DA, Gnagy EM, et al. (2013). Young adult educational and vocational outcomes of children diagnosed with ADHD. *J Abnorm Child Psychol*. 41: 27-41.
41. Lu Y, Sjölander A, Cederlöf M, D'Onofrio BM, Almqvist C, et al. (2017). Association between medication use and performance on higher education entrance tests in individuals with Attention-Deficit/hyperactivity disorder. *JAMA Psychiatry*. 74: 815-822.

42. Ornoy A, Rivkin D, Barlev L. (2018). [Children with Attention Deficit Hyperactivity Disorder (ADHD): Accessibility and Availability Of Services In Israel]. *Harefuah*, 157: 219-224.
43. King S, Griffin S, Hodges Z, Weatherly H, Asseburg C, et al. (2006). A systematic review and economic model of the effectiveness and cost-effectiveness of methylphenidate, dexamfetamine and atomoxetine for the treatment of attention deficit/hyperactivity disorder in children and adolescents. *Health Technol Assess*. 10: iii-iv, xiii-146.
44. Mishan E. (1976). *Elements of Cost-Benefit Analysis*, Routledge.
45. Schlander M, Trott GE, Schwartz O. (2010). The health economics of attention deficit hyperactivity disorder in Germany. Part 1: Health care utilization and cost of illness. *Nervenarzt*. 81: 289-300.
46. Schlander M, Trott GE, Schwarz O. (2010). The health economics of attention deficit hyperactivity disorder in Germany. Part 2: Therapeutic options and their cost-effectiveness. *Nervenarzt*. 81: 301-314.
47. Pelham WE, Foster ME, Robb JA. (2007). The economic impact of attention-deficit/hyperactivity disorder in children and adolescents. *J Ped Psychol*. 7: 121-131.
48. Doshi JA, Hodgkins P, Kahle J, Sikirica V, Cangelosi MJ, et al. (2012). Economic impact of childhood and adult attention-deficit/hyperactivity disorder in the United States. *J Am Acad Child Adolesc Psychiatry*. 51: 990-1002.
49. Birnbaum HG, Kessler RC, Lowe SW, Secnik K, Greenberg PE, et al. (2005). Costs of attention deficit-hyperactivity disorder (ADHD) in the US: excess costs of persons with ADHD and their family members in 2000. *Curr Med Res Opin*. 21: 195-206.
50. Le HH, Hodgins P, Postma MJ, Kahle J, Sikirica V, et al. (2014). Economic impact of childhood/adolescent ADHD in a European setting: the Netherlands as a reference case. *Eur Child Adolesc Psychiatry*. 23: 587-598.
51. Pliszka S; AACAP Work Group on Quality Issues. (2007). Practice parameter for the assessment and treatment of children and adolescents with Attention-Deficit/Hyperactivity Disorder. *J Am Acad Child Adolesc Psychiatry*. 46: 894-921.