Objective

The most recent report from the CDC shows that prevalence rates for autism spectrum disorder (ASD) have increased by 23% since their last report in 2009 (Centers for Disease Control, 2014). Given this increase in prevalence, information regarding the lifetime costs associated with ASD and the impact early intervention has on outcomes is timely. Therefore, we sought to examine the impact early interventions have on lifetime costs, including medical, nonmedical, and indirect costs. At this time, a comprehensive estimate of costs related to ASD has not appeared in the literature. Instead, individual groups of studies on particular types of costs appear, but no encompassing estimate. As such, this exercise is a synthesis of the existing literature to provide that encompassing number. We do not engage in an original empirical investigation. More accurate estimates could be achieved with an explicit investigation through economic analysis –although such a comprehensive dataset would be difficult to come by. Our estimate is an initial effort based on the best available science to date, but is subject to the flaws and gaps in the existing literature. The following sections detail the methods employed to estimate the average costs over a lifetime.

Cost Methods

In order to determine the costs of ASD associated with different ages of intervention, we initially preformed a systematic review of the literature based on methods outlined for Cochrane reviews. This review began first by identifying appropriate key search terms; once these terms were identified and selected, we searched several databases using these terms, which are detailed in Table 1 of the Appendix. We paired the database queries with an independent search of journals that focus on ASD or developmental disabilities and citations from particularly robust and salient cost articles to broaden the literature search (shown in Table 2 of the Appendix). After we exhausted all search methods, the set of articles were reviewed for relevance. Relevant articles were examined and evaluated for quality using Cochrane Review-based assessments, and each article was identified with weak, moderate, or high quality (Jackson & Waters, 2005; Rychetnik, Frommer, Hawe, & Shiell, 2002). Only moderate and high quality studies were included in our estimates.

All collected cost data were converted to 2014 U.S. dollars and are presented in present value using a constant discount rate of 3% for future year dollars. All costs are also estimated to begin at age of intervention and continue until age 65. Since the literature and clinical experts agree that services received before ASD diagnosis and treatment vary widely and are not well documented, we do not include estimates in our calculations of costs before evidence based intervention for ASD. Thus in all cases, the lifetime costs shown at older age groups are not only higher, but are also incurred over a shorter amount of time. For example a child who receives intervention at age 2 would have lifetime costs estimated over 63 years, whereas a child's lifetime costs estimate for intervention at age 6 was incurred only over 59 years.

Efficacy Rates

Given our interest in the impact of early intervention on costs and outcomes, we narrowed our review to articles specifically focused on birth to age 8. The paucity of information regarding costs as it relates of age of intervention, results in our determination that variation in costs and outcomes with regard to age of intervention has not been well investigated to this point. Given this problem, we integrated several existing well referenced models to estimate costs specific to age of intervention, including Chasson, Harris, & Neely, 2007, Jacobson, Mulick, & Green, 1998, and Peters-Scheffer, Didden, Korzilius, & Matson, 2012. Using these models as a guide, we centered our estimations on the efficacy of treatment on children's placement in school as a main determinant of costs. The following section details how we used school placement efficacy rates in our cost estimation model.

Peters-Scheffer et al (2012) collected articles containing efficacy rates associated with ABA-based interventions (EIBI specifically) from the literature, and separated groups of children into three categories: 1.) successfully included in regular education, 2.) placed in special education with limited support, placed in regular education with full-time or part-time support, went to private school that had small class sizes, or received a mixture of regular and special education, 3.) received special education and/or one-on-one support (Peters-Scheffer et al., 2012). Building on this work, we examined the articles included in their review and assessed them for quality and completeness of information, keeping the three categories they established and included information regarding average age of participants, and the duration and intensity of intervention.

Efficacy rates from articles scoring moderate to high on quality were used to estimate average efficacy rates by age. We also searched for articles with efficacy rates not included in Peters-Scheffer's (2012) articles, but did not find complete data in the time frame of this project (articles published from 2003 - 2014). ABA-intervention efficacy rates were available for ages 2-6 years; we divided all rates by age and used a weighted average across studies (when applicable), seen in Table 1 below. The three categories in the table are the same as Peters-Scheffer et al (2012) described above. Like other researchers (Jacobson et al., 1998; Peters-Scheffer et al., 2012), we assumed that members of group 1 would sustain a level of independence through adulthood that would allow them to live independently and have a job. Group 2 was assumed to remain semi-dependent into adulthood, while group 3 was assumed to be completely dependent, requiring intensive community services.

Table 1: Efficacy Rates from Ages 2-6

				Duration		**Outcome**		
Age range	Reference	N	Age	Hours	Months	1	2	3
2-3 years old	(Cohen, Amerine-Dickens, & Smith, 2006)	21	30.2	35-40	36	48%	33%	19%
	(Lovaas, 1987)		34.6	40	24+	47%	42%	11%
	(Sallows & Graupner, 2005)	23	35	37.58	48	48%	43%	9%
	(Sheinkopf & Siegel, 1998)	11	33.8	27.02	16	27%	18%	55%
Weighted Average						**45%**	**36%**	**19%**
3-4 years old	(Weiss, 1999)	20	41.5	40	24	50%	25%	25%

	(Smith, Groen, & Wynn, 2000)	15	36.07	24.52	33	27%	13%	60%
	(Magiati, Charman, & Howlin, 2007)	28	38	32.8	24	0%	82%	18%
	(Boyd & Corley, 2001)	22	41.3	30-40	23	0%	41%	59%
	(Bibby, Eikeseth, Martin, Mudford, & Reeves, 2002)	66	45	30.3	32	5%	53%	42%
	(Remington et al., 2007)	23	35.7	25.6	24	74%	0%	26%
	(Anderson, Avery, DiPietro, Edwards, & Christian, 1987)	14	42.79	15-25	12-24	0%	31%	69%
Weighted Average						**18%**	**42%**	**40%**
4-5 years old	(Harris & Handleman, 2000)	27	49	35-45		11%	30%	59%
Weighted Average						**11%**	**30%**	**59%**
5-6 years old	(Eikeseth, Smith, Jahr, & Eldevik, 2002, 2007)	13	66.31	28	31.4	0%	38%	62%
Weighted Average						**0%**	**38%**	**62%**

* Months were rounded up to the nearest month to categorize into an age group

Medical costs

To estimate medical costs over a lifetime but specific to age of intervention and sensitive to efficacy rates of treatment, we used Wang, Mandell, Lawer, Cidav, & Leslie, 2013 estimates for average annual medical cost for children with ASD and converted them to 2014 dollars. Wang et al (2013) broke down the average medical costs into four groups: ages 0-6, 7-9, 10-13, and 14-17; the corresponding annual cost by age can be seen in Table 2.

To estimate adult costs, we used Buescher, Cidav, Knapp, & Mandell, 2014 estimates, that showed that adult medical costs are approximately 1.5 times greater than medical costs for ages 6-17 (Buescher, Cidav, Knapp, & Mandell, 2014). Given these estimates, we calculated the average of medical costs for ages 6-17 to be $29,069 using Wang et al (2013) estimates, then multiplied that by 1.5 to find the average medical cost for an adult to be $43,603 as suggested by Buescher et al. All estimates can be seen in Table 2 below.

Table 2: Estimated annual medical costs for different age groups, based on Wang et al 2013 and Buescher et al 2014

	Age group (years)				
	0-6	7-9	10-13	14-17	18+
Average annual medical costs, in 2014$	$ 21,180	$ 22,739	$ 26,801	$ 37,667	$ 43,603

The estimates above aggregate both private insurance costs and Medicaid costs. This may underestimate the true annual medical costs of children with ASD because private insurance costs tend to be significantly lower than Medicaid, which has been largely attributed to the fact that many insurance companies do not cover, or are extremely limited for, ASD-related services. Therefore, true costs may not be reflected in private insurance measures (Wang, Mandell, Lawer, Cidav, & Leslie, 2013a).

In order to estimate lifetime medical costs, we first wanted to establish the lifespan for an individual with ASD. Several studies limited the timespan used to estimate average annual costs (Ganz, 2007; Jacobson et al., 1998; Peters-Scheffer et al., 2012). Current studies have not been conclusive on life expectancy of individuals with autism. Jacobson (1998) estimated costs until age 55 for individuals given that at the time there were no studies showing the mortality rate of those with ASD, while the more recent article by Peters-Scheffer and colleagues (2012) estimated costs until age 65. Indeed, a gap in the literature remains concerning the mortality rate of individuals with autism. Several studies have found no overall increased mortality rate for individuals with ASD(Gillberg, Billstedt, Sundh, & Gillberg, 2010; Happe & Charlton, 2012), while one study found that at birth, individuals with autism had a decreased life expectancy of 6.1 years (Shavelle & Strauss, 1998). Given the lack of consensus, we used the estimated life expectancy of 67, used most recently by Buescher, Cidav, Knapp, and Mandell (2014)[1]; researchers determined this estimate using data from a study examining the comparative mortality of individuals with ASD in California from 1980-1996 (Shavelle & Strauss, 1998).

Using the average annual medical cost shown in Table 2 and the age expectancy of 67, we then began to estimate lifetime costs based on age of intervention by using efficacy rates of ABA-based interventions (Table 1). We do this by first estimating the lifetime medical costs by group. This was completed by adding the annual medical costs using the estimates from table 2, discounting them at a constant rate of 3% for 20, 19, 18, and 17 years years for group 1, 55, 54,53, and 52 years for group 2, and 65 years for group 3, depending on age of treatment. These estimates are shown in Table 3 below, and were based on Jacobson (1998) and include the following assumptions:

1. Individuals in group 1 are those who successfully entered regular education and can be expected to live lives consistent with neurotypical individuals. Based on Jacobson's assumptions, we assumed that group 1 would receive Medicaid for 3 years at 100% during treatment, and 10% of the group would receive Medicaid until age 65. After treatment, group 1 would incur medical costs consistent with individuals with disabilities, $17,516 per year. Table 3 breaks down the estimated costs for each age subset in group 1 over a lifetime.

Table 3: Individual lifetime costs for group 1

Age Groups	Medical costs during treatment	Medical costs after treatment	Medicaid costs (22-64)	Total lifetime medical costs
Age 2-3	$61,708.71	$23,753.42	$44,235.01	$129,697.14
Age 3-4	$61,708.71	$22,661.89	$44,235.01	$128,605.61
Age 4-5	$61,708.71	$21,537.62	$44,235.01	$127,481.34
Age 5-6	$61,708.71	$20,379.61	$44,235.01	$126,323.33

[1] We do not include costs during retirement or the point at which individuals would be eligible for Medicare. We assume these estimates would follow those in the general population with regard to the distribution of disability and support consistent with complex morbidities in aging.
[2] This is the total cost of special education not marginal cost.
[3] While we know that this type of treatment intervention is not available in all places and may not be

2. Group 2 individuals are those who needed continuing support throughout their education and would be expected to need supports in housing for independent living. Based on Jacobson's (1998) assumption that group 2's time span of receiving Medicaid would be approximately 15% less than group 3's expected Medicaid use in years, group 2 would receive Medicaid for 55 years. Using costs in Table 2, we calculated lifetime costs for an individual in group 2 to be $946,268.31.

3. Group 3 individuals are those who needed intensive services and would not be able to live independently during adulthood. Based on Jacobson (1998), we assumed that 100% of group 3, individuals, would receive Medicaid for 64 years. Using costs in Table 2, we calculated lifetime costs for an individual in group 3 to be $1,015,075.

To determine estimated average lifetime medical costs segmented by age of intervention, we used the efficacy rates shown in Table 1 for each age group and assumed a population of 100 (Chasson et al., 2007). For example, we assumed 23 people out of 100 would be in group 1 if the efficacy rate was 23%. Below is a generic form of the equation used:

$$MC=\frac{(G1\times C1)+(G2\times \$946{,}268.31)+(G3\times\$1{,}015{,}075.07)}{100}$$

MC = Average lifetime medical cost
C1 is the lifetime medical cost for group 1, which can be found in Table 3.
G1, G2, and G3 variable values can be found below in Table 1.

Non-Medical Services Costs

Education

Educational costs were estimated using efficacy rates to estimate how many individuals receiving treatment at a given age would progress either to regular education, special education with support, or special education. Using the assumptions of Chasson and colleagues (2007), we assumed that all of group 1 would mainstream to regular education, group two would use special education at 45% of the average cost, and individuals in group three would be placed in special education at 100% of the cost. It was also assumed that children would receive an average of 15 years of schooling, based on Chasson et al (2007). Average educational costs were estimated by first assuming a population of 100 and using efficacy rates to determine the number of children in each group (Chasson et al., 2007).

$$C = 15\times\left[\frac{(G1\times R)+(G2\times(S\times 45\%))+(G3\times S)}{100}\right]$$

C = education cost per person per year
R = cost of regular education per person per year, using this estimate $12,987.54
S = total cost of special education per person per year[2], used this estimate $25,815(Chambers, Parrish, & Harr, 2004; Chambers, Shkolnik, & Perez, 2003; Chasson et al., 2007)

[2] This is the total cost of special education not marginal cost.

45% = the estimated reduction in marginal special education costs for group 2 (Chasson et al., 2007; Jacobson et al., 1998)
G1, G2, and G3 variable values can be found in Table 1.

Intervention Costs
It was assumed that, regardless of age group, individuals would receive approximately three years of, of moderate to high intensity treatment (20-40 hours/week). Since Applied Behavior Analysis (ABA) is the most well evidenced set of treatments in the literature, we used the average annual cost of this treatment for our estimates: $41,202[3] and discounted it over 3 years for a total of $120,040.78. This number is derived from the median cost of this type of treatment intervention from previous research estimates (Chasson et al., 2007; Jacobson et al., 1998; Jaerbrink, 2007; Sallows & Graupner, 2005). We held this number constant at all ages of intervention since we assume the same treatment intervention for all.

Childcare
The existing literature has not extensively addressed the variety of childcare needs and costs of children with ASD who receive treatment with regard to severity and/or intervention age. Given this, we used Ganz's (2003) estimated annual cost of childcare of $6,324 (in 2014 dollars) for ages 2-18 and $6,177 for ages 18-21[4]. Using these numbers, the total discounted cost of childcare for groups 2 and 3 can be found in Table 4; these estimates assume that childcare would be used until the child reached age 22. We assume that group 1 would only incur childcare costs during intervention, for a total cost of $18,424.78. This may underestimate the costs associated with childcare for children with greater needs given that it is only one estimate not differentiated on severity or age of intervention. With this caveat, we use Ganz's figure as a constant in our calculations.

Table 4: Childcare costs by age of Intervention

Age Groups	Childcare costs
2-3 years	$96,648.59
3-4 years	$92,939.97
4-5 years	$89,214.45
5-6 years	$85,377.17

Supplemental security income (SSI) payments
To determine the lifetime payments from supplemental security income, we used the January 2014 monthly estimate of SSI benefits for an individual in his or her own household, which was $721.00 (U.S. Social Security Administration, 2014). The yearly payments were estimated to be approximately $8,652.00 for 2014. The lifetime SSI payment calculation that resulted was then used in conjunction with the efficacy rates to determine the average lifetime cost for each age group (Jacobson et al., 1998; Peters-Scheffer et al., 2012).

[3] While we know that this type of treatment intervention is not available in all places and may not be appropriate for all cases, we opted to use a well documented highly evidence based treatment for our estimates as a best effort.

[4] The average childcare costs were calculated assuming Ganz's estimates are marginal costs.

There are several assumptions that govern this calculation, which are based on Jacobson's (1998) and Peters-Scheffers and colleagues (2012) models, including

1. Individuals in group 1 that achieved normal range effects of intervention would receive SII payments at 100% for three years of intervention ($25,207) and 10% of SSI payments over the rest of their lifetime.
2. Individuals in group 2 and 3 receive SSI payments beginning at the age of intervention at 100% over the rest of their lifetime, assumed to be 65 years.
3. Annual SSI payments will remain constant over the next 65 years (Jacobson et al., 1998).

The following equation was used in this calculation:

$$S = \frac{\left(G1 \times \left((X \times 10\%) + \$25{,}207\right)\right) + (G2 \times X) + (G3 \times X)}{100}$$

S = average lifetime SSI payments
X= discounted SSI payments after intervention (Table 5 shows the breakdown by age of intervention)
$25,207 = discounted SSI payments over 3 years
G1, G2, and G3 variable values can be found in Table 1.

Table 5. Cost of SSI payments by age at intervention

Age of Intervention	Annual Cost	Ages	Discounted Total Cost
2-3 years			
60 years SSI	$8,652	5 through 65	$227,047.54
3-4 years			
59 years SSI	$8,652	6 through 65	$225,703.62
4-5 years			
58 years SSI	$8,652	7 through 65	$224,319.39
5-6 years			
57 years SSI	$8,652	8 through 65	$222,893.63

Family support services
Family support services[5] in this calculation were estimated using Jacobson's (1998) annual family support services cost estimate, which was converted into 2014 dollars ($1,679.78). This

[5] Family support services includes benefits families receive apart from early intervention, educational and developmental services; this includes benefits such as public housing subsidies, food stamps, temporary assistance, childcare assistance, higher education grants, vocational assistance, public transportation, and Medicaid card services (Jacobson 1998).

calculation used Jacobson's (1998) assumptions that both groups 2 and 3 would receive family support services when the child began intervention until age 26. Group 1 would receive only 3 years of family services (Jacobson 1998).

To calculate average lifetime family support services costs, we assumed a population of 100 and used the efficacy rates to determine how much, on average, an individual from a particular group would use. The following equation illustrates the process:

$$F=\frac{(G1 \times \$4{,}894)+(G2 \times X)+(G3 \times X)}{100}$$

$4,893 = estimated discounted cost for 3 years of family support services
X= estimated discounted cost for family support services based on age of intervention (Table 6 shows these estimates by age)
G1, G2, and G3 variable values can be found in Table 1.

Table 6: Family support services cost by age of intervention for groups 2 and 3

Age Groups	Family support services costs
2-3 years	$30,038.63
3-4 years	$29,214.73
4-5 years	$28,366.12
5-6 years	$27,492.05

Supported employment
Jacobson (1998) assumed that individuals attaining semi-dependence (group 2) and 40% of very dependent individuals (group 3) would receive 25 years of supported employment starting at age 22. Using this timeframe and the estimated annual employment services cost for adults with ASD of $556 from Buescher, Cidav, Knapp, and Mandell (2014), we calculated the average lifetime cost for supported employment. As with other estimations, children that reached a normal range of functioning (group 1) did not require employment support and therefore, is not a part of this cost estimation.

$$SE=\frac{(G2 \times \$5{,}503) + (G3 \times 40\% \times \$5{,}503)}{100}$$

G2, and G3 variable values can be found in Table 1
$5,503= the lifetime cost of supported employment, discounted starting at age 22
40% = the proportion of group 3 individuals that would receive employment services

Supported housing for adults
Adults with ASD often move into supported living facilities full time; in this cost calculation, we assume that the annual cost for accommodation is approximately $28,543 in 2014 dollars (Buescher et al., 2014). Buescher and colleagues (2014) based this estimation on an average of

different types of supported living, including sheltered housing, extra care housing, lodgings, and group homes. In this model we assumed that all individuals in group 2 and 80% of group 3 would live in supported living facilities. We use the 80% estimate for group 3, following Jacobson (1998), with the remaining 20% of that group would require intensive community services, which is calculated below.

We assumed that individuals would enter supported living facilities at age 22 and would continue to live there until age 67, for a total of 45 years (Buescher et al., 2014).

$$A = \frac{(G2 \times \$387{,}483) + (G3 \times 80\% \times \$387{,}483)}{100}$$

$387,483 = average cost of accommodation for 45 years, discounted
G2, and G3 variable values can be found in Table 1.
80% = the proportion of group 3 who would live in supported living facilities

Nonmedical services for adults

Additional services for adults are needed when they move to a supported living facility. This calculation used the nonmedical service estimate of $8,988 annually to estimate the total lifetime costs of these types of services (Buescher et al., 2014). Similar to the estimates for accommodation, we estimated that individuals would begin to receive nonmedical services for adults at age 22 and continue to receive them until age 65, for a total of 44 years. This may underestimate the actual cost of these services due to other factors associated with aging. Additionally, we estimated that 80% of group 3 would receive nonmedical services, since 20% was estimated by Jacobson (1998) to receive intensive community services. It is assumed in this calculation that none of group 1 would require the additional nonmedical services beyond those accounted for in their disability related medical costs. The equation used to estimate this cost is below:

$$NM = \frac{(G2 \times \$120{,}699.88) + (G3 \times 80\% \times \$120{,}699.88)}{100}$$

G2, and G3 variable values can be found in Table 1.
$120,699.88 = total lifetime estimated cost for nonmedical adult services, discounted from ages 22 - 65
80% = the proportion of group 3 who would receive additional nonmedical services

Intensive community services for adults

To account for variations in service use and delays that individuals may encounter, Jacobson (1998) assumed that 20% of group 3 would receive intensive community services in adulthood in addition to standard care. It is the purpose of this section to describe the costs for the 20% of group 3. It is assumed in this model that individuals from neither group 1 nor group 2 would receive intensive community services as adults. Based on these assumptions, we estimated the average costs from intensive community services an individual in group 3 would incur over a lifetime using cost data from Lakin and colleagues (2008). Using efficacy rates, lifetime costs associated with intensive community services were estimated using the following equation, assuming a population of 100:

$$I = \frac{(\$2{,}629{,}131 \times G3 \times 0.2)}{100}$$

I = cost of intensive community services for adults
$2,629,131 = lifetime costs per person using intensive community services from age 22-65
G3 variable values can be found in Table 1.
0.2= the estimated percentage of individuals using intensive community services from group 3

Indirect costs: Lost Earnings

Child

Lost earnings (productivity losses) for children were calculated using efficacy rates, and the median household income in the U.S. in 2014 dollars, adjusted for inflation.
Assumptions governing this calculation include:

1. Efficacy rates were broken down into three outcomes; researchers assumed that
    a. The first group would maintain independence through adulthood and would hold a job without support.
    b. The second group would work with support.
    c. The third group would not work.
2. An individual would be in the workforce for 25 years.
3. Supported wages are twenty percent of the national median household income (Jacobson et al., 1998)

Equation used in calculation:

$$PL = \frac{\left(G2 \times (\$559{,}264 \times 0.8)\right) + (G3 \times \$559{,}264\ )}{100}$$

PL = productivity loss
G2, and G3 variable values can be found in Table 1.
$559,264 = discounted income for a household over 25 years in 2014 U.S. dollars (U.S. Census Bureau, 2015)
0.8 = the percentage of household income an individual would lose

Parents

In a recent study, researchers found families with a child with ASD earned $17,763 ($19,589 in 2014 $) less than families with children with no health limitations and $10,416 ($11,487 in 2014 $) less than families with children with another health limitation (Cidav, Marcus, & Mandell, 2012). While calculating the productivity loss of parents, we used the three groups of efficacy rates. We assumed that the first group, where the child is included in regular education, would have a productivity loss of $8,102 per year per child (the loss families with a child with a health limitation other than ASD experience). Additionally, lifetime parental productivity loss was calculated per individual from ages 2-21; for a total discounted loss of $148,613 for individuals' in group one. Researchers assumed that parental productivity loss for the other two groups, who entered special education at either low or high support levels, to be $19,589 per year per child, for a total lifetime loss of $253,438 for groups two and three.

We took into consideration whether or not parental income would rebound after a child left the parents home for either supported or independent living. However, we were unable to find any studies that could speak to this issue, indicating another gap in the literature. For our synthesis, we went with what was known in the literature, as modeling this effect independently was beyond the scope of our project. It is reasonable to believe that productivity losses persist even when a child is not living at home with parents due to employability issues, additional informal support needs a parent gives, and other issues. While this is a reasonable assumption, this is an unanswered empirical question that could be important.

Calculation

Productivity loss was first calculated by finding the average productivity loss per child per year, assuming a population of 100.

$$PL= \frac{(G1 \times \$148,613)+((G2 + G3) \times \$253,438))}{100}$$

PL = productivity loss of parent

G1, G2, and G3 variable values can be found in Table 1.

$148,613 = discounted productivity loss of parents over 15 years assuming a child is included in regular education

$253,438 = discounted productivity loss of parents over 15 years assuming a child does not become included in regular education

Savings

In order to show the savings associated with early intervention across all categories of costs calculated in this synthesis, we compared the costs in each category associated with later intervention, i.e. intervention between the ages of 5-6 years, to costs associated with earlier interventions. This approach was used because although the average age of ASD diagnosis is 4 years and 5 months, intervention does not necessarily begin at time of diagnosis given the expense, lack of insurance coverage, and lack of available providers (Centers for Disease Control, 2014). Additionally, the average age of diagnosis for ASD subtypes can range from 4 years of age for Autistic Disorder to 6 years and 2 months for Asperger Disorder (Centers for Disease Control, 2014).

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Appendix

Table 1: Cost search process

Web of Science	8/27/2014	(autism OR autis*) AND (early intervention OR therapy OR early medical intervention) AND (cost of illness OR burden of illness)
	8/28/2014	(autism OR autis*) AND (early intervention OR therapy OR early medical intervention) AND (cost of disease OR cost of sickness OR disease cost* or healthcare cost* or quality of life)
	9/3/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (cost of illness OR cost* of disease OR burden of illness OR cost* of sickness OR health care costs OR quality of life)
	9/4/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (financial burden OR economic burden OR direct cost* OR indirect cost* OR medicaid OR economic)
	9/8/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (productivity loss OR employment OR cost OR economic*)
Medline	8/26/2014	(autism OR autistic disorder) AND early intervention AND cost
	9/9/2014 (redone 9/10/14)	(autism OR autistic disorder) AND early intervention AND cost
	9/9/2014(redone 9/10/14)	(autism OR autis*) AND (early intervention OR therapy OR early medical intervention) AND (cost of illness OR burden of illness)
	9/9/2014 (redone 9/10/14)	(autism OR autis*) AND (early intervention OR therapy OR early medical intervention) AND (cost of disease OR cost of sickness OR disease cost* or healthcare cost* or quality of life)

	9/10/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (cost of illness OR cost* of disease OR burden of illness OR cost* of sickness OR health care costs OR quality of life)
	9/10/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (financial burden OR economic burden OR direct cost* OR indirect cost* OR medicaid OR economic)
	9/10/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (productivity loss OR employment OR cost OR economic*)
PsycINFO	9/24/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (cost of illness OR cost* of disease OR burden of illness OR cost* of sickness OR health care costs OR quality of life)
	9/24/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (financial burden OR economic burden OR direct cost* OR indirect cost* OR medicaid OR economic)
	9/24/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (productivity loss OR employment OR cost OR economic*)

EconLit	9/25/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (cost of illness OR cost* of disease OR burden of illness OR cost* of sickness OR health care costs OR quality of life)
	9/25/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (financial burden OR economic burden OR direct cost* OR indirect cost* OR medicaid OR economic)
	9/25/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (productivity loss OR employment OR cost OR economic*)
	9/25/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (productivity loss OR employment OR cost OR economic*)
NBER Working Papers	9/25/2014	(autism OR autis* OR autism spectrum OR autism spectrum disorder*) AND (early intervention OR head start program OR preventative health services OR community health services OR child health services) AND (cost of illness OR cost* of disease OR burden of illness OR cost* of sickness OR health care costs OR quality of life)
	9/25/2014	autism AND early intervention AND cost
ScienceDirect	9/25/2014	KEYWORDS(autism early intervention) and ALL(cost)
	9/25/2014	KEYWORDS(autism spectrum disorder early intervention AND ALL(financial burden cost)
	9/25/2014	ALL (autism spectrum disorder early intervention) and ALL(productivity loss).

Table 2: Articles reviewed for additional references

Author/Year	**Title**
(Amendah, Grosse, Peacock, & Mandell, 2011)	The economic cost of autism: a review
(Bilaver & Jordan, 2013)	Impact of State Mental Health Parity Laws on Access to Autism Services
(Buescher et al., 2014)	Costs of Autism Spectrum Disorders in the UK and the US
(Chasson et al., 2007)	Cost Comparison of Early Intensive Behavioral Intervention and Special Education for Children with Autism
(Cidav, Lawer, Marcus, & Mandell, 2013)	Age-Related Variation in Health Service Use and Associated Expenditures Among Children with Autism
(Granpeesheh, 2009)	ABA interventions with children with ASD
(Grindle et al., 2012)	Parents' Experiences of Home-Based Applied Behavior Analysis Programs for Young Children with Autism
(Helt et al., 2008)	Can Children with Autism Recover? If So, How?
(Jacobson et al., 1998)	Cost-Benefit Estimates for Early Intensive Behavioral Intervention for Young Children with Autism –General Model and Single State Case
(Jaerbrink, 2007)	The Economic Consequences of ASD among children in a Swedish municipality
(Järbrink & Knapp, 2001)	The economic impact of autism in Britain
(Koegel, Koegel, Ashbaugh, & Bradshaw, 2014)	The importance of early identification and intervention for children with or at risk for autism spectrum disorders.
(Lavelle et al., 2014)	Economic Burden of Childhood Autism Spectrum Disorders

(Lord & Luyster, 2006)	Early diagnosis of children with autism spectrum disorders
(Mandell et al., 2010)	Age of diagnosis among Medicaid-enrolled children with ASD
(Matson & Konst, 2013)	What is the evidence for long-term effects of early autism interventions?
(Peters-Scheffer et al., 2012)	Cost comparison of early intensive behavioral intervention and treatment as usual for children with autism spectrum disorder in The Netherlands.
(Rivard, Terroux, & Mercier, 2014)	Effectiveness of EBI in public and mainstream settings: The case of preschool-age children with autism spectrum disorders
(Towle, Vacanti-Shova, Shah, & Higgins-D'alessandro, 2014)	School-Aged Functioning of Children Diagnosed with Autism Spectrum Disorder Before Age Three: Parent-Reported Diagnostic, Adaptive, Medication, and School Placement Outcomes
(Webb, Jones, Kelly, & Dawson, 2014)	The motivation for very early intervention for infants at high risk for autism spectrum disorders
(Zuckerman, Lindly, & Bethell, 2014)	Family impacts among children with ASD: the role of health care quality