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# The Effectiveness of Equine-Based Therapy in the Treatment of Social and Behavioural Aspects of Children with Autism Spectrum Disorder: A Systematic Review

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## **The Effectiveness of Equine-Based Therapy in the Treatment of Social and Behavioural Aspects of Children with Autism Spectrum Disorder: A Systematic Review**

**Introduction:** Individuals with Autism spectrum disorder (ASD) present with impairments in social interactions, communication, restricted, repetitive and stereotyped patterns of behaviour, interests or activities. Equine-based therapy is used as a treatment with children with disabilities. There have been no systematic reviews conducted on the effectiveness of equine-based therapy in children with ASD. **Purpose:** To examine the effectiveness of equine-based therapy on behavioural and social interactions in the treatment of children with ASD. **Methods:** A systematic search of Cochrane, OT Seeker, MEDLINE, Embase, CINAHL, PsychINFO, Informit health databases and Proquest central were conducted. Studies of participants, aged 4-16 years, with professional diagnosed ASDs were included if they utilised outcome measures assessing behaviours and social interactions through questionnaire or observation. A critical appraisal, using the McMaster Critical Review Form for Quantitative Studies, was performed to assess methodological quality. NHMRC body of evidence framework was used to provide the study with an overall grade of recommendation in assessing quality of evidence. **Results:** Eight studies of varying research designs and methodological quality met the inclusion criteria. The participants in these studies were aged between 4-16 years of age. The duration of the interventions ranged from 6-12 weeks, and each study used varied measures of outcome. Overall, studies showed some improvements in behaviours and social interactions following an equine-based therapy intervention. **Conclusions:** Few studies have investigated the effect of equine therapy on behaviour and social interactions of children with ASD. The current body of evidence is constrained by small sample size, lack of comparator, crude sampling methods, and the lack of standardised outcome measures. Equine-based therapy shows potential as a treatment method for behaviours and social interactions in children with ASD.

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### ABSTRACT

Individuals with autism spectrum disorder (ASD) present with impairments in social interactions, communication, restricted, repetitive, and stereotyped patterns of behaviour, interests, or activities. Equine-based therapy is used as a treatment with children with disabilities. There have been no systematic reviews conducted on the effectiveness of equine-based therapy in children with ASD. **Purpose:** To examine the effectiveness of equine-based therapy on behavioural and social interactions in the treatment of children with ASD. **Methods:** A systematic search of Cochrane, OT Seeker, MEDLINE, Embase, CINAHL, PsychINFO, Informit health databases, and Proquest central were conducted. Studies of participants, aged 4 to 16 years, with professional diagnosed ASDs were included if they utilised outcome measures assessing behaviours and social interactions through questionnaire or observation. A critical appraisal, using the McMaster Critical Review Form for Quantitative Studies, was performed to assess methodological quality. NHMRC body of evidence framework was used to provide the study with an overall grade of recommendation in assessing quality of evidence. **Results:** Eight studies of varying research designs and methodological quality met the inclusion criteria. The participants in these studies were aged between 4 to 16 years of age. The duration of the interventions ranged from 6 to 12 weeks, and each study used varied measures of outcome. Overall, studies showed some improvements in behaviours and social interactions following an equine-based therapy intervention. **Conclusions:** Few studies have investigated the effect of equine therapy on behaviour and social interactions of children with ASD. The current body of evidence is constrained by small sample size, lack of comparator, crude sampling methods, and the lack of standardised outcome measures. Equine-based therapy shows potential as a treatment method for behaviours and social interactions in children with ASD.

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### INTRODUCTION

The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV, which has now been superseded by DSM-V with redefined diagnoses) identifies a set of Autism Spectrum Disorders (ASD) which include Autistic Disorder, Asperger's Disorder, and Pervasive Development Disorder.<sup>1</sup> All of these related developmental disorders are marked by deficits in social communication and interaction across multiple contexts, as well as restricted, repetitive patterns of behaviour, interests, or activities. Symptoms of ASD may appear at different ages, with a variety of diverse affects which range from mild to severe deficits.<sup>2</sup> Some individuals are considered high-functioning and can live independently requiring minimal, if any, help. Others, however, may need partial or full supervision and assistance to navigate even the most basic tasks of everyday life. Data from the Australian 2012 Survey of Disability, Ageing and Carers (SDAC) showed an estimated 115,400 Australians (0.5%) had autism, which was a 79% increase on the 64,400 people estimated to have the condition in 2009.<sup>3</sup> The 2012 SDAC reported further to state that males were four times more likely than females to have the condition, with prevalence rates of 0.8% and 0.2% respectively.<sup>3</sup> Autism can also have a significant financial cost.<sup>4</sup> Lavelle et al reported on the overall economic burden of childhood ASD, including health care, education, family-coordinated services, caregiver time and ASD-related therapy, which was estimated to cost at least \$17,000 more per year compared to a child without ASD.<sup>4</sup>

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There are a large number of interventions for ASD including allied health, sensory-integration, behavioural, psychosocial, educational, medical, and complementary approaches. In addition to mainstream therapies, there are also a number of emerging complementary therapies such as such as pet-therapy, autism assistance-dogs, hydrotherapy, and music-therapy.<sup>5-8</sup> One such complementary therapy is equine-based therapy. Equine-based therapy refers to a general category of interventions utilising the presence of a horse, including therapeutic riding, hippotherapy, and other non-mounted activities, such as equine facilitated psychotherapy (i.e. grooming). Traditionally, equine-based therapy has been used for patients with physical impairments;<sup>9-11</sup> however, this therapeutic technique has recently become increasingly prevalent in treating those with other impairments.<sup>9-14</sup>

In recent years, animal-assisted therapy has gained popularity in treating symptoms and behaviours associated with ASD with limited focus on cognitive, emotional, and social outcomes. According to Waltz, people with ASD feel a special empathy with animals, and the bonds formed can help people learn compassion and feel less lonely, and there is some evidence to support these claims.<sup>15</sup> Macauley & Gutierrez discovered positive experiences in equine-based therapy, which can lead to improved self-concept, locus of control, behaviour, and affect.<sup>16</sup> Positive affect, in turn, encourages the brain to work more effectively to release chemicals that help relax muscles, reduce stress, and provide a sense of well-being.<sup>17</sup> Children with ASD often have difficulties with social interaction that may lead to academic and occupational underachievement and a lack of community inclusion; therefore, social development is a crucial aspect to consider in interventions for positive outcomes and optimal quality of life.<sup>18,19</sup> The structure of equine-based therapy interventions may assist to improve attention, engagement, reciprocal interaction, and communication.

Therefore, the aim of this systematic review was to investigate the effectiveness of equine-based therapy interventions in improving the behaviours and social interaction of children with ASDs. Improvements in these areas would extend the application of equine-based therapy beyond physical impairments, in children with ASD.

**METHODS**

**Search Strategy**

This review was conducted and reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.<sup>20</sup> In February 2015, a search of eight electronic databases was conducted collaboratively by two reviewers. Searched databases included Cochrane, OT Seeker, MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsychINFO, Informit health databases, and Proquest central. Only studies published in English were included. No restrictions were placed on gender or age. No date restrictions were applied as there were no known published systematic reviews focusing on equine therapy. Table 1 outlines the search question in relation to the PICO (Population, Intervention, Comparator, Outcome) criteria. The following key search terms were used; “Autistic Disorder” OR Autism OR “autis\* spectrum disorder” OR ASD OR Asperger\* OR Pervasive Developmental Disorder, AND horse OR “horse riding” OR 'horse-back' OR hippotherapy OR “equine therapy.” Truncation symbols and MESH headings were used where appropriate across the different databases. Reference lists of all the included studies were reviewed (also termed as pearling or secondary searching) to elicit any relevant studies that were not located by the electronic search. Grey literature, using commonly available internet search engines, were searched for further articles. Emails were also sent to organisations such as Equine Therapy Animal Assisted Therapy and Horses for Hope to identify any unpublished reports which could inform the review question

**Table 1.** Search Strategy (PICO Criteria)

Definition	
Population	Children aged 4 to 16 years diagnosed with Autism Spectrum Disorder
Intervention	Equine based therapy, such as hippotherapy, horse-back riding, or therapeutic horse-riding
Comparator	Waitlisted control group or no equine therapy
Outcome	Assessing behaviour and/or social interaction through questionnaire or observation

**Study Design**

All forms of primary evidence searched for including retrospective studies, randomised control trials (RCTs), controlled clinical trials (CCTs), and case studies.

**Population**

Studies were included for consideration if participants were aged 4 to 16 years with a formal diagnosis of Autism Spectrum Disorder (ASD), specifically including Autism and Asperger’s syndrome according to the Diagnostic and Statistical Manual of Mental Disorders (either DSM-IV or DSM-V).<sup>1</sup>

### **Intervention**

Studies were included if the intervention described an equine based therapy, such as hippotherapy, horse-based therapy or therapeutic horse-riding (THR).

### **Outcome measures**

Studies were included if they utilised outcome measures that assessed behaviour and social interaction through questionnaire or observation, such as the Social Responsiveness Scale (SRS), Child Behaviour Checklist, or Child Health Questionnaire (CHQ).

### **Search of literature**

A review protocol was established and databases were searched. Search results were pooled, and duplicates removed. Potential studies were identified by evaluating the title and abstract, to determine their appropriateness, following the PICO criteria (as described in Table 1). The relevant studies were independently reviewed in full by two reviewers to determine their inclusion, based on the predetermined criteria and evidence of hierarchy. Any disagreements were resolved with discussion, where needed.

### **Quality assessment**

The methodological quality of included studies was independently assessed by the two reviewers. The National Health and Medical Research Council (NHMRC) hierarchy of evidence (Australian Government 2009) was used to assess the quality of evidence of the studies reviewed. As the question being reviewed is an effectiveness question the "intervention" section of the hierarchy was used. The McMaster Quantitative Critical Appraisal Review Form for Quantitative Studies were used for all RCTs, CCTs, and single-case study designs.<sup>21</sup>

### **Data extraction and analysis**

The data was extracted by the two reviewers and collated into Microsoft excel spread sheets, customised for this review. The customised data extraction forms included information relating to study design, number and type of participants (age, diagnosis), intervention components, comparator (if applicable), and outcome measures, and results were collected and placed in a table to provide an overview of each of the studies. Data on outcome measures, behaviour and social interaction, was extracted. Because of the small number of studies, variability in the outcome measures and general heterogeneity, a meta-analysis was not appropriate. Instead a narrative analysis of the included literature was undertaken.

### **Body of evidence framework**

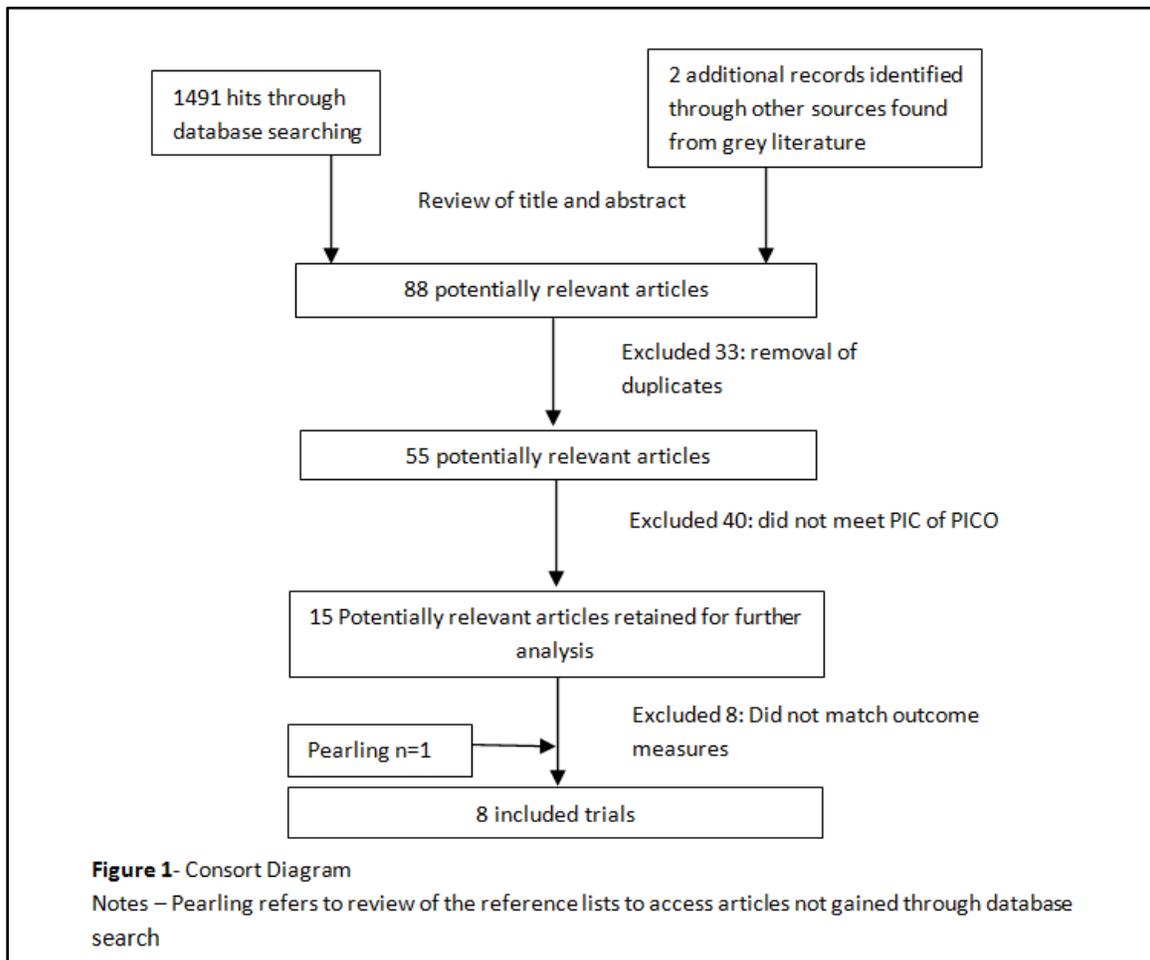
The NHMRC body of evidence framework was used in the interpretation of findings and the implications for clinical practice.<sup>22</sup> The framework considers multiple dimensions of evidence for all included studies, and based on the framework, evidence-based recommendations were drawn. There are five dimensions of evidence including 1) evidence-base level, quality and quantity; 2) consistency; 3) clinical impact; 4) generalizability; and 5) applicability of the research. The applicability component was not considered for this review as the findings from this review may be relevant to an international population (and not confident to the applicability of the Australian population). Mortimer, Privopoulos & Kumar successfully used the NHMRC body of evidence framework in their previous work on ASD and this systematic review replicated those processes.<sup>7</sup>

## **RESULTS**

### **Search Results**

The search strategy returned 1491 total "hits," of which 88 of were potentially relevant studies. After removal of duplicates, review of full-text versions and pearling, a total of eight studies were identified as being eligible for review. Search results are outlined in Figure 1. Potentially relevant articles that fulfilled initial (PICO) inclusion criteria were subsequently excluded for the following reasons:

- Interventions were with other types of animals
- Exposure to prior equine experience for an extended period of time within the last 6 months
- Diagnosis of other types of developmental disorders such as Childhood Disintegrative Disorders and Rett syndrome.
- Outcome measures did not assess behaviour or social interactions (i.e., only assessed gross-motor skills or balance)
- No valid outcome measure used
- Full-text article not published in English



**Methodological Quality of studies**

The results of the critical appraisal can be seen in Table 2. According to the NHMRC, one study was rated level II, another was level III-1, four were level III-2, and two were level III-3.<sup>22</sup> A range of methodological issues were identified as witnessed during the critical appraisal process. The main methodological issues that were missed include justification of sample size, avoidance of co-intervention, clinical importance not being reported, and dropouts not being reported. Potential biases include sample size bias due to no justification of sample size, co-intervention bias due to continued therapy throughout treatment, attrition bias as no dropouts were reported, and sampling bias due to lack of randomisation. Only one of the eight studies reported random allocation of its participants.<sup>23</sup> Studies of level III-3 were given “not applicable (N/A)” for question 6b as this question addressed contamination, referring to the control being sufficiently different to the intervention, as these studies did not have a control group this question was deemed irrelevant.

**Study characteristics**

The studies included in this review were published from 2010 -2014. They consisted of a randomised controlled trial, a pseudorandomised controlled trial, a non-randomised experimental trial, a quasi-experimental trial, a single-case experimental design, a longitudinal quasi-experimental design, a single group pre-post design, and a single group quasi-experimental interrupted time series design.<sup>23-30</sup> Of the eight studies included, seven of the studies were conducted in the United States, and one of the studies was conducted in Spain.<sup>26</sup>

**Table 2.** McMaster Results of Methodological Quality

Item	Score																Raw	%
	1	2	3	4	4	4	5	5	6	6	6	7	7	7	7	8		
Authors				a	b	c	a	b	a	b	c	a	b	c	d			
<b>Level II</b>																		
Bass & Llabre 2010	Y	Y	RC T	5 0	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	11/1 4	78%
<b>Level III-1</b>																		
Gray 2007	Y	Y	CC T	1 9	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	13/1 4	93%
<b>Level III-2</b>																		
Gabriels et al. 2012	Y	Y	CC T	4 2	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	11/1 4	79%
Garcia-Gomez et al. 2014	Y	Y	CC T	1 6	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	N	9/14	64%
Jenkins et al. 2013 <sup>27</sup>	Y	Y	CC T	7	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	Y	10/1 4	71%
Lanning et al. 2014	Y	Y	CC T	2 5	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	10/1 4	71%
<b>Level III-3</b>																		
Ajzenman, Standeven & Shurtleff 2013	Y	Y	AB	6	Y	N	Y	Y	Y	N/A	N	Y	Y	Y	Y	Y	11/1 3	85%
Ward et al. 2013	Y	Y	AB	2 1	Y	N	Y	Y	Y	N/A	N	Y	Y	N	N	Y	9/13	69%

McMaster Items: 1. Was the purpose stated clearly?; 2. Was the relevant background literature reviewed?; 3. What is the study design?; 4a. sample size; 4b. Was the same described in detail?; 4c. Was the sample size justified?; 5a. Were the outcome measures reliable?; 5b. Were the outcome measures valid?; 6a. Intervention was described in detail?; 6b. Contamination was avoided?; 6c. Co-intervention was avoided?; 7a. Results were reported in terms of statistical significance?; 7b. Were the analysis method(s) appropriate?; 7c. Clinical importance was reported?; 7d. Drop-outs were reported?; 8. Conclusions were appropriate given study methods and results?

**Participant characteristics**

Number, diagnosis and ages of participants in each study is reported in Table 3. The number of participants range from six to 50. Participants were all diagnosed with Autism Spectrum Disorder, including Autism and Asperger’s Syndrome and were aged between 4 to 16 years. Participants were excluded if they were diagnosed with any other pervasive developmental disorder.

**Types of intervention**

A variety of equine-based therapies were used across the included studies with a common denominator being the use of a horse in the intervention. The interventions ranged from therapeutic horse riding or horseback riding for most studies, equine-assisted therapy for one and hippotherapy for another study. Details on the specific intervention can be found in Appendix 1. Follow up periods of the studies and the duration of interventions varied considerably. Bass & Llabre had a 12-week intervention period of THR with two months follow up and each session ran for 1 hour and 15 minutes.<sup>23</sup> Gray was only a 6-week intervention period of THR, with each session running for one hour.<sup>24</sup> Gabriels et al had a 10-week intervention with one hour sessions of THR each week.<sup>25</sup> Garcia-Gomez et al ran a 3-month intervention program of two session of THR per week, each session running for 45 minutes.<sup>26</sup> Jenkins and DiGennaro ran 9 weeks of THR each running for one hour.<sup>27</sup>

Lanning et al ran 12 weeks of equine assisted activities each for one hour as well as having children involved in social circles groups and compared to children only receiving the social circles groups.<sup>28</sup> Ajzenman et al ran 12 weeks of hippotherapy with each session running for 45 minutes.<sup>29</sup> Finally, Ward et al ran 6 weeks of THR, 6 week break, another 4 weeks of THR, 6 weeks break, and a final 8 weeks of THR all for one hour.<sup>30</sup>

**Types of outcomes**

The outcomes reviewed in this study were behaviour and social interaction. Each of the included studies investigated one or both of these outcomes, but the measures and terminology around the outcomes were different for each of the studies. Appendix 2 highlights included studies and what terminology and measures have been used to report on behaviour and social interaction. For behaviour, a number of different terms were included to report behaviour, such as self-regulation, adaptive behaviour, withdrawal, problem behaviour, rule breaking behaviour, aggressive behaviour, stereotyped behaviour, and attention problems. To report on social interaction, a number of different terms were also used, including socialisation/social functioning, social problems, social

inclusion, social awareness, social cognition, and social motivation. For each of these outcomes, a wide range of measures were used. The measures used that are relevant to behaviour and social interaction include the social responsiveness scale (SRS), child behaviours checklist, Aberrant behaviour checklist-community (ABC), Vineland Adaptive behaviours scales (VABS), Behaviour assessment system for children (BASC), Quality-of-life questionnaire, observation, Paediatric Quality-of-Life (child and parent report), Gilliam autism rating scale-2 (GARS-2) and Sensory profile school companion (SPSC). All outcome measures were reported to have good psychometric properties.

### Summary of Results

The results of the studies are summarised in Appendix 2, with the studies grouped according to the NHMRC hierarchy of methodological quality.<sup>22</sup> From the summary of the results found in each study, it can be seen that most, but not all, studies found that results were beneficial; however, the lack of significance shows that overall, the result of equine-based therapy on behaviour and social interaction were mixed.

Bass et al study was the only randomised controlled trial (Level II). This study was the highest-level of evidence therefore weighing heavily on the overall results for this review. Bass et al used the Social Responsiveness Scale (SRS), completed by both parents and teachers, to address social issues with 12 weeks of therapeutic horse-riding (THR).<sup>23</sup> Pretesting showed groups were homogenous and randomisation had made groups comparable. The results indicated that parent report SRS showing significant differences ( $p < 0.05$ ) between treatment and control groups for social motivation, although results were not significant ( $p > 0.05$ ) for social cognition and social awareness. Gray's study was a pseudorandomised research design, level III-1 on the NHMRC hierarchy of evidence and second highest quality study reviewed.<sup>24</sup> Gray assessed the effectiveness of THR over a 6-week intervention period. Results reported found that the Child Behaviour Checklist (CBCL) indicated a significant treatment effect for the subscale withdrawal ( $p = 0.002$ ); however, no significant effects were found for social problems ( $p = 0.133$ ), attention problems ( $p = 0.095$ ), rule-breaking behaviour ( $p = 0.315$ ), and aggressive behaviour ( $p = 0.968$ ).<sup>24</sup>

The majority of the studies included in this systematic review were Level III-2. This was the most common level found for this intervention, as randomisation within this population was difficult (these studies are clinical controlled trials and compare an intervention and control group). Gabriels et al was a non-randomised experimental trial, Garcia-Gomez et al is a quasi-experimental trial, Jenkins et al is a single-case experimental design and Lanning et al is a longitudinal quasi-experimental design.<sup>25-28</sup> The interventions used for the four studies were comparable in duration; 10 weeks of THR,<sup>25</sup> 3 months of THR,<sup>26</sup> 9 weeks of THR,<sup>27</sup> and 12 weeks of equine-assisted therapy.<sup>28</sup> A number of outcomes were reviewed in these studies looking at both behaviour and social interactions. Three of the four studies reported on adaptive behaviour with mixed results.<sup>25,26,28</sup> Gabriels et al found a significant improvement in adaptive behaviour between intervention and control group ( $p < 0.05$ ), Garcia-Gomez et al found no significant improvement ( $p = 0.588$ ), and Lanning et al found that adaptive behaviour improved but not significantly more than the control group.<sup>25,26,28</sup> A number of other outcomes were assessed for each of these studies. Gabriels et al found significant improvements when comparing baseline to post-intervention ( $p < 0.05$ ) for all components of self-regulation (irritability, lethargy, stereotypy, hyperactivity and inappropriate speech), and statistically significant improvements for 4 of the 5 components (excluding inappropriate speech) when comparing intervention group to control ( $p < 0.01$ ).<sup>25</sup> Garcia-Gomez et al found significant improvements in intervention group for aggressiveness ( $p = 0.039$ ) but no significant results for behaviour problems ( $p = 0.48$ ), attention problems ( $p = 0.915$ ), withdrawal ( $p = 0.343$ ) or social skills ( $p = 0.5$ ) these results were not compared to the control group. Garcia-Gomez et al also found no significant improvement in social inclusion ( $p = 0.22$ ) when comparing intervention and control group.<sup>26</sup> Jenkins et al looked at problem behaviour and found no significant results and parents reported no observable decreases in problem behaviour.<sup>27</sup> Lanning et al found that the intervention group significantly improved in social functioning and this improvement was greater than that of the control group, however the difference was not significant.<sup>28</sup>

Two of the eight studies reviewed were Level III-3 and did not compare treatment with control. Precautions need to be taken when considering the contribution of these findings to the overall systematic review due to the absence of a control group (and hence low level evidence). Ajzenman et al investigated the effectiveness of a 12-week hippotherapy intervention on adaptive behaviours and social interaction.<sup>29</sup> Ward et al investigated THR in a time interrupted design: THR occurred for 6 weeks, followed by a six week break, then four weeks of THR, another six week break, and then the final 8 weeks of THR. This was undertaken to test the effect of breaks on intervention results as well as overall effectiveness of THR on social interaction and behaviour.<sup>30</sup> Ajzenman et al found a statistically significant overall improvement in adaptive behaviour ( $p = 0.027$ ) and in socialisation ( $p = 0.027$ ); however; they were limited by small effect size.<sup>29</sup> Ward et al reported significant effects over-time in improving social interaction ( $p < 0.05$ ) and no significant results for stereotyped behaviours or behaviour in general ( $p > 0.05$ ).<sup>30</sup> Parents and teachers both reported improvements in behaviour of children receiving the intervention, showing that these results can generalise to multiple contexts.

**NHMRC body of evidence framework**

Table 3 describes the analysis of the results using the NHMRC body of evidence framework.<sup>22</sup> Overall it is evident that the body of evidence is limited with methodological flaws. Therefore, the results from these studies should be interpreted with caution. Therefore, despite the generally positive findings from the studies, limitations in the evidence base restricts unequivocal recommendation of the effectiveness of equine-based therapy for the treatment of social and behavioural aspects of children with autism spectrum disorder.

**Table 3. NHMRC Body of Evidence Framework**

<b>Component</b>	<b>Grade</b>	<b>Comments</b>
<b>Evidence base</b>	D - Poor Level IV studies or Level I to III studies with high risk of bias	Quantity: 8 studies Total participants: 186 Level II: 1 Level III: 7 Quality: low
<b>Consistency</b>	D- Poor Evidence inconsistent	Multiple study designs All participants with ASD including autism or Asperger's Syndrome. Co-morbidities not addressed Varied outcome measures
<b>Clinical impact</b>	D - Poor Slight or restricted	Effect size reported in 1 study Intervention adequately explained Consistent findings for both outcomes Only one study looked at follow up, 2 months No adverse effects reported Reason for drop outs sometimes addressed
<b>Generalizability</b>	B – Good Population studied in the body of evidence are similar to target population	Population reviewed similar to target population Small sample size due to method of recruiting Age: 4-16years Severity of ASD varied or not reported Most studies reported co-intervention taking place Co-intervention not avoided
<b>Grade of recommendation</b>	D- Poor Body of evidence is weak and recommendation must be applied with caution.	Overall studies reviewed were low level and of low quality. While some similarities were found in results for outcome measures the evidence base lacks clarity in terms of comorbidities, severity of diagnosis, follow up as well as outcome measures reported in a number of different ways.

**DISCUSSION**

This systematic review aimed to evaluate the effectiveness of equine-based therapy as a treatment option for children aged 4 to 16 with a diagnosis of ASD or Asperger's syndrome, regarding improvements in behaviour and social interactions. This review identified eight studies of various designs, of a low methodological quality, with inconsistencies throughout. Seven of the eight studies showed a benefit of equine-therapy in terms of behaviour and social interaction for children with ASD. Several studies 23,25,28,30 have reported an increase in attention as well as a decrease in distractibility as a result of equine based therapy.

While these findings are encouraging and the positive outcomes may be directly attributable to equine-based therapy, studies report that these improvements in behaviour and social aspects may be merely a result of interacting with the horse.<sup>25</sup> Researchers have speculated a number of potential causes, including the nature of horse-back riding such as the presence of the horse or the motion of riding.<sup>23-25</sup> For example, the act of horse riding may be motivating or reinforcing for the child,<sup>23</sup> or may produce a calming effect.<sup>26</sup> Gabriels et al.<sup>26</sup> reported that behavioural and communication benefits may be due to the horse responding to the child's commands in a way that gains the child's attention and satisfies their concrete learning style. This interaction provides an engaging and motivating experience in a regular, controlled environment and could provide positive results.<sup>26</sup>

Ajzenman et al.<sup>29</sup> discussed similar findings in their research, suggestions that improvements in receptive communication, social interaction, coping and participation in daily activity could be linked to improved postural control. With improved postural responses, children have the potential to effectively attend to tasks as motor responses become more automatic for functional engagement.<sup>29</sup>

While this is not the focus of equine-based therapy, these benefits may have a holistic effects and hence translate to improved relationships, social acceptance and an overall positive quality of life.

### **Interventions**

A diverse range of equine-based therapies and treatment plans were reported among the included studies. While it could be argued that flexibility in the treatment plans were required to suit the individual needs of the child, this does highlight the lack of agreed or standardised treatment parameters for equine-based therapies. To date no research has found that a specific lesson plan is superior to another resulting in varied and customised treatment plans.<sup>27</sup> Duration of interventions were sometimes comparable between studies with four out of the eight studies reporting sixty minutes in duration, three reporting forty-five minutes and one reporting hour and fifteen minutes. One study conducted sessions twice a week, compared to the other seven only conducting sessions once a week. All interventions were conducted by a certified instructor that was trained in equine based therapy and, six of the eight studies reviewed used riding programs that were accredited by Professional Association of Therapeutic Horsemanship (PATH) International.<sup>31</sup>

### **Limitations**

As with any systematic review, this review has several limitations. There is currently a lack of high level, high quality primary research evidence investigating equine-based therapy as a treatment intervention for children with ASD. From an extensive review of the literature, only eight studies met the inclusion criteria for this review. The included studies were mostly low level research designs (Level III) with only one randomised controlled trial (Level II) with methodological concerns. Methodological concerns include sampling techniques, allocation to treatment group, homogeneity of treatment methods, and blinding which may be difficult to address due to the population of interest. Majority of the included studies were limited in their statistical power by small sample size and lacking justification, possibly due to poor availability of children with ASD to participate in the studies. Diversity was also witnessed in terms of how the behaviour and social interaction outcomes were reported and measured, making robust comparisons between studies difficult. Finally, the applicability of equine-based therapy across all settings may also act as a limitation. Geographic location can limit availability of equine therapy due to limited service providers and need for large space, equine-based therapy is costly for clients as well as for service providers, again limiting accessibility of services.<sup>24</sup> This cost is often not covered by insurance companies as it is an alternative therapy and to be covered by medicine it would need medical justification by the client's physician.<sup>24</sup>

## **CONCLUSION**

### ***Implications for clinical practice***

Equine-based therapy is part of a growing trend of complementary therapies available for children with ASD. While there is emerging evidence which indicates that equine-based therapy may contribute to improved social and behavioural aspects of children with autism spectrum disorder, the evidence base underpinning this treatment is fraught with methodological concerns. From an end-user perspective, child report surveys found that the children who participated reported enjoyment in participating in the equine-based therapy and a high level of satisfaction with the therapy as a whole. Furthermore, parent survey and report in a number of studies found that overall parents were pleased with the equine-based therapy program and the progress that their children were making. Therefore, these personal perspectives should be carefully balanced with the current equivocal evidence to support equine-based therapy for children with ASD.

### ***Implications for future research***

While an emerging body of evidence for equine-based therapies was identified, it was underpinned by a number of methodological limitations. This highlights the need for ongoing further research, especially given the growing popularity of complementary therapies, and address ongoing knowledge gaps. Future studies could benefit from using a standardised intervention method following the guidelines of PATH,<sup>31</sup> as well as standardised and consistent application of measures of outcomes. Sampling methods could be improved with larger sample size, with clear justifications provided. In order to compare like with like, homogenous samples could be selected (such as children with similar levels of severity within the autism spectrum) from representative populations. It would be advisable to replicate these studies with a focus on the long term, cost effectiveness and follow-up to demonstrate sustainability and efficiency of these services. Furthermore, as this treatment matures, it will be important to demonstrate the value and effectiveness of equine-based therapy as a stand-alone intervention or as an adjunct to other traditional interventions. Finally, many of the studies included in this review used DSM-IV diagnostic criteria which have now been superseded by DSM-V with redefined diagnoses for ASD. Future research should consider the new DSM-V diagnostic criteria to inform diagnoses and choice of interventions.

## References

1. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association. 2013 (cited 2015 Feb 5). Available from: <http://dsm.psychiatryonline.org/book.aspx?bookid=556>.
2. Seltzer M, Krauss M, Shattuck P, Orsmond G, Swe A, Lord C. The Symptoms of Autism Spectrum Disorders in Adolescence and Adulthood. *J Autism Dev Disord*. 2003 Dec;33(6):565-81.
3. Australian Bureau of Statistics. *Autism in Australia 2012* (updated 2014; cited 2015 Mar 3). Available from: <http://www.abs.gov.au/ausstats/abs@.nsf/>
4. Lavelle TA, Weinstein MC, Newhouse JP, Munir K, Kuhlthau KA, Prosser LA. Economic burden of childhood autism spectrum disorders. *PubMed Pediatrics*. 2014;133(3):520-9.
5. O'Haire M. Animal-Assisted Intervention for Autism Spectrum Disorder: A Systematic Literature Review. *J Autism Dev Disord*. 2013;43(7):1606-22.
6. Berry A, Borgi M, Francia N, Alleva E, Cirulli F. Use of Assistance and Therapy Dogs for Children with Autism Spectrum Disorders: A Critical Review of the Current Evidence. *J Altern Complement Med*. 2013;19(2):73-80.
7. Mortimer R, Privopoulos M, Kumar S. The effectiveness of hydrotherapy in the treatment of social and behavioral aspects of children with autism spectrum disorders: a systematic review. *J Multidiscip Healthc*. 2014;7:93-104. [PMID: 24520196]
8. James R, Sigafoos J, Green V, Lancioni G, O'Reilly M, Lang R. Therapy for Individuals with Autism Spectrum Disorder: a Systematic Review. *Rev J Autism Dev Disord*. 2015;2(1):39-54.
9. Peacock G. Riding for people with disability. *BMJ*. 1994;309(6950):340-1.
10. Winchester P, Kendall K, Peters H, Sears N, Winkley T. The effect of therapeutic horseback riding on gross motor function and gait speed in children who are developmentally delayed. *Phys Occup Ther Pediatr*. 2002;22(3-4):37-50.
11. Hawkins BL, Ryan JB, Cory AL, Donaldson MC. Effects of Equine-Assisted Therapy on Gross Motor Skills of Two Children with Autism Spectrum Disorder: A Single-Subject Research Study. *Ther Recreation J*. 2014;48(2):135-49.
12. Heimlich K. Animal-assisted therapy and the severely disabled child: a quantitative study. *J Rehabil*. 2001;67:48-54.
13. Bizub AL, Joy A, Davidson L. "It's like being in another world": demonstrating the benefits of therapeutic horseback riding for individuals with psychiatric disability. *Psychiatr Rehabil J*. 2003;26(4):377-84.
14. Glazer H, Clark M, Stein D. The impact of hippotherapy on grieving children. *J Hosp Palliat Nurs*. 2004 Jul-Sep;6:171-6.
15. Waltz M. *Autistic Spectrum Disorder: Understanding the Disorder and Getting Help*. Sebastopol, CA: O'Reilly & Associates; 2001.
16. Macauley BL, Gutierrez KM. The effectiveness of hippotherapy for children with language-learning disabilities. *Commun Disord Q*. 2004;25(4):205-17.
17. Stickney MA. *A Qualitative Study of the Perceived Health Benefits of a Therapeutic Riding Program for Children with Autism Spectrum Disorders* (dissertation). University of Kentucky Doctoral Dissertation; 2010.
18. Ruble LA. Analysis of social interactions as goal-directed behaviors in children with autism spectrum disorders. *J Autism Dev Disord*. 2001;31(5):471-82.
19. White SW, Keonig K, Scahill L. Social skills development in children with autism spectrum disorders spectrum disorders: a review of the intervention research. *J Autism Dev Disord*. 2007;37(10):1858-68.
20. Moher D, Liberati A, Tetzlaff J, Altman DG. PRISMA Group; Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264-9.
21. Law M, Stewart D, Pollock N, Letts L, Bosch J, Westmorland M. *Critical Review Form—Quantitative Studies*, Hamilton, ON: McMaster University; 1998 (cited 2015 Feb 5) Available from: <http://www.srs-mcmaster.ca/Portals/20/pdf/ebp/quanreview.pdf>.
22. Australian Government: National Health and Medical Research Council (NHMRC). *NHMRC Additional Levels of Evidence and Grades for Recommendations for Developers of Guidelines- stage 2 consultation*. Canberra; 2009 (updated cited Feb 5 2015) Available from: [http://www.nhmrc.gov.au/\\_files\\_nhmrc/file/guidelines/stage\\_2\\_consultation\\_levels\\_and\\_grades.pdf](http://www.nhmrc.gov.au/_files_nhmrc/file/guidelines/stage_2_consultation_levels_and_grades.pdf)
23. Bass MM, Duchowny CA, Llabre MM. The effects of equine assisted activities on the social functioning in children with autism. *J Autism Dev Disord*. 2009;39(9):1261-7.
24. Gray AC. *The Effects of Therapeutic Horseback Riding with Autistic Children* (dissertation). Capella University; 2007.
25. Gabriels RL, Agnew JA, Holt KD, Shoffner A, Zhaoxing P, Ruzzano S. Pilot study measuring the effects of therapeutic horseback riding on school-age children and adolescents with autism spectrum disorders. *Res Autism Spectr Disord*. 2012;6(2):578-88.
26. García-Gómez A, Risco M, Rubio J, Guerrero E, García-Peña I. Effects of a program of adapted therapeutic horse-riding in a group of autism spectrum disorder children. *Rev Electron Investig Psicoeduc Psigopedag*. 2014;12(1):107-28.
27. Jenkins SR, DiGennaro Reed FD. An experimental analysis of the effects of therapeutic horseback riding on the behavior of children with autism. *Res Autism Spectr Disord*. 2013;7(6):721-40.
28. Lanning BA, Baier EM, Ivey-Hatz J, Krenek N, Tubbs JD. Effects of equine assisted activities on autism spectrum disorder. *J Autism Dev Disord*. 2014;44(8):1897-907.

29. Aizenman HF, Standeven JW, Shurtleff T. Effect of hippotherapy on motor control, adaptive behaviors, and participation in children with autism spectrum disorder: a pilot study. *Am J Occup Ther.* 2013;67(6):653-63.
30. Ward S, Whalon K, Rusnak K, Wendell K, Paschall N. The association between therapeutic horseback riding and the social communication and sensory reactions of children with autism. *J Autism Dev Disord.* 2013;43(9):2190-8.
31. Dorotik-Nana C. *Equine Therapy: Narha No More, Now PATH.* Psych Central. 2003 (cited 2015 Mar 12). Available from: <http://blogs.psychcentral.com/equine-therapy/2011/07/equine-therapy-narha-no-more-now-path>.

## Appendix 1. Study Characteristics

Study	Design type (NHMRC level)	Pop (sample size)[age range]	Intervention	Comparator(s)	Outcome measures	Result
Bass & Llabre 2009	RCT (Level II)	ASD (50)[7-12]	THR 12wks, 1 time/wk, 60min (2-mo follow-up)	No intervention	SRS	Significant differences between treatment and control for social functioning but not for social cognition and social awareness.
Gray 2007	Pseudorandomised controlled-trial (Level III-1)	ASD (19)[6-12]	THR 6wks, 1 time/wk, 60min	No intervention	CBC	No significant difference in abnormal behaviours.
Gabriels <i>et al.</i> 2012	Non-randomised experimental trial (Level III-2)	ASD or Asperger's syndrome (42)[6-16]	THR 10wks, 1 time/wk, 60min	No intervention	ABC VABS	THR resulted in improvements in adaptive skills compared to control group pre and post.
Garcia-Gomez <i>et al.</i> 2014	Quasi-experimental trial (Level III-2)	ASD (16)[7-14]	THR 3mo, 24 sessions, 45min	No intervention	BASC QL-Qu.	Significant differences found in some quality of life indicators and a lower aggressiveness.
Jenkins & DiGennaro Reed 2013	Single-case experimental design (Level III-2)	ASD (7)[6-14]	THR 9wks, 1 time/wk, 60min	centre-based activities, waitlisted	Observation CBC	No statistically significant changes were seen as a result of THR.
Lanning <i>et al.</i> 2014	Longitudinal quasi-experimental design (Level III-2)	ASD (25)[4-14]	Equine-assisted activities 12wks, 1 time/wk, 60min	Social circles group, 12wks	Peds-QL	Intervention and control improved in behaviour, results more favourable to the equine therapy.
Ajzenman, Standeven & Shurtleff 2013	Single-group pre-post design (Level III-3)	ASD (6)[5-12]	Hippotherapy 12wk, 1 time/wk, 45min	N/A	VABS	Overall adaptive behaviours were observed to have increased
Ward <i>et al.</i> 2013	Single-group quasi-experimental interrupted time series (Level III-3)	ASD (21)[4-10]	THR 6wks, 6wk break, THR 4wks, 6wk break, THR 8wk, 1 time/wk, 45 min	N/A	GARS SPSC	Increased social interaction. Improvement not maintained over time, were recovered.

**Abbreviations:** RCT, randomised control trial; ASD, Autistic Spectrum Disorder; THR, Therapeutic horse-riding; SRS, social responsiveness scale; QL-Qu., Quality-of-life questionnaire; CBC, child behaviour checklist (parent and teachers); ABC, Aberrant behaviour checklist-community; Peds-QL, Pediatric Quality of Life Child and Parent response; VABS, Vineland Adaptive behaviours scales; BASC, Behaviour assessment system for children; GARS-2, Gilliam autism rating scale-2; SPSC, Sensory profile school companion; N/A, not applicable.

**Appendix 2. Summary of results.**

Study	Behaviour								Social interaction					
	Self-regulation	Adaptive Behaviour	Withdrawal	Problem Behaviour	Rule breaking Behaviour	Aggressive Behaviour	Stereotyped Behaviour	Attention Problems	Socialisation/ Social Functioning	Social Problems	Social Inclusion	Social Awareness	Social Cognition	Social Motivation
<b>Level II</b>														
Bass & Llabre 2009									↑(+)			↔	↔	↑(+)
<b>Level III-1</b>														
Gray 2007			↓(+)		↔	↔		↔		↔				
<b>Level III-2</b>														
Gabriels et al. 2012	↑(+)	↑(+)												
Garcia-Gomez et al. 2014		↑(+)	↓(+)	↓(+)		↓(+)		↓(+)	↑(+)		↑(+)			
Jenkins & DiGennaro Reed 2013				↔										
Lanning et al. 2014		↑(+)							↑(+)					
<b>Level III-3</b>														
Ajzenman, Standeven & Shurtleff 2013		↑(+)							↑(+)					
Ward et al. 2013							↓(+)		↑(+)					

↑ = increased, ↓ = decreased, (+) = positive change/improvement, ↔ shows no effect either positive or negative as a result of intervention.