Applied Behavior Analysis Interventions on Children with Autism Spectrum Disorder in Indonesia: A Proposal for Systematic Review and Meta-Analysis

Amala Fahditia[1,] Heryanti Satyadi[2,*] P. Tommy Y. S. Suyasa[3]

[1] *Professional Psychology Magister Program, Universitas Tarumanagara, Indonesia*
[2] *Professional Psychology Magister Program, Universitas Tarumanagara, Indonesia*
[3] *Professional Psychology Magister Program, Universitas Tarumanagara, Indonesia*
[*]*Corresponding author. Email:* heryantis@fpsi.untar.ac.id

ABSTRACT

The prevalence of autism spectrum disorder increases every year. Autism spectrum disorder refers to a neurodevelopmental disorder characterized by difficulties in communication and social interaction as well as patterns of behavior, interests, and activities that are limited and repetitive. ABA intervention is useful for minimizing the symptoms of behavioral problems seen in children with autism spectrum disorder. ABA intervention is a treatment approach that is implemented in accordance with the principles of ABC (antecedents, behavior, and consequences) and is applied as early as possible, preferably before the age of three. In Indonesia, researchers have not found any systematic review or meta-analysis related to ABA interventions on children with autism spectrum disorder. The lack of research from Indonesia that has been included in various published systematic reviews and meta-analyses regarding ABA interventions on children with autism spectrum disorders raises a question. Thus, the researchers aim to evaluate research related to the topic through a systematic review method. In addition, if the data is good, the researchers aim to examine the level of effectiveness of the intervention through meta-analysis.

Keywords: Autism Spectrum Disorder, Applied Behavior Analysis, Indonesia, Systematic Review, Meta-Analysis..

1. INTRODUCTION

The prevalence of autism spectrum disorder increases every year [1, 2, 3]. One of the diagnostic criteria for autism spectrum disorder is limited and repetitive patterns of behavior, interests, and activities [4]. This is probably because they have a different structure, function, and brain chemistry compared to other people in general [5].

Problems with behavioral patterns that appear in children with autism spectrum disorders can be minimized through the provision of various types of behavioral interventions. The most well-known behavioral intervention is the Applied Behavior Analysis (ABA). Basically, the ABA intervention uses the principles of ABCs (antecedents, behaviors, and consequences) based on the operant conditioning theory of B.F. Skinner: stimulus, response, and reinforcement as three terms that shape behavior [6].

ABA has been widely used in schools and nursing clinics and is widely accepted among health care professionals [1]. The ABA intervention program was found to be quite effective in bringing significant benefits for children with autism spectrum disorders in various areas such as improving intellectual abilities, communication, expressive language, receptive language; as well as increasing the intelligence quotient (IQ) provided through nonverbal tests, adaptive behavior, and socialization [7].

Entering the keywords "applied behavior analysis intervention in Indonesia" in Google Scholar on 27 July 2021, researchers found 7,270 results of studies on ABA intervention that have been conducted in various regions in Indonesia. This shows that ABA intervention has been frequently and widely used. However, researchers have not been able to find studies that have examined the effectiveness of the use of ABA interventions in Indonesia especially in children with autism spectrum disorder.

Regarding ABA interventions in children with autism spectrum disorder in Indonesia, so far researchers have not found any systematic review or meta-analysis studies (as well as research related to the effectiveness of these interventions in Indonesia). By conducting research that focuses on this country, it will help develop science and knowledge that is more specific to the prevailing culture. The information obtained from research results, which mostly in Western or European context, is aimed at the autism community in the region, which does not necessarily apply in Indonesian context (e.g. [8]).

In addition, by finding out the level of effectiveness of ABA interventions in children with autism spectrum disorder in Indonesia, the information obtained will be more specific to the existing culture, resulting in more effective intervention. The best intervention given to children can vary due to individual differences such as age, strengths, weaknesses, and challenges that exist in each individual (Brookman-Frazee et al. in [1]).

Interventions can show different or the same level of effectiveness in different contexts. For example, the effectiveness of different intervention methods in different contexts was found in the meta-analysis of Hendriks et al. [9], where the effect size of positive psychological interventions in non-Western studies was found to be three to five times higher than in Western studies. This is largely due to the lower overall quality of studies in non-Western studies, but does not rule out the possibility that the intervention is more effective due to its cultural nature.

In addition, an intervention can also have the same level of effectiveness in different contexts. This is found in the study of Rahman et al. [10], where the use of parent-mediated intervention developed in the context of high-income countries (UK) can also be used in the context of low-income and middle-income countries: (India and Pakistan). These differences or similarities indicate the importance of re-examining the effectiveness of an intervention in different contexts.

Thus, as the prevalence of autism spectrum disorders continues to increase every year, the role of ABA interventions that can help minimize problems with behavior patterns that exist in children with autism spectrum disorders, as well as the absence of systematic review studies or meta-analyses related to ABA interventions in children with autism spectrum disorder in Indonesia, this topic needs to be researched.

The lack of research from Indonesia that was included after meeting the inclusion criteria set by various systematic reviews and meta-analyses as mentioned above raises questions. Research related to ABA intervention in children with autism spectrum disorders in Indonesia needs to be evaluated. Thus, this study aims to evaluate ABA interventions in children

with autism spectrum disorders in Indonesia by systematically reviewing research that has been conducted in Indonesia. Furthermore, if the selected studies meet certain requirements and conditions for the implementation of the meta-analysis, the level of effectiveness of the intervention can also be reviewed through meta-analysis method. Further analysis needs to be done to see its effectiveness, because the use of ABA interventions in Indonesia is rather common.

2. METHOD

2.1 Systematic Review and Meta-Analysis

A systematic review is a review conducted to answer research questions by trying to combine all relevant evidence using systematic and explicit methods to minimize bias during the process of identifying, selecting, synthesizing, and summarizing various studies. On the other hand, meta-analysis is a statistical method that combines and summarizes the results of various studies (which can be contained in a systematic review) that meet the inclusion criteria [11, 12].

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is one of the guidelines for reporting systematic reviews and meta-analyses. PRISMA is a revised result of a previously created guide called Quality of Reporting of Meta-Analyses (QUOROM Statement). In the methods section of the PRISMA guide, several things that need to be explained are as follows: (a) protocol and registration, (b) eligibility criteria, (c) sources of information, (d) search, (e) study selection, (f) process of data collection, (g) items, (h) risk of bias in individual studies, (i) summary of measurements, (j) synthesis of results, (k) risk of bias across studies, and (l) additional analysis (if any) [11]. This information will be presented below.

2.2 Eligibility Criteria

In this study, the criteria determined were whether the research: (a) used experimental or quasi-experimental design; (b) used ABA intervention technique; (c) have a sample of children in Indonesia diagnosed with autism spectrum disorders, autism, autistic disorders, PDD, or PDD-NOS; (d) provide pre-treatment and post-treatment assessments; (e) was published in Indonesian or English.

2.3 Information Sources and Search

The databases that will be used to search for articles to be reviewed in this study are various databases found during the use of the Google Scholar search engine. In Google Scholar, we looked for articles published from 2000 to 2020. The keyword that will be used in the Google Scholar search engine to identify all articles researching ABA interventions in children with autism

spectrum disorders in Indonesia is "autism spectrum disorders," " autism," "autistic disorder," "PDD," "PDD-NOS," "applied behavior analysis intervention," "ABA intervention," and "Indonesia."

2.4 Study Selection

In this study, several steps are taken in the study selection process. The study selection process consists of four stages: identification, screening, eligibility, and inclusion. An illustration of the study selection process is shown in Figure 3.1, using the PRISMA Flow Diagram [11].

The author will use the Rayyan [13] application along with Microsoft® Excel for Mac version 16.16.27 for identification to screening stage. Then, the author will assess the feasibility of the study manually using the Excel application. Applications are used to help see if the inclusion criteria are met or not met by the papers one by one.

In the screening stage, the first thing that will be seen is the title and the second is the abstract. The title or abstract must describe that there is an ABA intervention for children with autism spectrum disorders, using experimental or quasi-experimental research design, and there are pre-treatment and post-treatment assessments. If several aspects have not been explained in the abstract, but during the screening stage it meets the criteria (for example, it has not been or was not mentioned if the experimental method was used in the research in the abstract, but it has been explained that there is an ABA intervention for children with autism spectrum disorders in Indonesia), it will proceed to the feasibility stage and be reviewed in full-text.
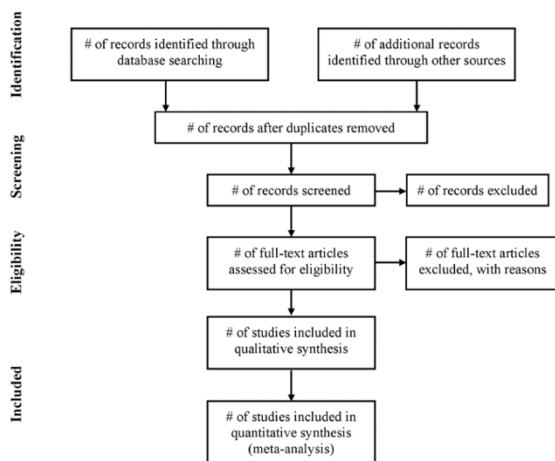

Figure 1. Flow of information through the different phases of a systematic review.
doi:10.1371/journal.pmed.1000097.g001

Figure 1 *PRISMA Flow Diagram* [11].

In the eligibility stage, articles that have passed the screening stage will be reviewed by looking at the full text to ensure that the articles meet all inclusion criteria.

If the selected articles are homogeneous and can be synthesized through the meta-analysis method, it will proceed to the meta-analysis stage. However, if the selected articles are heterogeneous, they will proceed to the systematic review stage.

2.5 Data Collection Process and Data Items

After selecting studies, data will be collected by reviewing the contents of the selected studies. Manually, the author will display information from each selected article in the form of a table, which contains: (a) the author and the year the study was published, (b) the location of the study (if any), (c) the research method, (d) the type of ABA intervention, (e) the duration of the intervention, (f) the characteristics of the participants in the form of the number of participants (male and female) and the average age of the participants (male and female), (g) the type of standardized test used (if any), and (h) research results.

The data in this systematic review and meta-analysis study are: (a) the characteristics of the participants, namely children who have been diagnosed with autism spectrum disorder; (b) the type of intervention, namely the intervention using the ABA intervention technique; (c) behavioral outcomes, including positive improvements in children with autism spectrum disorder such as intelligence (verbal and/or non-verbal), receptive language, expressive language, and adaptive behaviour improvements.

2.6 Risk of Bias in Individual Studies

In this study, the method that will be used to assess the risk to internal validity is the Cochrane risk of bias tools. This tool is often used for randomized and non-randomized studies (Higgins & Green; Higgins et al.; Sterne et al. in [14]). The criteria for inferring the overall risk of bias assessment are as follows:

- The study is rated as having a low risk of bias in all domains for the results obtained.

- The study is rated as having some concerns in at least one domain for the results obtained.

- The study is rated as having a high risk of bias in at least one domain for the results obtained or having multiple concerns for multiple domains in a way that substantially lowers confidence in the results [15].

2.7 Summary Measures

The type of effect measure that will be used in this meta-analysis is the standardized mean change (ESchange) which shows the difference between the pre- and post-treatment measures. To calculate ESchange, we will use Hedges's g because it enforces a

conservative estimate (Hedges in [7]). To interpret the effect size, a rule of thumb is used which suggests that 0.2 indicates a small effect size, 0.5 indicates a medium effect size, and 0.8 indicates a large effect size (Lipsey & Wilson in [7]).

2.8 Synthesis of Results

In this meta-analysis, two statistical tests are used: the Cochran's Q statistic (or chi-square test) and I^2 statistics. The Cochran's Q statistic evaluates if the variability in the effect size is greater than expected on the basis of standard errors (heterogeneity) or at the expected level (homogeneity). If the Q statistic is significant, then the heterogeneity between the effect sizes is significant and may reflect the presence of disturbing confounding variables (Lipsey & Wilson in [7]). For I^2 statistics, the rules for interpreting them are as follows: (a) for I^2 = 0-40%, low heterogeneity; (b) I^2 = 30-60%, moderate heterogeneity; (c) I^2 = 50-90%, substantial heterogeneity; and (d) I^2 = 75-100%, considerable heterogeneity (Higgins & Green in [16]).

2.9 Risk of Bias Accross Studies

The statistical method used to test for publication bias consists of three procedures: visual inspection of funnel plots, the Egger's test (Egger et al. in [7]), and the Begg and Mazumdar rank correlation test (Begg & Mazumdar in [7]). If there is an asymmetry or gap in the funnel plot, then this reflects the possibility of publication bias (Sterne & Egger in [7]). The Egger's test uses a simple linear regression analysis basis that calculates the bias as captured by the funnel plot. Begg and Mazumdar's non-parametric test (in [7]) assessed publication bias using a rank correlation (Kendall's tau) between the estimated intervention effect and its variance.

REFERENCES

[1] Centers for Disease Control and Prevention. (2019, September 23). *Treatment and intervention services for autism spectrum disorder*. Retrieved November 5, 2020 from https://www.cdc.gov/ncbddd/autism/treatment.html

[2] Qiu, S., Lu, Y., Li, Y., Shi, J., Cui, H., Gu, Y., ... & Cheng, Y. (2020). Prevalence of autism spectrum disorder in Asia: A systematic review and meta-analysis. *Psychiatry Research*, 284, 112679. https://doi.org/10.1016/j.psychres.2019.112679

[3] World Health Organization. (2019, November 7). *Autism spectrum disorders*. Retrieved October 10, 2020 from https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders

[4] American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

[5] Anderson, C. (2012, June 8). Behavioral therapies: key interventions in ASD. *Interactive Autism Network.* Retrieved October 04, 2020, from https://iancommunity.org/cs/simons_simplex_community/behavioral_therapies

[6] Webster, J. (2020, January 29). ABC: Antecedent, behavior, consequence. *ThoughtCo.* https://www.thoughtco.com/abc-antecedent-behavior-and-consequence-3111263#:~:text=In%20his%20theory%20of%20operant,stimulus%2C%20response%2C%20and%20reinforcement.&text=Instead%20of%20the%20stimulus%2C%20there,reinforcement%2C%20there%20is%20a%20consequence.

[7] Makrygianni, M. K., Gena, A., Katoudi, S., & Galanis, P. (2018). The effectiveness of applied behavior analytic interventions for children with autism spectrum disorder: A meta-analytic study. *Research in Autism Spectrum Disorders, 51*, 18-31. https://doi.org/10.1016/j.rasd.2018.03.006

[8] Ilias, K., Cornish, K., Kummar, A. S., Park, M. S. A., & Golden, K. J. (2018). Parenting stress and resilience in parents of children with Autism Spectrum Disorder (ASD) in Southeast Asia: A systematic review. *Frontiers in Psychology, 9*, 280. https://doi.org/10.3389/fpsyg.2018.00280

[9] Hendriks, T., Schotanus-Dijkstra, M., Hassankhan, A., Graafsma, T. G. T., Bohlmeijer, E., & de Jong, J. (2018). The efficacy of positive psychological interventions from non-western countries: A systematic review and meta-analysis. *International Journal of Wellbeing, 8*(1). https://doi.org/10.5502/ijw.v8i1.711

[10] Rahman, A., Divan, G., Hamdani, S. U., Vajaratkar, V., Taylor, C., Leadbitter, K., ... & Green, J. (2015). Effectiveness of the parent-mediated intervention for children with autism spectrum disorder in South Asia in India and Pakistan (PASS): A randomised controlled trial. *The Lancet Psychiatry, 3*(2), 128-136. https://doi.org/10.1016/S2215-0366(15)00388-0

[11] Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PloS Med, 6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

[12] Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Stewart, L. A.

(2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews, 4*(1), 1. https://doi.org/10.1186/2046-4053-4-1

[13] Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan—a web and mobile app for systematic reviews. *Systematic Reviews, 5*(1), 210. https://doi.org/10.1186/s13643-016-0384-4

[14] Mayo-Wilson, E., & Grant, S. (2019). Transparent reporting: Registrations, protocols, and final reports. Dalam H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The Handbook of Research Synthesis and Meta-analysis Third Edition* (pp. 471-488). Russell Sage Foundation.

[15] Higgins, J. P. T., Savović, J., Page, M. J., & Sterne, J. A. C. (2016). *Revised Cochrane risk of bias tool for randomized trials (RoB 2.0)*. Retrieved November 14, 2020 from https://drive.google.com/file/d/0B7IQVI0kum0kX0dLblBJd2ltSzg/view

[16] Makrygianni, M. K., & Reed, P. (2010). A meta-analytic review of the effectiveness of behavioural early intervention programs for children with autistic spectrum disorders. *Research in Autism Spectrum Disorders, 4*(4), 577-593. https://doi.org/10.1016/j.rasd.2010.01.014