Sleeping Beauties in Autism Literature: A Review of the Research Literature in the Twentieth Century

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Abstract
Increasing scientific productivity in autism research requires citation evaluations that may produce multiple benefits. One of the most recent citation evaluations is the delayed recognition of scientific productions, known as "Sleeping Beauties", which in this study referred to research articles that were neglected (rarely cited) in the first ten years of publication (ten-year sleep/sleep depth) but suddenly cited in later years (at least ten years later/ten years an opportunity to wake up). Based on the standard and comprehensive selection criteria, out of a total of 8864 papers found in WoS and Medline databases between 1946 and 2000, 197 SB papers were identified. In Scopus, 8550 papers were published between 1946 and 2000, and 232 papers were identified as SB. Gillberg (1983) received the highest SB score in all citation databases, and Vilensky et al. (1981) received the highest SB score among the most cited papers. The innovative nature of the SB papers and the special attention paid to autism in recent years were discussed and concluded as possible reasons for the findings.

Keywords: Sleeping Beauties, Autism, Delayed Recognition, Bibliometrics.

Introduction
The increasing growth of knowledge and the specialization of research fields leads to increased scientific output, which requires repeated quantitative and qualitative measurements of scientific productivity. One of the most important indicators for measuring scientific productivity is the measurement and analysis of research citations (White, 2004). By providing various scientometric indicators and measuring the scientific impact in each field, the study of citations can demonstrate the long-term success of research in the fields under study (Leydesdorff, Bornmann, Comins & Milojević, 2016; Aksnes, Langfeldt & Wouters, 2019).
Also, by providing universal criteria of field expertise (such as the H-index), citation analysis can lead to a qualitative evaluation of researchers, thus facilitating appropriate research communication (Moed, 2009; Herther, 2009).

Despite all the advantages, some papers may be omitted with conventional citation analysis, missing vital information informative to the field of study. Thus, unique solutions should be considered. More specifically, some scientific papers may be neglected in the first years of publication and suddenly noticed in the following years (significant delay in citation). This phenomenon is known as "Sleeping beauty" (SB) in scientometrics literature (Van Raan, 2004). According to a more straightforward definition, SB is a princess (single research) who has been asleep for a long time (not considered/not received significant citation) and, after an extended period, suddenly a prince (another single research) wakes up (considered/cited) (Braun Glänzel & Schubert, 2010; Van Raan, 2004; Ye & Bornmann, 2018). Some events can facilitate the process of identifying neglected research, such as considering old coronavirus research after the onset of the pandemic (Fazeli-Varzaneh, Ghorbi, Ausloos, Sallinger & Vahdati, 2021). Finding SBs research can have several potential benefits; for example, because many SB studies are ahead of their time and therefore neglected, examining SBs can confirm the importance of innovative research (Fang, 2018). Therefore, identifying these studies in the first years of awakening can lead to the recognition of researchers’ opinions and accelerate the progress of the research, and associate the research owners with the benefits of increasing citations (such as receiving financial aid, increasing the probability of winning awards and research cooperation proposals, receiving recognition from their professional field of study or institution) (Fiala, Šubelj, Žitnik & Bajec, 2015; Ebadi & Schifflauerova, 2015). Besides, the evaluation of SBs can benefit research funding organizations by facilitating the identification of research gaps in that field and by allowing research organizations to better identify and address research gaps and direct research dollars to promising areas that were initially neglected.

At the start of this century, SBs evaluation began as a serious topic of discussion by VanRaan (2004). Despite the short life of studies of SBs, and due to the benefits mentioned in diverse fields of knowledge, numerous SB studies have been conducted. For example, SB papers are available within the fields of basic sciences (Ke, Ferrara, Radicchi & Flammini, 2015; Van Raan, 2004), mathematics (Hansen, 2019), computer science (Dey, Roy, Chakraborty & Ghosh, 2017), engineering sciences and physics (Van Raan, 2015), and psychology (Ho & Hartley, 2017).

Two important considerations arise from reviewing the extant SB research literature. First, in many studies reviewed, only general areas of knowledge were examined, while assessment of scientific productivity in specific areas was limited. While the low number of studies may explain one explanation for the low number of studies using the SB methodology within a narrow area, researchers may prioritize the study of large research areas to find a more significant number of SBs. However, examining smaller, more focused areas can provide incredible research benefits. Another issue we observed is that many SB studies failed to apply a standard analytic approach (e.g., ignored their proper implementation). For example, Ho and Hartley (2017) examined SB papers in psychology by simply counting the citations of each paper, resulting in findings that are ambiguous at best and perhaps misleading at worse.

Despite the limitations of the research literature, SB assessment of (a) specific areas of study vs general domains of knowledge and (b) using standard and valid methods has the
potential for more applicable results. One specific area of knowledge that has yet to be evaluated for SBs is Autism Spectrum Disorder (ASD). ASD is one of the most important and common neurodevelopmental disorders (American Psychiatric Association, 2013) that has motivated cross-disciplinary research in various fields of knowledge. The diversity of associated characteristics, the unknown biological causes of the disorder, the cognitive impact (Amaral, 2017), and the increased prevalence across socioeconomic classes (1 out of 54 children; REF; King & Bearman, 2011) all contribute to the complexity and appeal of the ASD research field.

Applying a standardized approach to the assessment of SBs in ASD research will identify studies that were overlooked, with less impact in the field. Therefore, the present study aims to review SB studies in the field of ASD based on standard methods of SB evaluation. The study of SBs may be particularly timely because ASD scientific productivity is on the rise, with several potential outcomes: significant growth in research costs, extreme specialization, and, of course, greater emphasis on high-profile areas and disregarding neglected areas (Matthew Effect in Citation) (Cole, 1970; Wu & Wolfram, 2011). It seems that the evaluation of SBs in the field of ASD can at least help to identify forgotten research and reduce the Matthew effect in ASD studies, provided that the evaluation is standard.

Materials and Methods

Data Collection

The data were obtained from a combination of Web of Science Core Collection and Medline databases (by selecting “Web of Science (WoS) Core Collection” and “Medline” from “Select a database” field). A search was also conducted with the Scopus database to compare with WoS and Medline. Thus, we implemented an analysis of these two datasets and presented a comparison result. The following terms were searched in the topic field (title, abstract, and keyword) on 27 November 2020 to retrieve ASD research:

“Autism” OR “Autistic disorder” OR “Infantile autism” OR “Asperger syndrome” OR “Asperger disorder” OR “Childhood disintegrative disorder” OR “Heller’s syndrome” OR “Disintegrative psychosis” OR “Pervasive developmental disorder*” OR “Pervasive developmental disorder not otherwise specified” OR “PDD-NOS”

The coverage of retrieved papers in WoS and Medline was during 1946-2020. We collected the papers published between the first year to 2000 (by considering 10 years for the sleep period and 10 years for the awake period, the papers were removed from 2001 to 2020 as recommended by Van Raan, 2015, 2017). A total was received from WoS and Medline. As shown in Figure 1, the number of papers has generally grown positively and reached its peak in 2000 (809 papers). We downloaded the citation data (during 1946-2020) from the “Create Citation Report” section in WoS.

Scopus covered the papers between 1970 to 2020, as before, we collected the papers published between the first year to 2000 (to account for the sleep period and awake period, the papers published during 2001-2020 were not considered). Finally, we downloaded the citation data of 8550 papers from the “Citation Overview” section in Scopus, published during 1970-2000 and cited during 1970-2020. Also, the growth rate of autism research in Scopus (Figure 1) is similar to that in WoS and Medline and reached its peak in 2000 (796 documents).
Finding Sleeping Beauties (SBs)

Generally, Van Raan (2015, 2017) considers four main variables for SB: (1) depth of sleep in terms of a maximum citation rate during the sleeping period (an average annual citation less than 1 in sleeping period length), (2) 10 years sleeping period length after publication, (3) 10 years awake period in years after the sleeping period (the reason we considered publications up to 2000 is that the SBs collection must have experienced at least 10 years of sleep and 10 years of awake period), (4) awake intensity in terms of a minimum citation rate during the awake period (We considered papers that have a complete citation at least 5 during the awake period).

The beauty Coefficient (B-score) was introduced by Ke et al. (2015), and afterward, the modified coefficient was introduced by Du and Wu (2018). The value of the modified beauty coefficient is denoted as Bcp. This systematic methodology is helpful for low citation (or not-so-highly cited) papers and identifies the SBs' key characteristics.

Bcp-score is defined as follows:

\[ Bcp = \sum_{t=0}^{t_m} \frac{1 - c_0}{t_m} \cdot t + c_0 - c_t \]

Where \( t \) is the (discrete integer) year number (for example, the first year of publication \( t_0 \) is 0, the following year \( t_1 \) is 1, etc., up to \( t_m \), \( c_t \) is the cumulative percentage of citation history of the paper in year of \( t \) (for example, \( c_0 \) is the cumulative percentage of citations in the first year of publication up to \( c_m \)(the cumulative percentage of citations in the last year of publication).

The Bcp-score was calculated for all papers of “WoS and Medline” and “Scopus” in Excel 2013 software. By exerting main variables on data, a total of 197 SBs in the WoS and Medline datasets, and 232 SBs in the Scopus dataset remained (Figure. 2).
The distribution of all SBs in terms of Bcp-score is shown in Figure 3. Because the value of the Bcp-score for the papers that have not received citations so far is 0, we did not consider these papers to calculate the Bcp-score. Thus, the Bcp-score of SBs is greater than 0.

### Results

**Overall SBs in Autism**

Using the information gained from the WoS and Medline dataset, the features of the top 10 overall SBs ranked by Bcp-score are presented (Table 1). 197 SBs were found in the WoS and Medline datasets with a Bcp-score greater than 0. According to Table 1, the paper entitled “Are autism and anorexia-nervosa related” in the WoS and Medline datasets has the greatest Bcp-score. This paper, published by Gillberg in 1983, received the maximum number of citations in 2020, has been cited 50 times so far (average of 1.31 citations per year), and was cited only once in the first 10 years of publication. Next, the paper entitled “Autism and autoimmune disease: a family study” by Money, Bobrow and Clarke (1971) received a Bcp-score of 10.78. This paper received 4 citations in the first 10 years of publication (and 71 overall citations) and
the maximum number of citations in 2009. Generally, 7 of the top 10 SBs have been published by US-affiliated authors. The range of publication years of these top 10 SBs is from 1971 to 1992, and the year of maximum citations is between 2009 and 2020. On average, the lag time between publication and the year of maximum citations of these top 10 SBs is 33.3 years.

Table 1


<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Collaborator Countries</th>
<th>Year of Publication</th>
<th>Year of Maximum Citations</th>
<th>Total citations</th>
<th>Annual citation (for the first 10 years of publication)</th>
<th>Annual citation (Overall)</th>
<th>Bep</th>
</tr>
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<tbody>
<tr>
<td>Are autism and anorexia-nervosa related</td>
<td>Christopher Gillberg</td>
<td>British Journal of Psychiatry</td>
<td>Sweden</td>
<td>1983</td>
<td>2020</td>
<td>50</td>
<td>0.1</td>
<td>1.31</td>
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<tr>
<td>Autism and autoimmune disease: a family study</td>
<td>John Money et al.</td>
<td>Journal of Autism and Childhood Schizophrenia</td>
<td>USA</td>
<td>1971</td>
<td>2009</td>
<td>71</td>
<td>0.3</td>
<td>1.42</td>
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<td>Assessment of the autistic patient’s dental needs and ability to undergo dental examination</td>
<td>O. Lowe and R. Lindemann</td>
<td>Journal of Dentistry for Children</td>
<td>USA</td>
<td>1985</td>
<td>2019</td>
<td>44</td>
<td>0</td>
<td>1.22</td>
<td>10.6</td>
</tr>
<tr>
<td>Girls with social deficits and learning problems: Autism, atypical Asperger syndrome or a variant of these conditions</td>
<td>Svenny Kopp and Christopher Gillberg</td>
<td>European Child &amp; Adolescent Psychiatry</td>
<td>Sweden</td>
<td>1992</td>
<td>2017</td>
<td>63</td>
<td>0</td>
<td>2.17</td>
<td>10.3</td>
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<td>Dental management of the autistic child</td>
<td>Saul Kamen and Judith Skier</td>
<td>Special Care in Dentistry</td>
<td>USA</td>
<td>1985</td>
<td>2011</td>
<td>31</td>
<td>0</td>
<td>0.86</td>
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<td>Cross-disciplinary perspectives on autism</td>
<td>Wendy L. Stone</td>
<td>Journal of Pediatric Psychology</td>
<td>USA</td>
<td>1987</td>
<td>2019</td>
<td>66</td>
<td>0.6</td>
<td>1.94</td>
<td>8.5</td>
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<tr>
<td>Pronoun errors in autistic children: Support for a social explanation</td>
<td>Rosalind Charney</td>
<td>British Journal of Disorders of Communication</td>
<td>USA</td>
<td>1980</td>
<td>2020</td>
<td>28</td>
<td>0.3</td>
<td>0.68</td>
<td>8.3</td>
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<td>Title</td>
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<td>Journal</td>
<td>Collaborator Countries</td>
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<td>Year of Maximum Citations</td>
<td>Total citations</td>
<td>Annual citation (for the first 10 years of publication)</td>
<td>Annual citation (Overall)</td>
<td>Bcp</td>
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<tr>
<td>The acquisition of grammatical morphemes in autistic children: A critique and replication of the findings of Bartolucci, Pierce, and Streiner, 1980</td>
<td>Patricia Howlin</td>
<td>Journal of Autism and Developmental Disorders</td>
<td>England</td>
<td>1984</td>
<td>2016</td>
<td>39</td>
<td>0.2</td>
<td>1.05</td>
<td>8.2</td>
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<tr>
<td>Gait disturbances in patients with autistic behavior: a preliminary study</td>
<td>Joel Vilensky et al.</td>
<td>ARCHIVES OF NEUROLOGY</td>
<td>USA</td>
<td>1981</td>
<td>2013</td>
<td>166</td>
<td>0.7</td>
<td>4.15</td>
<td>8.1</td>
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<tr>
<td>Behavioral phenotypes in organic genetic disease: presidential address to the Society for Pediatric Research</td>
<td>William Nyhan</td>
<td>Pediatric Research</td>
<td>USA</td>
<td>1972</td>
<td>2009</td>
<td>76</td>
<td>0.5</td>
<td>1.55</td>
<td>8</td>
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</table>

Table 2 shows the top 10 SBs in Scopus. Half of the top SBs papers in Table 2 overlap with the top 10 SBs in Table 1 (First, second, third, sixth, and eighth papers). The order of the top two SBs in the mentioned tables is the same. The only significant difference was that the Bcp-score of these two papers was slightly lower in the Scopus database. Generally, 6 of the top 10 SBs were published by US-affiliated authors. As can see in this table, 4 of the top 10 SBs were published by the Journal of Autism and Childhood Schizophrenia. The publication year of these SBs is between 1971-1985, and the coverage of maximum citation year is during 2007-2020. Therefore, on average, these 10 SBs have received their maximum citations after 35.8 years of publication.
### Table 2

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Collaborator Countries</th>
<th>Year of Publication</th>
<th>Year of Maximum Citations</th>
<th>Total Citations</th>
<th>Annual citation (for the first 10 years of publication)</th>
<th>Annual citation (Overall)</th>
<th>Bep.</th>
</tr>
</thead>
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<tr>
<td>Are autism and anorexia-nervosa related</td>
<td>Christopher Gillberg</td>
<td>British Journal of Psychiatry</td>
<td>Sweden</td>
<td>1983</td>
<td>2020</td>
<td>53</td>
<td>0.1</td>
<td>1.39</td>
<td>12.4</td>
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<tr>
<td>Autism and autoimmune disease: a family study</td>
<td>John Money et al.</td>
<td>Journal of Autism and Childhood Schizophrenia</td>
<td>USA</td>
<td>1971</td>
<td>2009</td>
<td>74</td>
<td>0.1</td>
<td>1.48</td>
<td>11.6</td>
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<td>Behavioral phenotypes in organic genetic disease: presidential address to the Society for Pediatric Research, May 1, 1971</td>
<td>William L. Nyhan</td>
<td>Pediatric Research</td>
<td>USA</td>
<td>1972</td>
<td>2017</td>
<td>79</td>
<td>0.4</td>
<td>1.61</td>
<td>9.9</td>
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<tr>
<td>Malabsorption and cerebral dysfunction: a multivariate and comparative study of autistic children</td>
<td>Mary Stewart Goodwin et al.</td>
<td>Journal of Autism and Childhood Schizophrenia</td>
<td>USA</td>
<td>1971</td>
<td>2009</td>
<td>76</td>
<td>0.6</td>
<td>1.52</td>
<td>9.7</td>
</tr>
<tr>
<td>Proprioceptive versus visual control in autistic children</td>
<td>Brooks A. Masterton and Gerald B. Biederman</td>
<td>Journal of Autism and Developmental Disorders</td>
<td>Canada</td>
<td>1983</td>
<td>2012</td>
<td>43</td>
<td>0.0</td>
<td>1.13</td>
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<td>Assessment of the autistic patient’s dental needs and ability to undergo dental examination</td>
<td>O. Lowe and R. Lindemann</td>
<td>Journal of Dentistry for Children</td>
<td>USA</td>
<td>1985</td>
<td>2012</td>
<td>53</td>
<td>0.3</td>
<td>1.47</td>
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<td>The rationale for computer-based treatment of language difficulties in nonspeaking autistic children</td>
<td>Kenneth Mark Colby</td>
<td>Journal of Autism and Childhood Schizophrenia</td>
<td>USA</td>
<td>1973</td>
<td>2013</td>
<td>88</td>
<td>0.7</td>
<td>1.83</td>
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<tr>
<td>Gait disturbances in patients with autistic behavior: a preliminary study</td>
<td>Joel A. Vilenksy et al.</td>
<td>Archives of Neurology</td>
<td>USA</td>
<td>1981</td>
<td>2013</td>
<td>182</td>
<td>0.8</td>
<td>4.55</td>
<td>8.6</td>
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</table>
Autistic phenomena in neurotic patients
Sydney Klein
International Journal of Psycho-Analysis
England
1980
2018
121
0.6
2.95
8.4

Maintenance of sameness in children with Kanner’s syndrome
Margot Prior et al.
Journal of Autism and Childhood Schizophrenia
Australia
1973
2007
49
0.5
1.02
8.3

Figure 4 shows the number of citations to the paper “Are autism and anorexia-nervosa related” (Gillberg, 1983) as the topmost Sleeping Beauty in all databases. The blue line indicates the number of citations per year, and the brown line indicates the cumulative distribution of citations. The citation distribution is similar across the Scopus, WOS, and Medline databases. This paper has been cited an average of 0.15-0.19 times from 1983 to 2008 (25 years), illustrating its deep sleep until 2008. Increased citations started in 2009 and peaked in 2020 (by 10 and 11 citations). This paper has been cited 46-48 times during his waking period with an average of 21-25-fold citations during his sleep period (on average, 3.8 to 4 citations per year).

Figure 4: The Topmost Sleeping Beauty (Gilberg, 1983) in all Databases

Highly cited SBs in Autism
The top 10 SBs in WoS and Medline are sorted by the number of citations (Table 3). As seen in this table, the paper entitled “Gait disturbances in patients with autistic behavior: a preliminary study” by Vilensky et al. was published by the Archives of Neurology in 1981 and received the maximum citations (n=16) in 2013. This paper received 166 citations (an average of 4.15 per year) but was cited only 7 times in the first ten years of publication. After that, there is another paper entitled “Perceptions of Stigma: The Parents of autistic children” by Gray
(1993) with 154 overall citations. The second paper received 6 citations in the first 10 years of publication and the maximum number of citations in 2018. The overall citation of other papers was significantly lower than the two papers. In total, 6 of 10 SBs were published by US-affiliated authors. Also, three of these 10 SBs have been published by the Journal of Autism and Developmental Disorders. The average time between publication and the year of maximum citations among these 10 SBs is 23.8 years.

Table 3

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Journal</th>
<th>Collaborator Countries</th>
<th>Year of Publication</th>
<th>Year of Maximum Citations</th>
<th>Total citations</th>
<th>Annual citation (for the first 10 years of publication)</th>
<th>Annual citation (Overall)</th>
<th>Bep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait disturbances in patients with autistic behavior: a preliminary study</td>
<td>Joel A. Vilensky et al.</td>
<td>Archives of Neurology</td>
<td>USA</td>
<td>1981</td>
<td>2013</td>
<td>166</td>
<td>0.7</td>
<td>5.5</td>
<td>8</td>
</tr>
<tr>
<td>Perceptions of stigma: The parents of autistic children</td>
<td>David E. Gray</td>
<td>Sociology of Health &amp; Illness</td>
<td>Australia</td>
<td>1993</td>
<td>2018</td>
<td>154</td>
<td>0.4</td>
<td>5.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Parent and professional evaluations of family stress associated with characteristics of autism</td>
<td>James M. Bebko et al.</td>
<td>Journal of Autism and Developmental Disorders</td>
<td>Canada</td>
<td>1987</td>
<td>2011</td>
<td>129</td>
<td>0.6</td>
<td>3.79</td>
<td>6</td>
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<tr>
<td>Depressed lymphocyte responsiveness in autistic children</td>
<td>E. Gene Stubbs</td>
<td>Journal of Autism and Childhood Schizophrenia</td>
<td>USA</td>
<td>1977</td>
<td>2002</td>
<td>125</td>
<td>0.9</td>
<td>2.84</td>
<td>3.9</td>
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<td>Understanding minds and metaphors: Insights from the study of figurative language in autism</td>
<td>Francesca GE. Happé</td>
<td>Metaphor and Symbolic Activity</td>
<td>England</td>
<td>1995</td>
<td>2018</td>
<td>120</td>
<td>0.9</td>
<td>4.61</td>
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<tr>
<td>Brief report: morality in the autistic child</td>
<td>Robert JR Blair</td>
<td>Journal of Autism and Developmental Disorders</td>
<td>England</td>
<td>1996</td>
<td>2009</td>
<td>110</td>
<td>0.8</td>
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<tr>
<td>Viral exposure and autism</td>
<td>Eva Y. Deykin and Brian MacMahon</td>
<td>American Journal of Epidemiology</td>
<td>USA</td>
<td>1979</td>
<td>2017</td>
<td>108</td>
<td>0.9</td>
<td>2.57</td>
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</table>
Table 4 shows the top SBs in Scopus ranked by total citation. The first, second, third, eighth, and ninth papers in Table 4 overlap with the top-cited papers in Table 3, but with different citations reported. While the order of the top three papers in the mentioned tables is the same, the only significant difference is that more citations of the top papers in the Scopus database were identified. Likewise, 7 of 10 SBs were published by US-affiliated authors. The average time between publication and the year of maximum citations among the 10 SBs presented in Table 4 is 27.9 years.
### Table 4

<table>
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<th>Title</th>
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<th>Journal</th>
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<td>Australia</td>
<td>1993</td>
<td>2020</td>
<td>178</td>
<td>0.8</td>
<td>6.35</td>
<td>7</td>
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<td>The development of contingent discourse ability in autistic children</td>
<td>Helen Tager-Flusberg and Marcia Anderson</td>
<td>Journal of Child Psychology and Psychiatry</td>
<td>USA</td>
<td>1991</td>
<td>2015</td>
<td>135</td>
<td>0.9</td>
<td>4.5</td>
<td>5.3</td>
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<td>Hyper-responsivity to touch and vestibular stimuli as a predictor of positive response to sensory integration procedures by autistic children</td>
<td>A. Jean Ayres and Linda S. Tickle</td>
<td>American Journal of Occupational Therapy</td>
<td>USA</td>
<td>1980</td>
<td>2020</td>
<td>128</td>
<td>0.6</td>
<td>3.12</td>
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<td>Parent and professional evaluations of family stress associated with characteristics of autism</td>
<td>James M. Bebko et al.</td>
<td>Journal of Autism and Developmental Disorders</td>
<td>Canada</td>
<td>1987</td>
<td>2013</td>
<td>123</td>
<td>0.6</td>
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<td>Autistic phenomena in neurotic patients</td>
<td>Sydney Klein</td>
<td>International Journal of Psycho-Analysis</td>
<td>England</td>
<td>1980</td>
<td>2018</td>
<td>121</td>
<td>0.6</td>
<td>2.95</td>
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<td>Psycho-social well-being among the parents of children with autism</td>
<td>David E. Gray and William J. Holden</td>
<td>Australia and New Zealand Journal of Developmenatal Disabilities</td>
<td>Australia, USA</td>
<td>1992</td>
<td>2014</td>
<td>118</td>
<td>0.5</td>
<td>4.06</td>
<td>4.6</td>
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<tr>
<td>Viral exposure and autism</td>
<td>Eva Y. Deykin and Brian MacMahon</td>
<td>American Journal of Epidemiology</td>
<td>USA</td>
<td>1979</td>
<td>2003</td>
<td>115</td>
<td>0.5</td>
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Discussion

Nowadays, citation analysis has an important role in qualitative research evaluation at the macro level. Few dynamic organizations can be found that do not take advantage of citation analysis in their future management and planning. However, the evaluation of SBs is less well-known than other citation analyzers and is a relatively new field. Given the importance of ASD research, the number of studies in the area, and the diversity of different disciplines related to ASD research, citation research is necessary. Because of the lack of evaluation of SBs, there was a need for systematic research on SBs in this area. To address this knowledge gap, we examined SBs papers in the field of ASD using a standardized and comprehensive approach—standard due to the use of valid methods and criteria and comprehensive due to the inclusion of almost all research literature in various citation databases.

By applying different criteria and assumptions for the analysis, the number of papers was significantly reduced, resulting in only 429 papers with a positive Bcp-score for data analysis. According to Figure. 5, the number of SB autism studies in the early years of the disorder (the 40s to 70s) was significantly lower. Apart from the small number of studies in these years, this could indicate the importance of ASD research in the very first years of publication. In fact, during these years, autism was considered an emerging disorder, and the research community at that time was testing various interesting hypotheses in this field, so less research was neglected. For example, we can refer to psychoanalytic theories about the mother-child relationship (refrigerator mothers hypothesis) from the mid-1940s to the 1960s and various studies that agree with these theories; Similarly, opposing studies identified autism as a neurodevelopmental failure and additional studies that sought to address with symptoms of autism with behavioral interventions (Rimland, 1968; Ward, 1970; Kanner, 1943; Mahler, 1958). According to Figs. 5 and 6, specifically in all citation databases studied, most studies with a Bcp-positive score were published in the mid-1980s. This phenomenon could have been influenced by the advent of the DSM-III in 1980 (American Psychiatric Association, 1980), as it was the first time for researchers (experts) to agree that autism is a distinct disorder; That is, the "Infantile Autism" diagnostic label became a separate diagnostic criterion that distinguished
autism from childhood schizophrenia. The availability of diagnostic criteria, with the increasing prevalence of the disorder and the study of autism in universities in general, multiplied the growth of research.

Similarly, with the increase in the number of papers, the number of neglected quality papers (SBs research) also increased. In addition, according to Figures. 5 and 6, the maximum number of citations for SBs research (Awakening) began in the mid-1990s. One possible reason was that the availability of diagnostic criteria for different forms of autism (such as Asperger's Disorder) increased research motivation and attention to forgotten research. Likewise, more attention to SB research in this decade may be influenced by federal laws that require public education services to children and youth with autism (e.g., the Individuals with Disabilities Education Act in the United States). Further, the generalization of autism federal protection laws in different countries, the integration of autism disorders into one spectrum (autism spectrum disorder), and special attention to milder forms in DSM-5 (American Psychiatric Association, 2013) could justify increased attention to SB autism research in the twentieth century (especially from 2010 onwards).

Figure 5: Distribution of SBs papers (Bcp+) based on Year of Publication and Year of Maximum Citations in WoS and Medline
The abundance of ASD research calls for the specialized assessment using SB methodology. Paying attention to the details of autism research areas and putting previous innovative topics in the direction of the needs of clients and policymakers can lead to the awakening of SB autism research. For example, the identified SB research by Gilberg (1983) examined the relationship between autism and anorexia nervosa, a topic that addressed two emerging disorders (recently coded in the DSM-III). These areas of study were not evaluated thoroughly until decades later. In recent years, due to the health needs of people with ASD and attention to mild forms of autism (autistic traits) in other psychological problems (such as anorexia nervosa), Gillberg’s study was considered relevant and cited. Other top SBs included the investigation of the relationship between autism and autoimmune functions and viral diseases (Money et al., 1971; Stubbs, Crawford, Burger & Vandenbark, 1977; Deykin & MacMahon, 1979), computer-based interventions in the autism treatment plan (Colby, 1973), and other innovative papers (in published time).

Another interesting finding of the significant number of top SBs was the publication journal. That is, 12 unique studies ranging from 1971 to 1991 were published in the "Journal of Autism and Developmental Disorders", previously published as the "Journal of Autism and Childhood Schizophrenia". This could indicate the journal's willingness to publish innovative work. Similarly, the renaming and scope of the journal, along with the sweeping changes in the study of autism in the late 1970s (Schopler, Rutter & Chess, 1979) may further signal the journal's innovative approach to publishing novel autism research.

There are limitations to our study. First, the most critical limitation is the impossibility of comparing our findings with those of other researchers using the modified formula. This limitation is partly due to timing. The modified formula we applied was recently published (Du and Wu, 2018). Recall that we used this formula to resolve problems caused by the original formula of large and exaggerated scores, especially problematic for smaller and more narrow areas of research such as ASD. This modified formula is justified because we selected a specific research area for study. Second, the present study was the first to identify SB research in the field of ASD. Thus, it is not possible to compare results, even with research based on other SB

Figure 6: Distribution of SBs papers (Bcp+) based on Year of Publication and Year of Maximum Citations in Scopus
detection methods. Third, our review of SB research excludes studies from 2000 onwards. As explained earlier, the reason for this was the criteria of analysis as papers for analysis of SB must have had at least 10 years of sleep (10 years have passed since its publication) and the opportunity to wake up (Receive citations). Specifically, studies from 2000 onwards failed to meet these criteria.

**Conclusion**

This was the first study to evaluate SBs research on ASD. The study showed research on SBs in ASD in various health science fields. In our analysis, some identified studies were innovative and were ahead of their time, although they may have been immature in some ways and were neglected. This study found that innovative papers in the field of ASD are prone to be overlooked if they are not well polished and outside the mainstream of research. This study, given the overlooked papers on ASD, believes that timely attention to innovative papers can help grow less well-known areas as soon as possible. Considering the remarkable increase in ASD studies in these years, the analysis of SBs in the following years (considering the papers published in the mentioned years) can have significant and unexpected results. Finally, future research can take an essential step in facilitating the introduction of these studies and authors and address unanswered research questions by focusing on the early/premature detection of SBs research in ASD literature.

**Declarations**

**Author contribution:** MF-V and MS contributed to the design and implementation of the research, analysis of the results, and writing of the manuscript. LAR contributed to language editing, provided critical reviews of the manuscript, and ensured data presented in tables and text were accurate. All authors approved the final manuscript as submitted and agree to be responsible for all aspects of the work.

**Conflict of interest:** The authors declare they have no conflict of interest.

**Ethical Approval:** This article contains no studies with human participants or animals performed by authors. So, ethical approval or participant consent is not required in the article.

**Data Availability Statements:** The datasets generated during and/or analyzed during the current study are available on the Web of Science, [http://www.webofknowledge.com/](http://www.webofknowledge.com/)

**References**


