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# Algorithmic exploration of thematic links between children's rights and biological parents

Exploración algorítmica de los vínculos temáticos entre los derechos de los niños y los padres biológicos

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## Abstract

This article explores thematic links between children's rights and biological parents using Scopus data (1963–2023). A dual clustering method DBSCAN followed by K-means segments concepts into three clusters. The first links "Reunification" and "Parents"; the second, "Family" and "Adolescent". The third, subdivided via Ward's method, explores adoption, parenting, violence, genetics, and extended family. Data analysis and graph visualization were performed in R Studio. The results reveal underexplored conceptual interactions and open multidimensional research perspectives.

Keywords: children's rights; biological parents; thematic links analysis; clustering analysis; R Studio.

## Resumen

Este artículo explora los vínculos temáticos entre los derechos del niño y los padres biológicos utilizando datos de Scopus (1963–2023). Se aplica un enfoque de agrupamiento dual DBSCAN seguido de K-means para segmentar conceptos en tres clústeres. El primero vincula "Reunificación" y "Padres"; el segundo, "Familia" y "Adolescente". El tercero, subdividido mediante el método de Ward, aborda adopción, crianza, violencia, genética y familia extendida. El análisis de datos y la visualización se realizaron con R Studio. Los resultados revelan interacciones conceptuales poco exploradas y abren nuevas perspectivas multidimensionales.

Palabras clave: derechos de los niños; padres biológicos; análisis de vínculos temáticos; análisis de agrupamiento; R Studio.

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# I. Introduction

Under 7 and 9 (3) articles of the Convention on the Rights of the Child each child has the right to know his or her parents. Also separated from his or her biological parents' child has the right for regular contacts with them<sup>1</sup>. A person's origins refer first and foremost to the bodily dimension, to so-called "biological" origins. The search for one's origins therefore naturally aims to obtain information about those who made it possible for us to come into the world<sup>2</sup>. This genetic dimension of the quest for origins has been greatly accentuated in recent years by scientific developments. Scientific progress has made it possible to multiply the number of people involved in the procreation process (gamete donors, embryo donors, surrogate mothers), and to verify a person's biological origins with virtual certainty thanks to genetic expertise (or DNA testing)<sup>3</sup>.

All children have the natural right to live with their parents, communicate with them and maintain legal, social and emotional ties. The father and mother who's DNA the child carries are usually called the child's biological parents<sup>4</sup>. Family relations with the child according to the law bind legal parents, but nowadays biological parents are increasingly being replaced by other persons, i.e. careers, guardians or adoptive parents who are not necessarily related. When a child loses one or both parents, there is a need to transfer the responsibilities of biological parents to other persons or institutions. With the emergence of a family that wants to fulfill the rights and duties of parents and with whom there is no biological connection, the institute of social parents appears which successfully replaces biological parents.

Considering this, two types of parenting are distinguished, i.e., biological and social parenting<sup>5</sup>. The relationship between a child and a parent is fundamental in human life. Parental rights and responsibilities regarding a child are related to legal parentage<sup>6</sup>. For this reason, it is important that social parentage is established as early as possible in a child's life after changing biological parents, as this will provide the child with security and stability. The increased incidence of children living apart from their biological father or mother, or both, raises the question of the child's right to know his biological parents.

The situations that raise this question are extremely varied, and the answers offered, whether in the form of existing laws, policies or common practice, are inconsistent in each case due to different histories or contemporary sensibilities. According to

1. UNCRC, 'United Nations Convention on the Rights of the Child. State Newsno, 1995, No. 60-1501.'
2. Francisco J Ayala, 'The Difference of Being Human: Morality' (2010) 107 Proceedings of the National Academy of Sciences 9015.
3. Nancy J Chodorow, *The Reproduction of Mothering: Psychoanalysis and the Sociology of Gender* (Univ of California Press 2023).
4. Elizabeth R Kirk, 'PARENTAL RIGHTS: IN SEARCH OF COHERENCE' (2023) 27 *Texas Review of Law & Politics* 729.
5. L.Melina, 'Talking to Children about Their Adoption: When to Start, What to Say, What to Expect' (2000) 19 *Adopted Child* 1.
6. Kirk (n 4).

UNICEF, about 15.1 million orphans worldwide have lost both of their parents. As children move from one stage of development to another, they acquire new cognitive skills and psychosocial structures<sup>7</sup>. They have different views on life and often have more worries or problems<sup>8</sup>. The relationship between biological parents and their children is exceptionally close and comprehensive, at least from a child's perspective. A child's relationship with his or her biological parents is the closest of that child's human relationship. This determines the identity of the child. Children may be born to different parents, and assisted reproduction or surrogacy procedures mean that the child's right to know their biological parents must be properly regulated and enforced, so that the child's current and future well-being is important<sup>9</sup>.

The relevance of the topic is determined by the fact that we currently have the recognition of biological paternity in the law, but in court practice, we see that biological paternity is no longer the main reason for legalizing and maintaining parental relations. Not so long ago, biological parenthood had priority over social parenthood, but today much attention is paid specifically to the legitimate interests of the child and attempts are made to find a balance between the interests of adults and the interests of children. Courts adhere to the principle of the primacy of the child's interests<sup>10</sup>.

Based on the above, the aim of this research is to explore and analyze the thematic relationships between "children's rights" and "biological parents" in scientific publications. To do so, it adopts a hybrid clustering approach based on machine learning to optimize overall performance on our datasets, while further exploring the most relevant and significant thematic links. Exploring the thematic links aims to highlight the reciprocal interactions and influences between these two fields. The idea of identifying thematic links opens up new conceptual perspectives, while highlighting dimensions previously neglected and less explored by researchers, requiring more nuanced and multidimensional explorations.

After presenting the background and objectives of our research, we review the literature that has evolved in relation to our research topic over the last few decades, and then detail our methodological choices. We then present the results obtained from our cluster analysis and our exploration of thematic connections. In conclusion, a general discussion will be devoted to interpreting the main aspects of our results and outlining avenues for future research.

7. Melina (n 5).

8. Olivia N Saracho, 'Theories of Child Development and Their Impact on Early Childhood Education and Care' (2023) 51 *Early Childhood Education Journal* 15.

9. Samantha Besson, 'Enforcing the Child's Right to Know Her Origins: Contrasting Approaches under the Convention on the Rights of the Child and the European Convention on Human Rights' (2007) 21 *International Journal of Law, Policy and the Family* 137.

10. Catherine M Wade and others, 'Focus on Fathers: Exploring the Parenting Experiences of Fathers Using a Large Population-Level Sample' (Springer 2023).

## 2. Literature review

By exploring the literature of the last decade concerning the relationship between children's rights and biological parents, we have identified three main research directions. This systematic review reveals a notable evolution in the way children's rights to know and maintain relationships with their biological parents are approached, reflecting changes in legal, social and ethical perspectives.

Family dynamics and parenting issues. This research orientations explores the experiences and challenges of modern parenthood. It includes studies of birth experiences<sup>11</sup>, the challenges of LGBT co-parenting following the legalization of same-sex marriage<sup>12</sup>, and the complex identity of a Jewish orphan<sup>13</sup>. It also examines the legal and practical aspects of parenthood<sup>14</sup>, including in specific contexts such as HIV-affected families<sup>15</sup> and LGBT families<sup>16</sup>. The philosophical implications of same-sex marriage<sup>17</sup>, children's right to be loved<sup>18</sup>, legal and constitutional developments relating to the family<sup>19</sup>, parents' work-life balance<sup>20</sup>, changing patterns of motherhood in Japan<sup>21</sup>, inheritance issues in non-traditional families<sup>22</sup>, and the genetic causes of pigment mosaicism<sup>23</sup> are also discussed.

Children's rights, adoption and family welfare. These lines of research covers adoption and children's rights in a variety of contexts. It covers conceptual analysis of adoption<sup>24</sup>, court cases concerning parents' and children's rights (Helland & Hollekim, 2023 ; Breen et al., 2020; Frostell, 2020 ; Ben-David, 2020) and life after out-of-home placement<sup>25</sup>. It explores parental leave reforms<sup>26</sup>, non-parental childcare

11. Geoffrey W Corner and others, 'The Birth of a Story: Childbirth Experiences, Meaning-Making, and Postpartum Adjustment.' [2023] *Journal of Family Psychology*.
12. Sara I. Friedman and Chao-Ju Chen, 'Same-Sex Marriage Legalization and the Stigmas of LGBT Co-Parenting in Taiwan' (2023) 48 *Law & Social Inquiry* 660.
13. Kateřina Králová, 'What Is True and What Is Right? An Infant Jewish Orphan's Identity' (Springer 2020).
14. Douglas NeJaime, 'The Constitution of Parenthood' (2020) 72 *Stan. L. Rev.* 261.
15. Sally Mason, 'Custody Planning with HIV-Affected Families: Considerations for Child Welfare Workers' [2017] *Children and HIV/AIDS* 61.
16. Michael J Higdon, 'Biological Citizenship and the Children of Same-Sex Marriage' (2019) 87 *Geo. Wash. L. Rev.* 124.
17. Tapio Puolimatka, 'How Wolterstorff's Defense of Same-Sex Marriage Violates His Theory of Justice: Philosophical Note on Wolterstorff's Argument for Same-Sex Marriage' (2017) 19 *Philosophia Christi* 363.
18. S Matthew Liao, 'The Right of Children to Be Loved 1', *What Is Right for Children?* (Routledge 2016).
19. James R. Stoner Jr., 'Does the Law and the Constitution of the Family Have to Change?' (2016) 45 *Perspectives on Political Science* 80.
20. Barbara Hobson and Susanne Fahlén, 'Parent's Work–Life Balance: Beyond Responsibilities and Obligations to Agency and Capabilities', *Regulating family responsibilities* (Routledge 2016).
21. Susan D Holloway, Yoko Yamamoto and Sawako Suzuki, 'What Is a Good Mother? Historical Shifts, Divergent Models in Urban Japan', *Parenting After the Century of the Child* (Routledge 2016).
22. Danaya C Wright, 'Inheritance Equity: Reforming the Inheritance Penalties Facing Children in Nontraditional Families' (2015) 25 *Cornell JL. & Pub. Pol'y* 1.
23. Ken Saida and others, 'Monogenic Causes of Pigmentary Mosaicism' (2022) 141 *Human Genetics* 1771. also known as hypomelanosis of Ito, is a neurocutaneous syndrome considered to be predominantly caused by somatic chromosomal mosaicism. However, a few monogenic causes of pigmentary mosaicism have been recently reported. Eleven unrelated individuals with pigmentary mosaicism (mostly hypopigmented skin
24. Zahra Amrollah Majdabadi Kohne and others, 'Concept Analysis of Adoption: A Hybrid Model' [2023] *Journal of Child and Adolescent Psychiatric Nursing*.
25. Ruwayda Said Salem and Lieselot De Wilde, 'Life after an Out-of-home Placement: What Biological Parents in Foster Care Tell Us about Parenthood' (2022) 27 *Child & Family Social Work* 112.
26. Anna Moring and Johanna Lammi-Taskula, 'Parental Leave Reforms in Finland 1977–2019 from a Diversity Perspective' (2021) 9 *Social Inclusion* 338.

rights<sup>27</sup>, and the role of minor parents<sup>28</sup>. Studies also cover surrogacy<sup>29</sup>, knowing the identity of biological parents<sup>30</sup>, stress in adoptive and biological parents<sup>31</sup>, professional foster care<sup>32</sup>, the health of neglected children<sup>33</sup>, and redefining parental responsibilities<sup>34</sup>. Other topics include listening to children's voices in decision-making<sup>35</sup>, parental guilt<sup>36</sup>, biological parenthood as a human right<sup>37</sup>, step-parent adoptions<sup>38</sup>, recognizing parent-child relationships resulting from surrogate gestation<sup>39</sup>, and anonymous birth<sup>40</sup>.

Reproductive rights, technology and ethics. This research direction focuses on the intersections between technology, ethics and reproductive rights. It includes studies on reproductive autonomy<sup>41</sup>, the path to parenthood for LGBT individuals<sup>42</sup>, and the implications of medical technology<sup>43</sup>. The motivations behind anonymous gamete donation<sup>44</sup>, neurobiological responses related to family history of alcohol abuse<sup>45</sup>, and the use of technology to trace the origins of orphaned children<sup>46</sup> are examined. This research orientations also discusses the role of films in depicting the destruction of families<sup>47</sup>, the neurobiology of rewards in children<sup>48</sup>, family

27. Daleer Kaur Randawan, Akbar Kamarudin and Abdul Stukor, 'Non-Parental Child Custody Rights: A Comparative Perspective' (2020) 28 *Intellectual Discourse* 529.
28. Helen Lynne Turnham, Ariella Binik and Dominic Wilkinson, 'Minority Report: Can Minor Parents Refuse Treatment for Their Child?' (2020) 46 *Journal of medical ethics* 355.
29. Susan Kennedy, 'Willing Mothers: Ectogenesis and the Role of Gestational Motherhood' (2020) 46 *Journal of medical ethics* 320.
30. Mathilde Nacher and others, 'Mapping French People's Positions Regarding the Children's Right to Know Their Biological Parents' Identity' (2020) 29 *Journal of Child and Family Studies* 1723.
31. Elena Canzi and others, '"Your Stress Is My Stress": A Dyadic Study on Adoptive and Biological First-Time Parents.' (2019) 8 *Couple and Family Psychology: Research and Practice* 197.
32. Jan P Basiaga, Anna Róg and Beata Zięba-Kolodziej, 'Professional Foster Families in the Reunification Process—Polish Experience' (2018) 23 *Child & Family Social Work* 649.
33. Susann Regber, Jovanna Dahlgren and Staffan Janson, 'Neglected Children with Severe Obesity Have a Right to Health: Is Foster Home an Alternative?—A Qualitative Study' (2018) 83 *Child Abuse & Neglect* 106.
34. Philip Marcus, 'Parental Responsibilities: Reformulating the Paradigm for Parent-Child Relationships Part 2: Who Has Responsibilities to Children and What Are These Responsibilities?' (2017) 14 *Journal of Child Custody* 106.
35. M Ángeles Babels, Nuria Fuentes-Peláez and Crescencia Pastor, 'Listening to the Voices of Children in Decision-Making: A Challenge for the Child Protection System in Spain' (2017) 79 *Children and Youth Services Review* 418.
36. Vered Ben-David, 'Are They Guilty of Their Parental Behavior? Parenting Forms Constructed in Termination of Parental Rights Court Cases' (2016) 15 *Qualitative Social Work* 518.
37. S Matthew Liao, 'Biological Parenting as a Human Right' (2016) 13 *Journal of Moral Philosophy* 652.
38. Themba Skosana and Sandra Ferreira, 'Step-Parent Adoption Gone Wrong: GT v CT [2015] 3 ALL SA 631 (GJ)' (2016) 19 *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad*.
39. Isabelle Rein Lescastereyes, 'Recognition of the Parent-Child Relationship as a Result of Surrogacy and the Best Interest of the Child: How Will France Adapt after the ECtHR Rulings' (Springer 2015).
40. Alice Margaria, 'Anonymous Birth: Expanding the Terms of Debate' (2014) 22 *The International Journal of Children's Rights* 552.
41. Jocelyn Chalmers and others, 'The Rights of Man: Libertarian Concern for Men's, But Not Women's, Reproductive Autonomy' (2023) 44 *Political Psychology* 603.
42. Marian Ađnanes and others, 'Lesbian and Gay Individuals' Path into Foster Parenting in Norway—Barriers and Facilitators at the Person and System Levels' [2023] *Child & Family Social Work*.
43. Lanye Hu and others, 'Cochlear Implantation in a Chinese Patient with a Novel Frameshift Variant in POU3F4 Gene and Incomplete Partition Type III: A Case Report' (2022) 50 *Journal of International Medical Research* 03000605211066253.
44. Tobias Bauer, 'A Systematic Review of Qualitative Studies Investigating Motives and Experiences of Recipients of Anonymous Gamete Donation' (2022) 7 *Frontiers in Sociology* 746847.
45. Meghan E Martz and others, 'Nucleus Accumbens Response to Reward among Children with a Family History of Alcohol Use Problems: Convergent Findings from the ABCD Study® and Michigan Longitudinal Study' (2022) 12 *Brain Sciences* 913.
46. Kamta Nath Mishra and others, 'A Novel Approach towards Tracing the Parents of Orphaned Children and Dead Bodies in Cloud and IoT-Based Distributed Environment by Integrating DNA Databank with Aadhar and FIR Databases' (2022) 11 *International Journal of Cloud Computing* 456.
47. Diane E Marling, 'State Terror and the Destruction of Families for Reproductive "Management" in Three Argentine Films', *The Palgrave Handbook of Reproductive Justice and Literature* (Springer 2022).
48. Amy E Kwarteng and others, 'Child Reward Neurocircuitry and Parental Substance Use History: Findings from the Adolescent Brain Cognitive Development Study' (2021) 122 *Addictive behaviors* 107034.

support services<sup>49</sup>, and the legal implications of surrogacy<sup>50</sup>. Other topics include womb rental contracts<sup>51</sup>, the medico-legal problems of post-mortem reproduction<sup>52</sup>, the impact of family structure on child-rearing<sup>53</sup>, the rights of children not to be conceived via reproductive technologies<sup>54</sup>, the recognition of parentage established abroad<sup>55</sup>, the ethical challenges posed by multiple parents<sup>56</sup>, the intergenerational transmission of neurological dysfunctions<sup>57</sup>, the reproductive rights of gay men<sup>58</sup>, the right of children conceived by donation to know their origins<sup>59</sup>, the ethical issues of assisted reproduction<sup>60</sup>, the end of donor anonymity<sup>61</sup>, bureaucratic negligence in child protection<sup>62</sup>, the anonymity of gamete donation<sup>63</sup>, the ethical challenges of creating embryos for donation<sup>64</sup>, the experience of blended families<sup>65</sup>.

### 3. Materials and methods

#### 3.1. Methodological choice

Clustering is a fundamental tool in machine learning<sup>66</sup>. It is a method for detecting cluster structures in a dataset, with the aim of maximizing similarity within each cluster and maximizing dissimilarity between different clusters<sup>67</sup>. In this context, a cluster is a collection of data objects that exhibit similar characteristics within the same cluster and are clearly distinguishable from objects belonging to other

49. Kwabena Frimpong-Manso, 'Family Support Services in the Context of Child Care Reform: Perspectives of Ghanaian Social Workers' (2021) 38 *Child and adolescent social work journal* 157.
50. Mohammad Hussein Mohammad AlAhmad, 'The Crime of Using a Surrogate Mother in the Jordanian Penal Code and Islamic Sharia: A Comparative Study.' (2021) 11 *Review of International Geographical Education Online*.
51. Enas Qutieshat and Ameen Alawath, 'Womb-Lease Contracts with Particular Reference to the Jordanian Law: Comparative Research' (2019) 34 *An-Najah University Journal for Research-B (Humanities)* 1921.
52. Olga Ye Avramova and Oleksandr Ye Kukhariev, 'Medical-Legal Problems of Interference in the Right to Human Autonomy in Postmortem Reproduction'.
53. Benta A Abuya and others, 'Family Structure and Child Educational Attainment in the Slums of Nairobi, Kenya' (2019) 9 *Sage Open* 2158244019855849.
54. Olivia Schuman, 'Sexual Citizenship and Reproduction: Do Children Have a Right Not to Be Conceived via New Reproductive Technologies (Nrts)?, Erotic Subjects and Outlaws (Bill 2018).
55. Fabrizio Marongiu Buonaiuti, 'Recognition in Italy of Filiation Established Abroad by Surrogate Motherhood, between Transnational Continuity of Personal Status and Public Policy' (2019) 11 *Cuadernos Derecho Transnacional* 294.
56. Maria Alias, 'Ethical Issues Raised by Multiparents', Clinical ethics at the crossroads of genetic and reproductive technologies (Elsevier 2018).
57. Agnieszka Pawelczyk and others, 'Higher-Order Language Dysfunctions as a Possible Neurolinguistic Endophenotype for Schizophrenia: Evidence from Patients and Their Unaffected First Degree Relatives.' (2018) 267 *Psychiatry Research* 63.
58. Camisha Russell, 'Rights-Holders or Refugees? Do Gay Men Need Reproductive Justice?' (2018) 7 *Reproductive Biomedicine & Society Online* 131.
59. Simo Zaami, 'Assisted Heterologous Fertilization and the Right of Donorconceived Children to Know Their Biological Origins' (2018) 169 *La Clinica Terapeutica* e39.
60. Melissa Moschella, 'The Wrongness of Third-Party Assisted Reproduction: A Natural Law Account' (2016) 22 *Christian Bioethics* 104.
61. Joyce C Harper, Debbie Kennett and Dan Reisel, 'The End of Donor Anonymity: How Genetic Testing Is Likely to Drive Anonymous Gamete Donation out of Business' (2016) 31 *Human reproduction* 1135.
62. Jessica L Yang and Debra Ortega, 'Bureaucratic Neglect and Oppression in Child Welfare: Historical Precedent and Implications for Current Practice' (2016) 33 *Child and adolescent social work journal* 513.
63. R Krastev and V Mitev, 'The Donation of Gametes and the Anonymity of the Donors' (2015) 42 *Acta Medica Bulgarica* 5.
64. Robert Klitzman and Mark V Sauer, 'Creating and Selling Embryos for "Donation": Ethical Challenges' (2015) 212 *American journal of obstetrics and gynecology* 167.
65. Cindy M George and M Sylvia Fernandez, 'A Case Study of a Stepfamily's Relationship Experiences Before and After the Death of a Custodial Biological Parent' (2014) 22 *The Family Journal* 258.
66. Anna Großwendt, Heiko Röglin and Melanie Schmidt, 'Analysis of Ward's Method' (SIAM 2019).
67. Leonard Kaufman and Peter J Rousseeuw, *Finding Groups in Data: An Introduction to Cluster Analysis* (John Wiley & Sons 2009).

clusters. In this way, a cluster of data objects can be treated collectively as a single group, allowing each cluster to be considered as a data entity in its own right <sup>68</sup>.

In this study, we examined our data using a hybrid approach that combines two advanced clustering techniques to ensure more accurate analysis. It is worth noting that clustering — an unsupervised learning method grounded in statistics and mathematics — is defined as such by <sup>69</sup>. The first method, DBSCAN, is deployed to filter and highlight the most relevant author keywords we've named (main concepts) and to discard terms we've named (peripheral concepts) that are less interesting. The richness of the data obtained forms the basis of our research. In a second step, we use the k-means clustering method to segment this carefully sorted data into thematic groups. This bimodal process enables targeted exploration to deduce relevant thematic connections using thematic network analysis.

### 3.1.1. Density-Based spatial clustering of applications with noise

Density-Based Spatial Clustering of Applications with Noise (DBSCAN) is an unsupervised clustering algorithm that groups closely clustered points (based on distance and minimum number of points) and marks points away from dense regions as anomalies <sup>70</sup>. The DBSCAN algorithm has two main parameters:

- eps (epsilon) is the maximum distance between two points for them to be considered neighbors;
- MinPts is the minimum number of points required to form a dense cluster.

The DBSCAN algorithm works through the following properties <sup>71</sup>:

- Density: It defines a cluster as a dense region of points, separated from other dense regions by less dense regions;
- Neighbors: For each point, DBSCAN forms a neighborhood using a specified distance  $\epsilon$ ;
- Base points: If a point has a certain minimum number of points in its  $\epsilon$ -neighborhood (i.e. it is surrounded by a sufficient number of points), it is considered a base point;
- Clustering: Base points linked together (i.e. close enough together) form a cluster;

68. J Kamber Han and Micheline Kamber, 'Data Mining: Concepts and Techniques'.

69. Nooshin Hanafi and Hamid Saadatfar, 'A Fast DBSCAN Algorithm for Big Data Based on Efficient Density Calculation' (2022) 203 Expert Systems with Applications 117501.

70. Martin Ester and others, 'A Density-Based Algorithm for Discovering Clusters in Large Spatial Databases with Noise' (1996).

71. Michael Hahsler, Matthew Pickenbrock and Derek Doran, 'DbSCAN: Fast Density-Based Clustering with R' (2019) 91 Journal of Statistical Software 1.

- Noise (or anomalies): Points that are not base points and are not close to a base point are considered noise or anomalies.

From a mathematical point of view, for a point  $p$ , the set of neighbouring points  $N$  is defined as follows:

$$N(p) = \{q \mid \text{dist}(p, q) \leq \epsilon\}$$

Where:

- $N(p)$ : a set of points that are at a distance from  $p$  less than or equal to  $\epsilon$ .
- $p$ : This is a reference point in space. The set  $N(p)$  is constructed by considering the distance of all other points from this point  $p$ .
- $q$ : any point in space. The equation explores all points like  $q$  to determine whether they should be included in  $N(p)$  according to their distance from  $p$ .
- $\text{dist}(p,q)$ : This is a distance function that measures the distance between points  $p$  and  $q$ . There are many ways of defining a distance depending on the context (for example, Euclidean distance in two-dimensional space).
- $\epsilon$ : A distance threshold. Any point  $q$  whose distance from  $p$  is less than or equal to  $\epsilon$  is included in the set  $N(p)$ .

### 3.1.2. K-means clustering algorithm

The K-means algorithm is a simple iterative clustering algorithm. Using distance as a metric and given  $K$  classes in the dataset, it averages the distances to give the initial centroid, with each class described by the centroid. For a given dataset  $X$  containing  $n$  multidimensional data points and the category  $K$  to be split, the Euclidean distance is selected as the similarity index and the clustering objectives minimize the sum of squares of the different categories; i.e., it minimizes <sup>72</sup>.

$$d = \sum_{k=1}^K \sum_{i=1}^n \|x_i - u_k\|^2$$

Where :

- $d$  is the sum of the squares of the distances,
- $K$  is the total number of clusters,
- $n$  is the total number of data points,

72. Qian Wang and others, 'Review of K-Means Clustering Algorithm' (2012) 20 Electronic design engineering 21.

- $x_i$  is the  $i$ -th data point,
- $u_k$  is the centroid of class  $k$ ,
- $\|\cdot\|$  represents the Euclidean norm, which measures the distance between points  $x_i$  and  $u_k$

### 3.2. Data processing methodology

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

Our data are scientific publications extracted from Scopus databases. This choice is based on the fact that Scopus constitutes one of the largest and most comprehensive sources of publication metadata and impact indicators over the years<sup>73</sup>. Scopus is widely recognized as the most comprehensive bibliographic database for diverse applications<sup>74</sup>, both multidisciplinary and selective<sup>75</sup>, and continuously enriched and updated<sup>76</sup>.

Our data is downloaded on 11/08/2023, using the following search string: TITLE-ABS-KEY-AUTH («children» AND «right» AND «biological parents») AND (EXCLUDE (LANGUAGE, «French») OR EXCLUDE (LANGUAGE, «Spanish») OR EXCLUDE (LANGUAGE, «Italian») OR EXCLUDE (LANGUAGE, «Russian») OR EXCLUDE (LANGUAGE, «Portuguese») OR EXCLUDE (LANGUAGE, «Polish») OR EXCLUDE (LANGUAGE, «Lithuanian») OR EXCLUDE (LANGUAGE, «Dutch»)).

The second step is to review and clean the data. Initially, the downloaded database consisted of 284 publications entered in CSV format. In order to ensure the quality, consistency and reliability of the variety of bibliographic information it contained, we carried out a process of revision, correction and standardization of the data using Excel software. During this stage, we removed one duplicate. We also standardized author names and publication years. As a result, the cleaned database consists of 283 publications. Figure 1 shows the distribution of scientific publications in our database after the pre-processing process, from 1963 to 2023.

The third stage of our study revealed a key variable: the «author's keywords». These terms, chosen by the authors, represent the central themes and aspects of

73. Barbara S Ballew, 'Elsevier's Scopus® Database' (2009) 6 *Journal of Electronic Resources in Medical Libraries* 245; Raminta Pranckutė, 'Web of Science (WoS) and Scopus: The Titans of Bibliographic Information in Today's Academic World' (2021) 9 *Publications* 12.

74. Junwen Zhu and Weishu Liu, 'A Tale of Two Databases: The Use of Web of Science and Scopus in Academic Papers' (2020) 123 *Scientometrics* 321.

75. M Carloni, T Tsenkulovsky and R Mangan, 'Web of Science Core Collection Descriptive Document.' [2018] Google Scholar There is no corresponding record for this reference; Jeroen Baas and others, 'Scopus as a Curated, High-Quality Bibliometric Data Source for Academic Research in Quantitative Science Studies' (2020) 1 *Quantitative science studies* 377.

76. D Rew, 'SCOPUS: Another Step towards Seamless Integration of the World's Medical Literature' (2010) 36 *European Journal of Surgical Oncology* 2.

their research. In our assessment of the completeness of bibliographic metadata, we found that over 34% of these terms were missing. This could be the result of incomplete indexing by Scopus, which can vary according to the diversity of sources or the evolution of indexing protocols. In addition, the limitations of Scopus may affect keyword indexing, particularly for older articles or atypical publications such as notes and book chapters.

Once our data had been pre-processed, we proceeded to vectorization. This process converts qualitative information into digital format. It involves tokenization (dividing text into words or phrases) and data cleaning<sup>77</sup>. During this stage, qualitative data, such as authors' keywords, were transformed into digital vectors so that our machine learning algorithms could process and analyze them.

Author keyword analysis was carried out using the R studio programming tool. This choice facilitated our analysis and visualization of bibliographic data from the Scopus database. R is an open-source ecosystem encompassing statistical algorithms, mathematical features, and visualization capabilities for scientific computation. Furthermore, R is distributed and archived through the CRAN network (<https://cran.r-project.org/>)<sup>78</sup>. In terms of usage, R is compatible with both Windows and Linux and offers a graphical user interface called RStudio<sup>79</sup>.

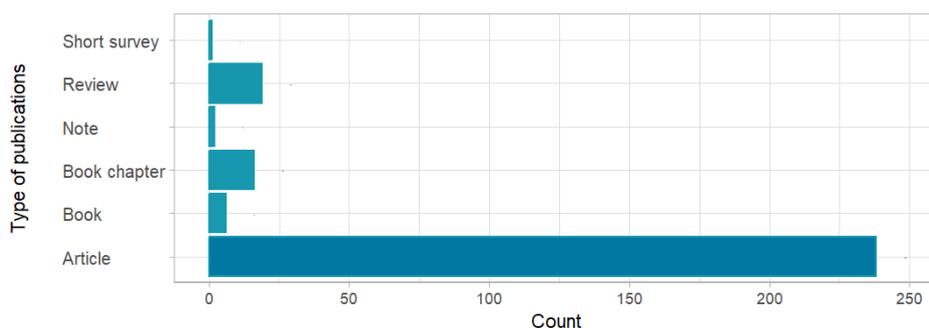


Figure 1. Number of publications per type of document

## 4. Results and discussion

This findings section is divided into three subsections. The first is devoted to presenting the distribution of scientific output and citations by country. The second is devoted to cluster analysis. The third is concerned with the analysis of thematic links.

77. Robert Kabacoff, *R in Action: Data Analysis and Graphics with R and Tidyverse* (Simon and Schuster 2022).

78. Hamid Derviş, 'Bibliometric Analysis Using Bibliometrix an R Package' (2019) 8 *Journal of Scientometric Research* 156.

79. Massimo Aria and Corrado Cuccurullo, 'Bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis' (2017) 11 *Journal of informetrics* 959.

#### 4.I. Distribution of scientific output and citations by country (1963-2023)

Analysis of Figures 2 and 3 shows that the USA clearly dominates in terms of scientific output, with 337 publications, and this dynamic is also reflected in their impact, with an impressive total of 1,764 citations. The USA is thus the undisputed leader in the field of children's rights and biological parenthood. Sweden, despite producing just 19 publications, accumulated a remarkable 1,633 citations. This suggests that every work published in Sweden has significant reach and influence, with an average of 86 citations per publication. Spain and the UK, with 238 and 233 citations respectively, also have a notable impact despite a more modest output of 9 and 48 publications. Denmark, with 210 citations for 15 publications, and Norway, with 83 citations for 14 publications, follow this trend.

However, countries such as Japan and China, which produced 36 and 19 publications respectively, have a relatively low citation count of 42 and 37. This could indicate that, although their output is high, the impact of their research on the international scene is lower. It is also worth noting that countries such as Belgium, Bulgaria, the Czech Republic, France, Iran and Jordan, despite having contributed to scientific output, received no citations. This raises questions about the visibility or relevance of their research in this particular field.

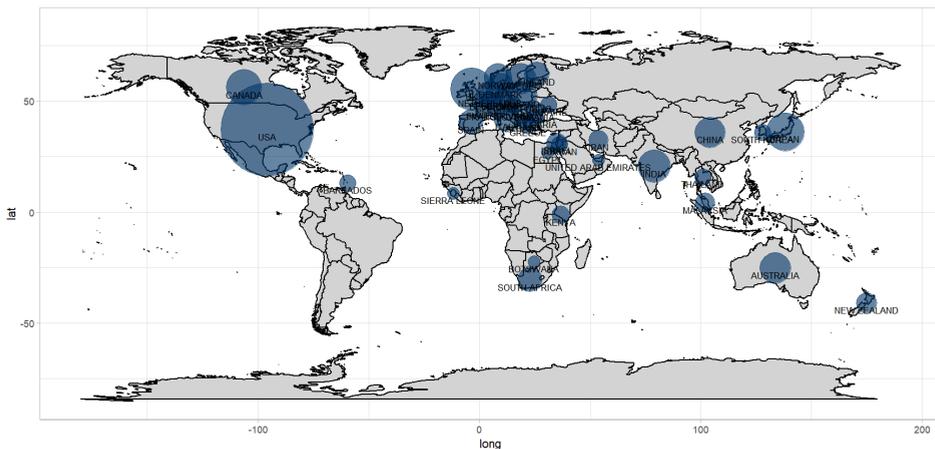


Figure 2. The globe depicted in the bubble map highlights countries that have garnered the highest frequency of publications throughout the years

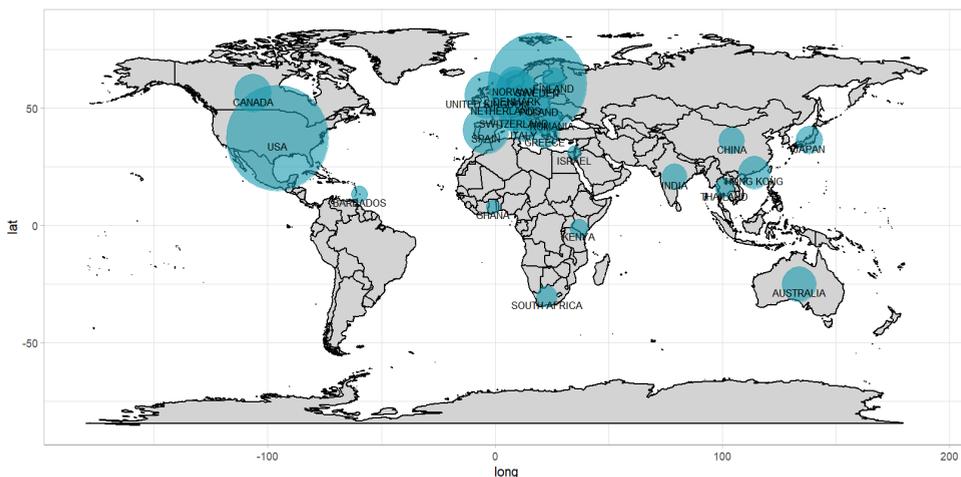


Figure 3. The globe depicted in the bubble map highlights countries that have garnered the highest frequency of citations throughout the years

## 4.2. Cluster analysis

This subsection is dedicated to cluster analysis using the DBSCAN algorithm (based on determining the optimal value of  $\epsilon$  using the k-th nearest neighbor method) and the K-means clustering algorithm, based on the implementation of the elbow method algorithm (to identify the optimal value of K) and the silhouette coefficient algorithm (to evaluate cluster quality).

### 4.2.1. Determining the optimal value of $\epsilon$ using the k-th nearest neighbor method

The distance to the kth neighbor is essential in cluster analysis, specifically for the DBSCAN algorithm, as it defines the  $\epsilon$  (epsilon) threshold, set here at 1, for distinguishing between dense and less dense areas. The choice of k is determined by the “MinPts” parameter, here set to 9, which steers us towards  $k=8$  (MinPts - 1). According to Figure 8, the line  $y=1.4$  serves as a threshold for identifying dense areas (defined as 48 main concepts): points below meet the density requirements defined by  $\epsilon$  and MinPts; while those above could be interpreted as noise (defined as 11 peripheral concepts).

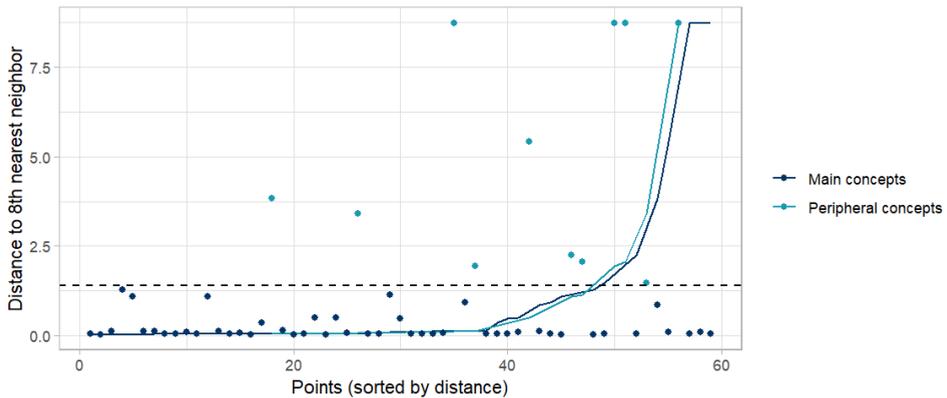


Figure 4. Optimizing the  $\epsilon$  parameter with the 8-th nearest neighbor technique

#### 4.2.2. Determining the optimal K value and evaluate the quality of the clustering

For the K-means algorithm, the number of clusters depends on the  $K$ <sup>80</sup>. In practice, the  $K$  value is generally difficult to define. For this reason, combining average silhouette width with the elbow method is a sensible approach to determining the optimal number of clusters in a clustering analysis.

Together, these two methods offer a more robust assessment of data structure and the number of clusters to be formed. The elbow method is based on observing the point at which adding additional clusters only marginally reduces the sum of squared errors (WCSS). This may indicate the optimal clustering point where intra-cluster variance is well balanced with inter-cluster variance. On the other hand, average silhouette width measures the extent to which objects are consistent within each cluster and distinct between clusters. This provides a more detailed understanding of the quality of the clusters formed.

**Elbow Method Algorithm.** The elbow method involves estimating the distance between sampling points within each cluster and the cluster centroid, using the square of this distance to generate a series of  $K$ -values. To measure performance, the sum of squared errors (SSE) is used. By iterating over the  $K$  values and calculating the SSE, we can observe that smaller values reflect greater convergence within each cluster<sup>81</sup>. The essence of this method lies in the objective of choosing the number of clusters in such a way that adding an extra cluster generates only a marginal improvement in terms of variance explained (intra-cluster inertia). The threshold at which this improvement begins to decrease is often referred to as the “elbow point”.

80. Ling-bo Han and others, 'Improved K-Means Initial Clustering Center Selection Algorithm' (2010) 46 *Jisuanji Gongcheng yu Yingyong*(Computer Engineering and Applications).

81. Chunhui Yuan and Haitao Yang, 'Research on K-Value Selection Method of K-Means Clustering Algorithm' (2019) 2 *J* 226.

Intra-cluster inertia is a measure of the dispersion of points within each cluster. For a given data set, the within-cluster inertia (WCSS - Within-Cluster Sum of Squares) for a given number of clusters  $k$  is calculated as the sum of the squares of the distances between each data point and the center of the cluster to which it belongs. The mathematical formula for intra-cluster inertia:

$$WCSS(k) = \sum_{i=1}^k \sum_{x \in C_i} \|x - \mu_i\|^2$$

Where :

- WCSS( $k$ ) represents the sum of squared distances within clusters for a specific number of clusters  $k$ ,
- $k$  is the number of clusters.
- $C_i$  is the  $i$ -th cluster.
- $x$  is a data point in cluster  $C_i$ .
- $\mu_i$  is the center of the  $C_i$  cluster.
- $\|\cdot\|$  represents the Euclidean norm, which measures the distance between points  $x$  and  $\mu_i$ .

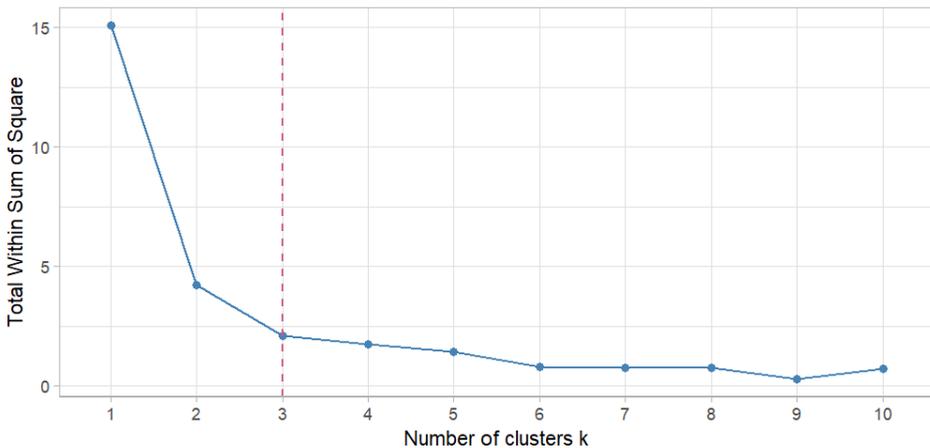


Figure 5. The elbow algorithm showing the optimum value of  $K$

Figure 5 identifies the optimum number using the elbow method. This is the point at which the slope of the curve begins to flatten. In this case, the point where the slope changes significantly is around 3 clusters, as indicated by the dotted red vertical line. The kink point represents a compromise between a low WCSS (which would mean assigning each point to its own cluster, resulting in a WCSS of zero) and a high number of clusters (which might not bring many significant

improvements). In this case, the optimal choice for the number of clusters seems to be around 3, because beyond this point, adding more clusters doesn't significantly reduce WCSS.

The silhouette coefficient algorithm. Average silhouette width is a metric used to assess the quality of clusters obtained using a clustering method. This metric assesses the extent to which points in a given cluster are similar to points in other clusters. It measures the compactness of points within each cluster and the separation between different clusters<sup>82</sup>. The silhouette width of a point  $i$  is calculated as follows:

$$S(i) = \frac{b(i) - a(i)}{\max\{a(i), b(i)\}}$$

Where:

- $S(i)$  is the measure we seek to calculate for a certain element or index  $i$ .
- $a(i)$ : The point's average distance from other points in the same cluster (compactness).
- $b(i)$ : The smallest average distance from the point to points in other clusters (separation).

The formula calculates the difference between  $b(i)$  and  $a(i)$ , then divides it by the maximum between  $a(i)$  and  $b(i)$ .

Compactness represents the similarity between the object and the cluster. When compared to other clusters, it is called separation. This comparison is made by the Silhouette value, which lies in the range -1 to 1. The Silhouette value is close to 1, indicating a close relationship between the object and the cluster. If a data cluster in a model is generated with a relatively high Silhouette value, the model is appropriate and acceptable.

Figure 6 shows the average silhouette width. The horizontal axis ( $x$ ) shows the indices of the elements grouped into clusters (keywords). The vertical axis ( $y$ ) shows the silhouette width values. Each bar represents an element (keyword) in your data and is colored according to the cluster to which it belongs. The result is an average silhouette width of 0.75, indicating a clear distinction between clusters and a notable similarity between elements within each cluster. This average is represented by the red dotted line on the graph for all elements. Our analysis aims to identify bars with high silhouette values, ideally above the red dotted line for efficient grouping of elements in their respective clusters, marking a clear distinction between the different groups.

82. Kaufman and Rousseeuw (n 67).

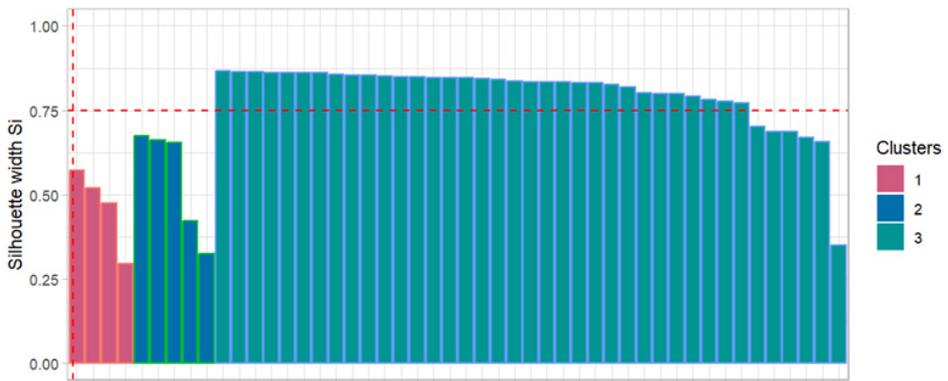


Figure 6. The silhouette coefficient algorithm demonstrates the consistency of objects within each cluster, as well as their distinction between clusters

Figure 7 shows the results of our thematic clustering analysis using the K-means algorithm, which resulted in the classification of three distinct clusters.

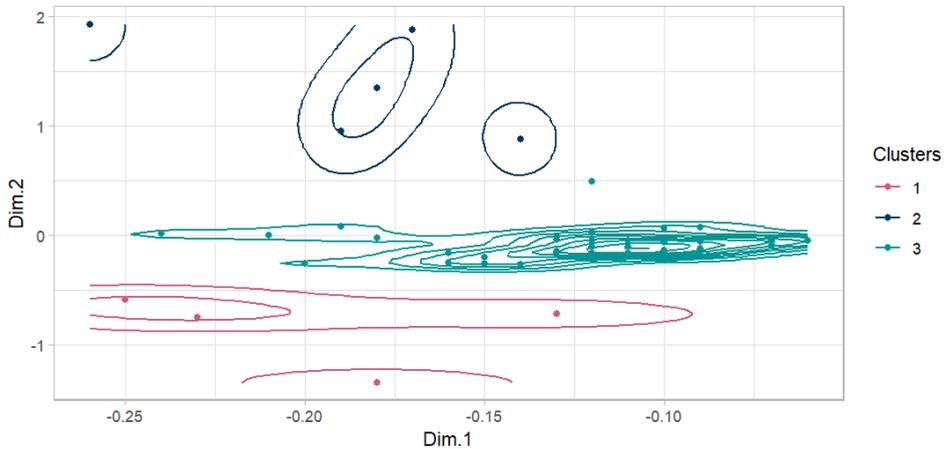


Figure 7. K-means clustering scatterplot of author keywords

### 4.3. Thematic links analysis

In this section, the analysis will focus on examining the thematic links between the three clusters identified in figure 9.

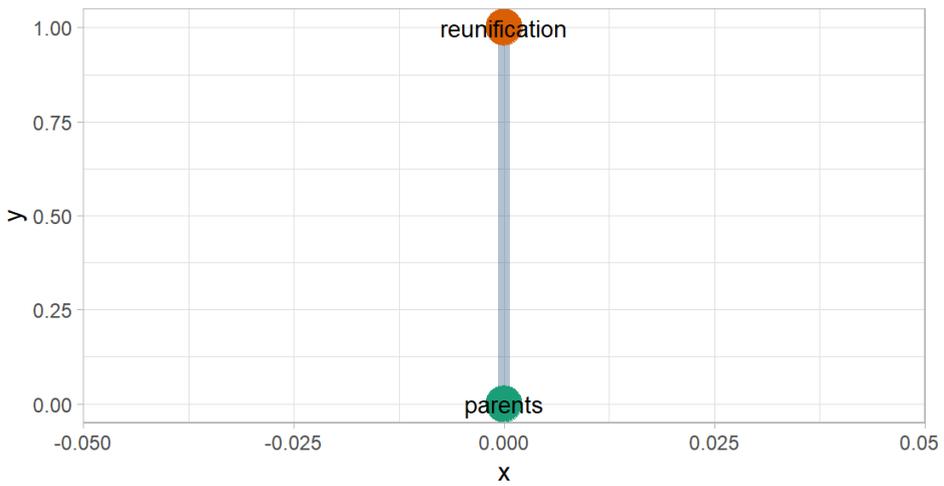


Figure 8. Analysis of cluster 1 thematic links

The network analysis centered on cluster 1, illustrated in figure 10, reveals a thematic link between the concepts of “reunification” and “parents”. On the other hand, the network analysis centered on cluster 2, illustrated in figure 11, highlights a thematic link between “family” and “adolescent”. Table 1 maps the thematic links and co-occurrences obtained in each of these clusters.

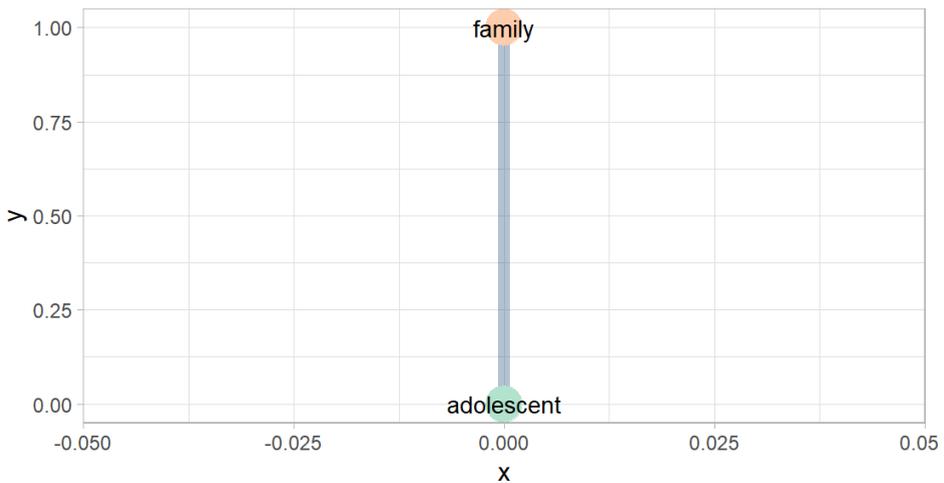


Figure 9. Analysis of cluster 2 thematic links

Table 1 Mapping of thematic links and co-occurrences in cluster 1 & cluster 2

Clusters	Thematic links	Detected co-occurrences	Research conducted
Cluster 1	reunification parents (see Fig. 8)	Reunification-parents	<sup>83</sup> focus on the role of professional fosterfamilies in the family reintegration process, examining their attitudes to reintegration and how they support children separated from their biological families and parents
Cluster 2	family adolescent (see Fig. 9)	Family-adolescent	<sup>84</sup> examine the effects of caregiver changes in early childhood on bonds and interactions in adolescence. <sup>85</sup> compares behavioral problems in adopted and non-adopted children. <sup>86</sup> analyze pro-violence attitudes among incarcerated adolescents. <sup>87</sup> study the impact of family structure on adolescent well-bein.

Given the diversity and large number of concepts that cluster 3 (shown in green in Figure 10) hosts, we have summarized our reclustering results using a dendrogram, a tree diagram illustrating the arrangement of clusters generated by Ward's hierarchical agglomerative clustering method. This is an agglomerative hierarchical clustering approach that seeks to minimize the total variance within clusters at each stage of agglomeration <sup>88</sup>. Ward's method of cluster merging aims to minimize the increase in the sum of squared errors (SSE) at each stage of the process. It starts by treating each observation as an individual cluster and gradually merges the clusters, selecting those that result in the smallest possible increase in the sum total of the squared distances between each point and the cluster mean (i.e. the cluster center).

The aim is to create clusters that are as homogeneous as possible. Ward's method uses a specific measure to decide which clusters to combine during agglomerative hierarchical clustering, called the increase in the sum of squared errors (SSE) or intra-cluster inertia. The mathematical formula for calculating this increase is as follows:

$$\Delta(SSE) = \frac{|C_i| \cdot |C_j|}{|C_i| + |C_j|} \cdot d(C_i, C_j)^2$$

83. Basiaga, Róg and Zięba-Kolodziej (n 32).

84. Jill Hodges and Barbara Tizard, 'Social and Family Relationships of Ex-institutional Adolescents' (1989) 30 *Journal of child psychology and psychiatry* 77.

85. William Feigelman, 'Comparing Adolescents in Diverging Family Structures: Investigating Whether Adoptees Are More Prone to Problems than Their Nonadopted Peers' (2001) 5 *Adoption Quarterly* 5.

86. Glenn Stone and Angela Dover, 'An Exploration of Violent Attitudes in Adolescent Males: Personal, Family, and Environmental Factors' (2007) 15 *Journal of aggression, maltreatment & trauma* 59.

87. Callie E Langton and Lawrence M Berger, 'Family Structure and Adolescent Physical Health, Behavior, and Emotional Well-Being' (2011) 85 *Social Service Review* 323.

88. Fionn Murtagh and Pierre Legendre, 'Ward's Hierarchical Agglomerative Clustering Method: Which Algorithms Implement Ward's Criterion?' (2014) 31 *Journal of classification* 274.

Where:

- $\Delta(\text{SSE})$  is the increase in the sum of squared errors due to the merging of two clusters;
- $|C_i|$  and  $|C_j|$  are the sizes (number of observations) of clusters  $i$  and  $j$ , respectively;
- $d(C_i, C_j)$  is the distance between the centers of gravity (or centroids) of clusters  $i$  and  $j$ ;
- $d(C_i, C_j)^2$  is the square of this distance.

Since our dataset is characterized by continuous data, the distance between each pair of continuous points is measured by the Euclidean distance. In an  $n$ -dimensional space, the Euclidean distance between two points  $p$  and  $q$  is calculated using the formula:

Where  $x_i$  and  $y_i$  are the coordinates of the points in each dimension.

Examination of the dendrogram in Figure 12 reveals a conceptual similarity in the length of the branches within cluster 3, delimiting three sub-clusters at a fixed height of 2.5.

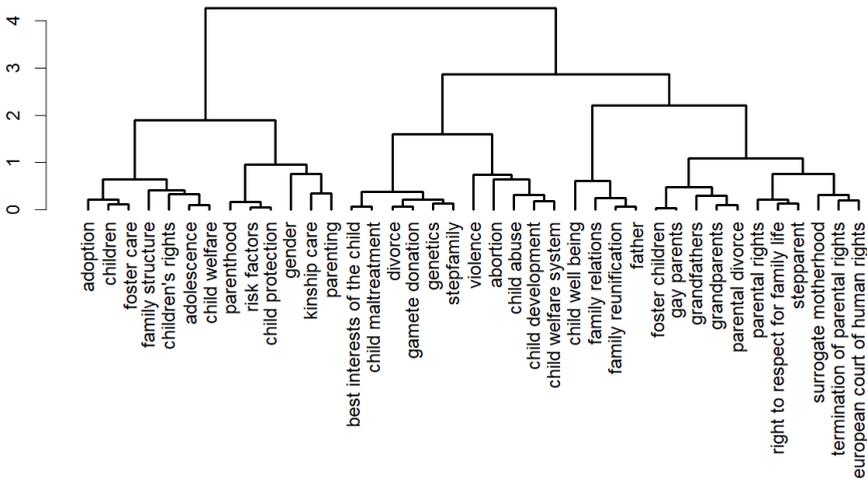


Figure 10. Dendrogrammatic representation of cluster 3

Figures 11, 12 and 13 show the thematic links of each sub-group obtained. Table 2 maps the thematic links and co-occurrences obtained in each of these clusters.

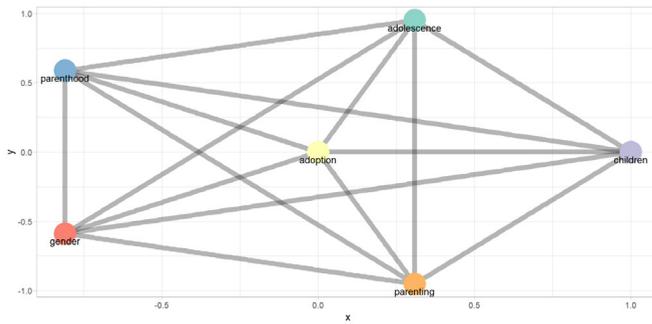


Figure 11. Analysis of sub-cluster A thematic links

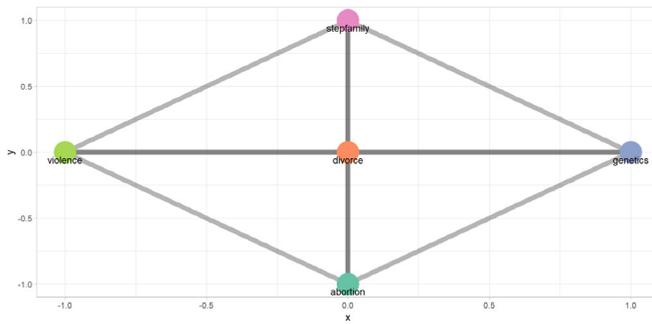


Figure 12. Analysis of sub-cluster B thematic links

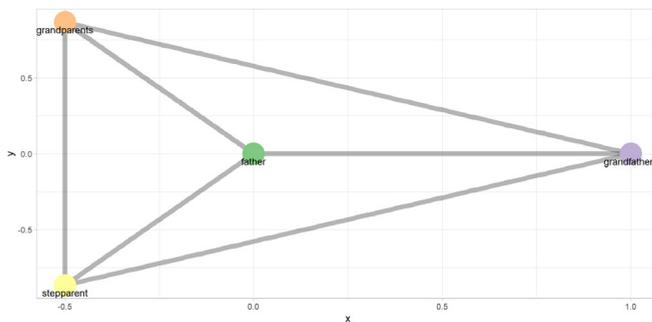


Figure 13. Analysis of sub-cluster C thematic links

Table 2. Thematic links and co-occurrences obtained in each of these clusters

Clustering results	Thematic links	Detected co-occurrences	Research conducted on co-occurrences	
Cluster 3	Sub-cluster A (see Fig. 11)	Adolescence Adoption Children Gender Parenthood Parenting	1 discusses the challenges faced by a young, financially limited, pregnant woman, examining abortion, child custody, and adoption options, and highlights the role of medical professionals and attorneys in adoptions in the United States.	
			Children – Adoption	2 analyze the reasons why older adopted children may have more problems than biological children, by comparing the behaviors and educational styles of adoptive and biological parents.
			3 examines how same-sex marriage, adoption and new reproductive technologies are changing the biological parent-child bond and their implications for children's human rights, highlighting the challenges posed to their fundamental rights linked to their biological origins and traditional family structure.	
			4 examine the family circumstances justifying intervention in respect of family life under Article 8 of the ECHR, analyzing the courts' definitions of "family" and "interests of the child".	
	Children – Gender	5 examine developmental and psychological disorders in African-American children, using non-clinical data from 1,458 African-American parents on their children's academic, behavioral and social-emotional adjustment, focusing on differences by gender, age, and family structure.		
	Children – Parenting	6, study the adjustment of 136 young adults from stepfamilies, focusing on exposure to the warmth, control and parenting style (authoritarian, authoritative, supportive or disengaged) of their parents and stepparents, and the impact of these factors on their well-being		
	Sub-cluster B (see Fig. 12)	Violence divorce stepfamily genetics abortion	Not available	
Sub-cluster C (see Fig. 13)	Father Grandfathers Grandparents Stepparent	Grandfathers – grandparent	7 explores the increasing use of family care, particularly by grandparents, for children separated from their biological parents for a variety of reasons, and examines the specific experiences and challenges of grandfathers involved in such care.	

1 Robin DuRocher, 'Balancing Competing Interests in Post-placement Adoption Custody Disputes: How Do the Scales of Justice Weigh the Rights of Biological Parents, Adoptive Parents, and Children?' (1994) 15 *Journal of Legal Medicine* 305.

2 C Ruth Solomon and Marie-Claude Poirier, 'Parenting Styles and Attributions and the Behavior of Children in the "No" Stage in Adoptive and Biological Families' (2006) 10 *Adoption Quarterly* 63.

3 Margaret Somerville, 'Children's Human Rights and Unlinking Child-Parent Biological Bonds with Adoption, Same-Sex Marriage and New Reproductive Technologies' (2007) 13 *Journal of Family Studies* 179.

4 Clarie Breen and others, 'Family Life for Children in State Care: An Analysis of the European Court of Human Rights' Reasoning on Adoption Without Consent' (2020) 28 *The International Journal of Children's Rights* 715.

5 Oscar A Barbarin and Robin E Soler, 'Behavioral, Emotional, and Academic Adjustment in a National Probability Sample of African American Children: Effects of Age, Gender, and Family Structure' (1993) 19 *Journal of Black Psychology* 423.

6 Jan M Nicholson and others, 'Relationship between the Parenting Styles of Biological Parents and Stepparents and the Adjustment of Young Adult Stepchildren' (2002) 36 *Journal of Divorce & Remarriage* 57.

7 Janet Okagbue-Reaves, 'Kinship Care: Analysis of the Health and Well-Being of Grandfathers Raising Grandchildren Using the Grandparent Assessment Tool and the Medical Outcomes Trust SF-36 TM Health Survey' (2006) 9 *Journal of Family Social Work* 47.

## 5. Discussion

Over the period 1963-2023, the predominance of articles in the research field is evident, with an impressive total of 238 publications. This trend underlines the vital importance of articles as a means of disseminating academic knowledge. In this research environment, the USA clearly stands out, occupying a leading position in terms of publication volume and citations. This pre-eminence is particularly noticeable in the field of studies exploring the relationship between children's rights and biological parents.

Combining DBSCAN and K-means, two distinct clustering algorithms, we first use DBSCAN for targeted and relevant concept segmentation, followed by the application of K-means. This method significantly improves the final clustering, leading to the creation of three distinct groups. The process involves determining the K-value using the elbow method algorithm and assessing the quality of the clustering using the silhouette coefficient algorithm. These three clusters are then carefully analyzed to identify thematic links, using network analysis with a high degree of precision.

The first cluster identified a notable thematic link between "reunification" and "parents". This specific association, though crucial, has only been observed in one existing study. This scarcity of data indicates that the field of study relating to the dynamics of family reunification and its impact on parental relationships remains largely underexplored, and would merit greater attention in future research. On the other hand, the second group revealed an interesting link between the concepts of "family" and "adolescent". This link was found in only two studies, raising questions about current understanding of family interactions involving adolescents. This suggests that, although slightly more explored than the first theme, the area concerning adolescents within family structures also requires further exploration in order to better grasp the nuances and complex dynamics of these relationships.

Given the diversity and large number of concepts that Cluster 3 contains, we classified it in the form of 3 sub-clusters generated by Ward's agglomerative hierarchical clustering method.

The first sub-cluster identified a notable thematic link between "Adolescence", "Adoption", "Children", "Gender", "Parenthood" and "Parenting". This specific association, although crucial, was respected in a limited way: "Children" co-occurred with "Adoption" in four studies, with "Gender" in only one study, and with "Parenting" also in only one study. This lack of data suggests that the area of study related to children's adoption, gender, and parenting dynamics remains largely underexplored and warrants increased attention in future research. On the other hand, other terms without co-occurrence offer the possibility of better understand-

ding these interactions. This indicates that, although slightly more explored, areas concerning children in relation to these themes also need to be explored further to better capture the complex nuances and dynamics of these relationships.

The second sub-cluster identified a particular thematic link between “violence”, “divorce”, “stepfamily”, “genetics” and “abortion”. However, no co-occurrences were found in the literature for these terms, suggesting that these thematic links have not yet been explored, paving the way for new studies. Consequently, this lack of interconnections in existing research indicates fertile ground for future investigations. Similarly, the third sub-cluster identified a notable thematic link between “father”, “grandfathers”, “grandparents” and “Stepparent”. An interesting co-occurrence between the concepts of “grandfathers” and “grandparents” was detected in a single study. This unique observation highlights the specificity of the relationship between grandfathers and grandparents in general, suggesting that this specific area of family dynamics may be underexplored and deserves greater attention in future research.

## 6. Directions for future studies

Based on our research findings, we felt it appropriate to raise the following future research directions:

**Dynamics of family reunification.** Exploring the dynamics of family reunification is directly linked to children’s rights and their relationship with their biological parents. This research theme is fundamental because it sheds light on how reunification influences the respect and protection of children’s rights in the family context. It helps us to understand how re-establishing and maintaining links between children and their biological parents can benefit children’s development and well-being.

**Family interactions involving adolescents.** This research direction highlights the importance of understanding family relationships, particularly with adolescents, in the context of children’s rights. It is essential for assessing how family dynamics affect the rights and development of adolescents, and how biological parents can be key players in promoting and protecting these rights.

**Interaction between adoption, gender and parenthood.** By examining the interactions between adoption, gender and parenting, this theme highlights critical aspects of children’s rights in relation to their biological parents. It explores how these factors influence children’s rights and well-being in different family contexts, highlighting the importance of an inclusive, rights-sensitive approach to parenting.

**Domestic violence.** Domestic violence, divorce and other factors profoundly affect children’s rights in relation to their biological parents. Studying this theme is essen-

tial to understanding how to effectively protect children's rights in conflictual or damaging family contexts, and to highlighting the need for targeted interventions to support children and their biological parents.

Grandparent and step-parent dynamics. Although focused on grandparents and step-parents, this research direction can reveal valuable information about how these relationships affect children's rights in relation to their biological parents. It underlines the importance of recognizing the influence of these extended family members on children's rights, and the need to include them in the debate on child welfare and protection.

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Conceptualization, D.P.; A.S.; and L.S.; methodology, D.P.; A.S.; V.L.; software, L.S.; D.P.; V.L.; validation, L.S.; A.S.; D.P.; and V.L.; formal analysis, A.S.; V.L.; investigation, L.S.; V.L.; D.P.; resources, L.S.; D.P.; data curation, L.S.; writing—original draft preparation, A.S.; D.P.; writing—review and editing, A.S.; D.P.; visualization, A.S.; supervision, L.S.; D.P., project administration, V.L.; funding acquisition, L.S.; D.P.; V.L. All authors have read and agreed to the published version of the manuscript.

#### Conflict of interest

The authors declare no conflict of interest.