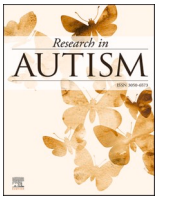
126 (2025) 202640

Contents lists available at ScienceDirect

Research in Autism

journal homepage: www.elsevier.com/locate/rasd



A bibliometric analysis of mindfulness-based interventions for individuals with autism spectrum disorder and their caregivers

Xinlin Huang [a,1], Maosen Guan [b,1], Tatyana R. Tomenko [a,c], Irina A. Tuzankina [d], Valery A. Chereshnev [d,e], Ningkun Xiao [a,e,*,2]

[a] Department of Psychology, Institution of Humanities, Ural Federal University, Yekaterinburg 620062, Russia
[b] Central Plains Wushu Research Institute of Henan University, Kaifeng 475000, China
[c] Ural State Medical University, Yekaterinburg 620028, Russia
[d] Institute of Immunology and Physiology of the Ural Branch of the Russian Academy of Sciences, Yekaterinburg 620049, Russia
[e] Department of Immunochemistry, Institution of Chemical Engineering, Ural Federal University, Yekaterinburg 620062, Russia

ARTICLE INFO

Keywords:
Autism spectrum disorders
Mindfulness-based intervention
Mindfulness
Mental health
Family well-being
Bibliometric study

ABSTRACT

Background: Autism spectrum disorder (ASD) presents significant challenges for both individuals and caregivers, often leading to stress, anxiety, and depression. Although mindfulness-based interventions (MBIs) have emerged as a promising approach to alleviate these burdens, this field lacks a comprehensive bibliometric analysis.

Aim: We discuss future research hotspots and directions, with the aim of helping researchers quickly identify key areas for collaboration and development in this field, thereby advancing the clinical application of MBIs and improving the physical and mental well-being of autistic individuals and their caregivers.

Methodology: We analyzed data from the Web of Science Core Collection (WoSCC), which included 335 articles authored by 1213 researchers and published in 146 journals. We employed bibliometric tools to examine publication trends, citations, key authors, and institutions. We conducted keyword and thematic evolution analyses to identify research hotspots and emerging trends.

Findings: Since 2013, research on MBIs for ASD has significantly increased, with the USA leading in both output and impact. Family-centered mindfulness interventions focused on caregivers' well-being, particularly for mothers, were a key theme. Researchers widely used psychometric tools like the Beck Anxiety Inventory (BAI) and Parenting Stress Index (PSI). Emerging trends include the integration of MBI with artificial intelligence and remote interventions, which address sensory processing and social communication in ASD.

Abbreviations: ABA, Applied behaviour analysis; ACT, Acceptance and Commitment Therapy; ADHD, Attention-deficit hyperactivity disorder; ASD, Autism Spectrum Disorder; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BRIEF, Behavior Rating Inventory of Executive Function; CBCL, Child Behavior Checklist; DASS, Depression Anxiety and Stress Scale; MBIs, Mindfulness-based interventions; MBCT, Mindfulness-based cognitive therapy; MBSR, Mindfulness-based stress reduction; PSI, Parenting Stress Index; PTSD, Post-traumatic stress disorder; SRS, Social Responsiveness Scale.

* Corresponding author at: Department of Psychology, Institution of Humanities, Ural Federal University, Yekaterinburg 620062, Russia.
E-mail addresses: Khuan.sinlin@urfu.me (X. Huang), guanmaosen123@gmail.com (M. Guan), Trtomenko@ya.ru (T.R. Tomenko), ituzan@yandex.ru (I.A. Tuzankina), v.chereshnev@iip.uran.ru (V.A. Chereshnev), Fellones.zero@gmail.com (N. Xiao).
[1] The following authors contributed equally
[2] https://orcid.org/0000–0002-0615–3222

https://doi.org/10.1016/j.reia.2025.202640
Received 28 October 2024; Received in revised form 27 May 2025; Accepted 2 June 2025
Available online 10 June 2025

Significance: This is the first bibliometric study on MBIs for ASD, highlighting their growing importance in improving mental health and reducing stress in both autistic individuals and caregivers. Future research should focus on personalized interventions and further explore the underlying mechanisms of MBIs.

1. Introduction

Autism spectrum disorder (ASD) is a lifelong neurodevelopmental condition characterized by impairments in cognition, communication, language, interests, and social behaviors (American Psychiatric Association & Association, 2013; Gosling et al., 2022). These challenges can make it more difficult for autistic individuals to engage in typical social activities compared to the general population, leading to increased aggression, feelings of loneliness, anxiety (van Steensel & Heeman, 2017), depression (Maddox & White, 2015), and sleep disturbances (Wachob & Lorenzi, 2015). Additionally, caregivers of autistic individuals often experience significant psychological stress (Nieto et al., 2017), and parenting-related pressures (Nikmat et al., 2008). These issues present substantial challenges to the daily lives and treatment of both autistic individuals and their caregivers, contributing to avoidance behaviors, repetitive or aggressive actions, and social isolation in autistic individuals. At the same time, caregivers may struggle to adapt their interactions with those they care for, creating tension within family dynamics and perpetuating a negative cycle (Beato et al., 2018). As a result, one key focus of treatment for ASD is alleviating stress, depression, and anxiety in both autistic individuals and their caregivers, while reducing feelings of loneliness and aggressive behaviors in the individuals themselves. Currently, non-pharmacological interventions such as applied behavior analysis (ABA), animal-assisted therapy (Xiao, Bagayi et al., 2024; Xiao et al., 2023), music therapy (Maw & Haga, 2018), and aerobic exercise (Kim & Lee, 2020) have shown some preliminary evidence of reducing stress in autistic individuals and their caregivers. However, the evidence supporting these interventions remains limited. In recent years, multiple studies have demonstrated that Mindfulness-based interventions (MBIs) can enhance prosocial behaviors (Berry et al., 2020), effectively reduce anger (Wright et al., 2009), violence (Gillions et al., 2019), aggression(Fix & Fix, 2013; Hourston & Atchley, 2017), as well as alleviate feelings of loneliness (N. N. Zhang et al., 2018; J. Zhang et al., 2018), depression and anxiety (Cachia et al., 2016), while improving overall subjective well-being. Given the high prevalence of co-occurring anxiety and depression in autistic individuals — along with their potential difficulty engaging in cognitively demanding therapies like cognitively oriented interventions (CBT) (Rotheram-Fuller & MacMullen, 2011; Sizoo & Kuiper, 2017; Spek et al., 2013)— researchers have adapted MBIs for use with autistic populations. This conceptual bridge has motivated the expansion of MBI applications in ASD contexts, particularly as these interventions emphasize experiential, emotion-focused engagement over cognitive restructuring.

Mindfulness is defined as the conscious awareness of thoughts, feelings, and the surrounding environment without judgment (Kabat-Zinn, 2003). MBIs, particularly Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) (Zhang et al., 2021), are widely recognized for their efficacy in addressing various mental and physical health conditions, including depression, anxiety (Hofmann et al., 2010), insomnia (Rash et al., 2019), pain (Hilton et al., 2017), addiction (Sancho et al., 2018), post-traumatic stress disorder (PTSD) (Niles et al., 2018), attention deficit hyperactivity disorder (ADHD) (J. N. Zhang et al., 2018; J. Zhang et al., 2018), and ASD (Hourston & Atchley, 2017). MBIs specifically encourage participants to focus on the present moment with an open and accepting attitude toward their emotions (Ridderinkhof et al., 2018). This aligns with the theoretical framework for alleviating anxiety, and an increasing number of studies suggest that MBIs effectively reduce stress and improves overall health in **autistic individuals** and their caregivers.

For autistic individuals, MBIs have demonstrated positive effects on mental health (Pagni, Hill et al., 2023; Sizoo & Kuiper, 2017), emotional regulation (Conner & White, 2018), executive function (Flook et al., 2010; Pagni, Hill et al., 2023), and social skills (Ridderinkhof et al., 2018). Notably, Singh and colleagues (Singh et al., 2014) found that MBIs significantly reduced aggression and improved communication in autistic individuals. MBIs have also been shown to enhance quality of life (Braden et al., 2021) in this population. For caregivers of autistic individuals, studies by Ruiz-Robledillo et al. (Ruiz-Robledillo et al., 2015) and Lunsky (Lunsky et al., 2017) report improvements in psychological well-being and reductions in caregivers stress following MBI participation.

Despite a growing number of empirical studies supporting the efficacy of MBIs for this domain, the field lacks a comprehensive analysis that maps global research patterns, key contributors, and evolving trends. Bibliometrics, a method that uses mathematical and statistical tools to perform quantitative analyses of authors, institutions, countries, keywords, and global research trends, is invaluable for helping researchers quickly identify current hotspots and frontiers in a given field(Ninkov et al., 2022). This approach integrates research information and fosters collaboration and exchange among scholars (Xiao, Huang, Zang et al., 2024; Zang et al., 2023). To address this gap, we conducted a systematic bibliometric analysis of MBIs in ASD research. This study aims to (1) describe the current landscape of MBI research involving autistic individuals and caregivers, (2) identify key countries, institutions, authors, and journals, and (3) highlight future research directions to foster knowledge exchange and advance clinical applications in the field.

2. Methods

2.1. Literature search and data collection

We conducted a comprehensive bibliometric analysis using the Web of Science Core Collection (WoSCC), specifically the Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI), which are widely regarded as authoritative sources for

bibliometric studies. WoSCC was chosen due to its standardized metadata format, compatibility with mainstream bibliometric software (e.g., VOSviewer, CiteSpace), and comprehensive citation information, making it particularly suitable for quantitative mapping of scholarly output (Xiao, Huang, Li et al., 2024; Xiao, Huang, Zang et al., 2024).

We developed a search strategy based on keywords related to MBIs and ASD, including their synonyms. The search formula was: (TS = ("mindful*" OR "dialectical behaviour therap*" OR "acceptance and commitment therap*")) AND (TS= ("autism spectrum disorder" OR "autistic spectrum disorder*" OR "ASD" OR "disorder, autistic spectrum" OR "asperger syndrome" OR "autis*" OR "pervasive developmental disorders" OR "Rett syndrome" OR "childhood disintegrative disorder")). We limited the search to peer-reviewed articles and reviews written in English, published through August 15, 2024. Inclusion criteria were: (a) original articles or review papers published in peer-reviewed journals, (b) focus on MBIs applied to autistic individuals or their caregivers, and (c) English language. Exclusion criteria included: (a) editorials, conference abstracts, letters, dissertations, or commentaries, (b) studies not directly involving autistic individuals or their caregivers, and (c) duplicate entries across document types (see supplementary materials for details).

After completing the search, two authors independently reviewed the titles and abstracts to ensure the inclusion of all eligible publications (see supplementary materials for details). In cases of disagreement, we consulted a third author to finalize the paper's inclusion. Then, we exported the selected papers in plain text and table-delimited formats, capturing key information such as publication year, title, authors, abstracts, and keywords.

2.2. Data analysis

We imported the collected data into Excel 2019 (Microsoft, Washington, USA) for deduplication, organization, and preliminary analysis. Following data cleaning, we utilized the platform (https://bibliometric.com/) and the bibliometrix package in R software version 4.0.3 to analyze the collaborative relationships among different authors, countries, regions, and institutions. We also explored the developmental trends and research hotspots in the field.

3. Results

3.1. Publication volume and growth trends

As of August 15, 2024, our search of the WoSCC core database retrieved 355 relevant documents. The final analysis included 335 publications after removing duplicates and excluding papers that did not meet the inclusion criteria (see Fig. 1). Fig. 1 shows the publication trend of research on MBIs in the field of ASD. The first article in this field appeared in 2006, and until 2013, there was a notable increase in the number of publications. Over the last six years (2019–2024), the field has experienced significant growth with the publication of 230 articles, accounting for 68.66 % of the total. In terms of citation data, the number of citations in this field has significantly increased since 2013, and it has maintained positive momentum in recent years, reaching 8705 total citations by 2024, with an average of 26 citations per paper (see Fig. 2).

3.2. Country/region and institutional analysis

Research on MBIs for ASD has involved 37 countries/regions worldwide. Nirbhay N. Singh from the Medical College of Georgia

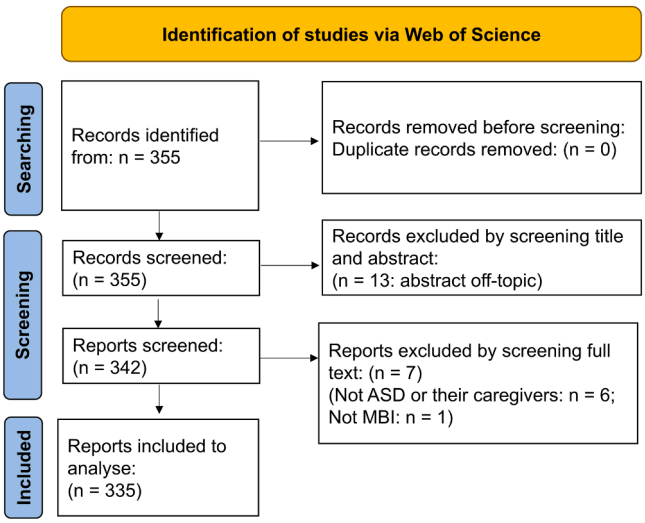


Fig. 1. Screening Flow Chart.

published the first article in this field in the Journal of Emotional and Behavioral Disorders in 2006. This pioneering study demonstrated that mindful parenting could reduce aggression, noncompliance, and self-injurious behavior in children while improving mothers' parenting skills and interaction satisfaction (Singh et al., 2006). In this area, the USA has been the leading contributor, with a rapid increase in publications since 2006. Between 2006 and 2024, the USA produced 331 articles, accounting for 98.81 % of the total output, establishing a dominant presence in the field. China published its first relevant study in 2014, and despite a later start, the country's output grew rapidly after 2016. By 2024, China had contributed 107 studies, accounting for 31.94 % of the global research output in this area. Other top contributing countries include Australia, which published 99 studies (29.55 %), the UK with 89 studies (26.57 %), Canada with 70 studies (20.90 %), the Netherlands with 61 studies (18.21 %), Sweden with 28 studies (8.36 %), Spain with 24 studies (7.16 %), Italy with 23 studies (6.87 %), and New Zealand with 18 studies (5.37 %) (see Fig. 3A).

Additionally, we analyzed the affiliations of the corresponding authors of the 335 papers, which provides further insight into the countries and regions with a research advantage in this field. The USA led in the number of articles with corresponding authors, contributing 119 papers, which accounts for 35.52 % of the total publications in this field, giving it a clear dominance. The USA-based corresponding authors solely authored 101 of these 119 articles, while they co-authored 18 with corresponding authors from other countries. Australia followed with 38 publications, representing 11.34 % of the total. Australian corresponding authors solely authored 28 of these publications, while other countries co-authored 10 more. China ranked third with 36 articles (10.74 %), with 30 having solely Chinese corresponding authors and 6 in collaboration with international corresponding authors (see Table 1). The UK contributed 31 papers, Canada 19, the Netherlands 17, Spain 9, Sweden 7, Ireland 6, and Italy 6. Among the top 10 countries for corresponding author affiliations, Sweden had the highest proportion of international collaborations at 57.14 %, whereas Spain and Iceland had no international co-authorships.

In terms of citations, the USA ranked first with 3829 citations, followed by Australia with 1240 citations and the Netherlands with 1121 citations. The top 10 countries by total citations also included the UK (n = 767), China (n = 636), Canada (n = 417), Jordan (n = 184), Iceland (n = 146), Sweden (n = 131), and Italy (n = 118). The Netherlands had the most average citations per article, with 65.90 citations per paper, followed by Australia (32.60 citations per paper) and the USA (32.20 citations per paper). China had an average of 17.70 citations per paper, Sweden 18.70, and Italy 19.70, indicating these countries are still catching up in terms of citation impact (see Fig. 3B).

In this field, a total of 509 institutions contributed to 335 articles. The University of Toronto ranked first with 23 publications, followed by Education University of Hong Kong and Vanderbilt University, each with 18 publications. Other top contributing institutions included the University of Pittsburgh (n = 16), Harvard University (n = 14), University of London (n = 13), University of Amsterdam (n = 12), King's College London (n = 12), Augusta University (n = 11), and Massachusetts General Hospital (n = 10) (see Fig. 4). Among the top 10 institutions, five are located in the USA, two in the United Kingdom, one in Canada, one in the Netherlands, and one in China, further highlighting the significant research output of the United States in this field.

3.3. Author analysis

A total of 1213 authors have contributed to research on MBIs for ASD. We summarized the top ten most prolific authors in this field (see Table 2 for details). Nirbhay N. Singh from Augusta University leads with 13 related publications between 2006 and 2022. His research focuses on using MBIs for children and autistic adolescents to reduce aggressive, disruptive, noncompliant, and self-injurious

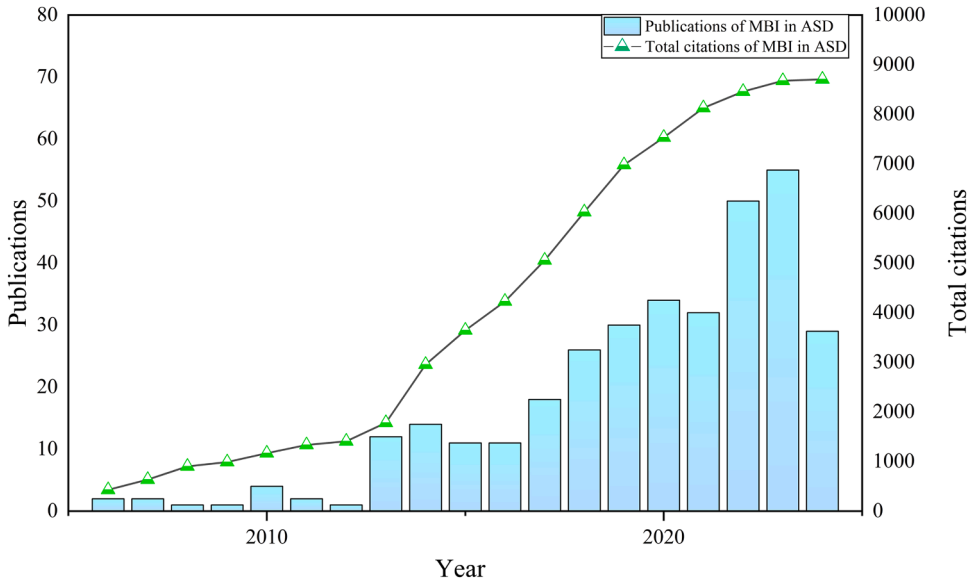


Fig. 2. Growth of publications.

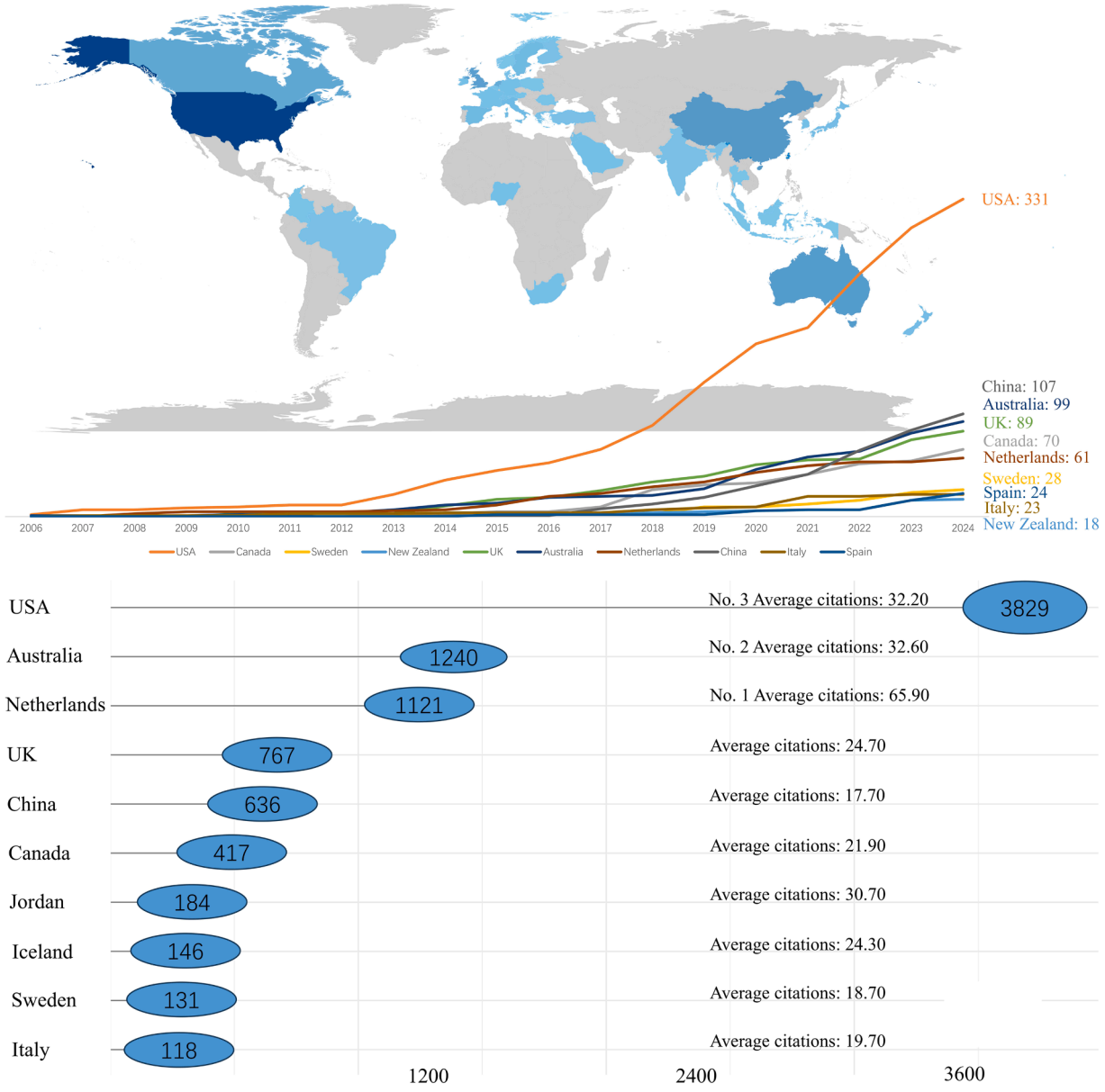


Fig. 3. A. Top 10 countries with highest publications on MBIs in ASD. B. Top 10 countries with highest citations on MBIs in ASD.

Table 1
The top 10 countries with corresponding authors of MBIs publications in ASD.

Country	Publications	SCP	MCP	Frequency	MCP_Ratio
USA	119	101	18	0.355	0.151
AUSTRALIA	38	28	10	0.113	0.263
CHINA	36	30	6	0.107	0.167
UK	31	25	6	0.093	0.194
CANADA	19	14	5	0.057	0.263
NETHERLANDS	17	11	6	0.051	0.353
SPAIN	9	9	0	0.027	0.000
SWEDEN	7	3	4	0.021	0.571
IRELAND	6	6	0	0.018	0.000
AUSTRALIA	6	5	1	0.018	0.167

SCP: Single country publications; MCP: Multiple country publications; Frequency: Number of publications in this country/total number of publications; MCP_Ratio: MCP/Publications

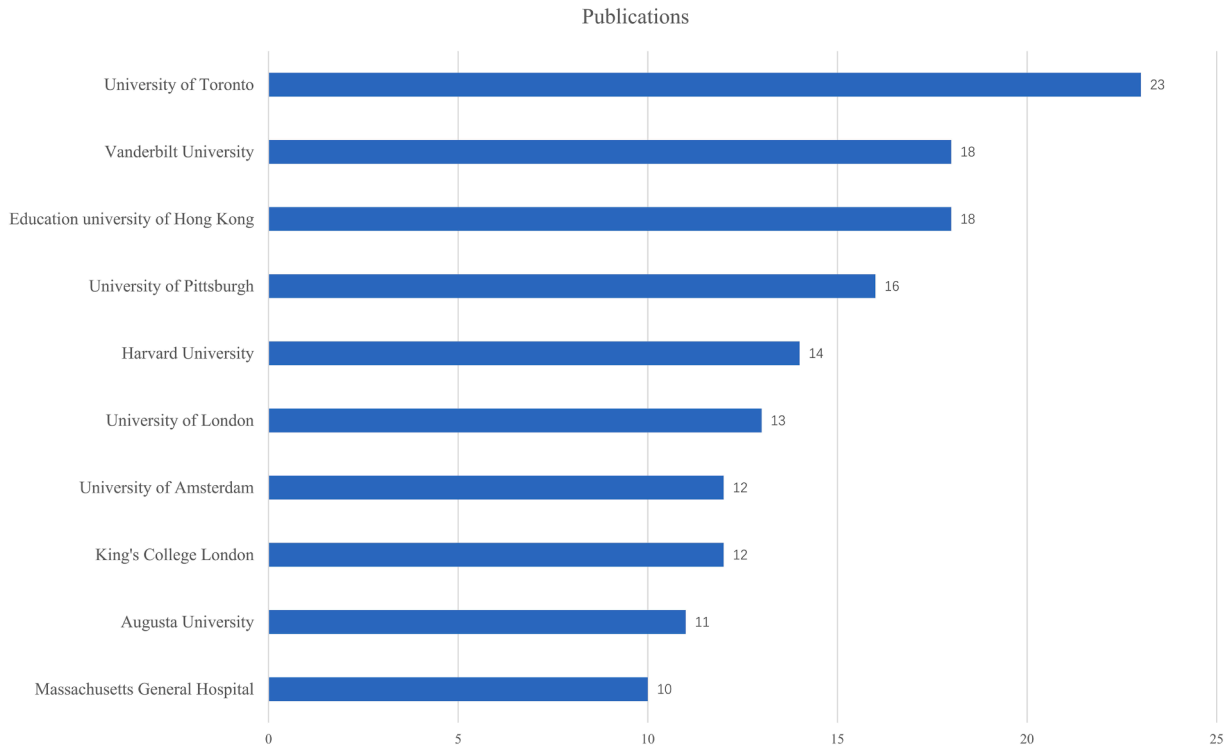


Fig. 4. Top 10 institutions with highest publications on MBIs in ASD.

behaviors while enhancing their self-management strategies, social behaviors, and overall quality of life (Singh, Lancioni, Manikam et al., 2011; Singh, Lancioni, Singh et al., 2011; Singh et al., 2006). Additionally, Singh has explored the impact of mindfulness interventions on the behaviors, stress, and quality of life of caregivers of individuals with ASD (Singh et al., 2019; Singh et al., 2020; Singh et al., 2014). Cameron L. Neece from Loma Linda University ranks second, with 10 articles published between 2014 and 2024. Neece's work focuses on the effects of mindfulness interventions on the behavioral problems of autistic individuals and their parents (Neece, 2014). She also investigates the feasibility and efficacy of mindfulness interventions in alleviating parental stress in autism families (Fenning et al., 2023; Neece et al., 2024). Richard Hastings from the University of Warwick, Giulio E. Lancioni from the University of Bari, and Yona Lunsky from the University of Toronto each contributed nine articles. From 2010 to 2023, Hastings studied how mindfulness interventions affected autistic children and parents' behaviors and well-being (Jones et al., 2014; Lunsky et al., 2017), and explored the impact of virtual mindfulness interventions on their caregivers (Lunsky et al., 2021). Lancioni has collaborated extensively with Singh between 2006 and 2021, focusing on enhancing the mindfulness parenting skills of mothers of autistic individuals (Singh et al., 2021), improving the quality of life of caregivers (Singh et al., 2020), and reducing aggressive, noncompliant, and self-injurious behaviors in autistic individuals (Singh, Lancioni, Manikam et al., 2011; Singh et al., 2006; Singh et al., 2014). Between 2015 and 2024, Lunsky investigated the effects of mindfulness on stress and behavioral interventions for autistic individuals and their parents (Lunsky et al., 2017; Maughan et al., 2024), as well as the feasibility and efficacy of virtual group mindfulness interventions for ASD families (Lunsky et al., 2021; Lunsky et al., 2022).

Susan M. Bögels from the University of Amsterdam and Jonathan A. Weiss from York University have each published eight related articles. Bögels, active from 2015 to 2021, has conducted several MBIs programs for autistic individuals and their parents, focusing on

Table 2
The top 10 productive authors with MBIs publications in ASD.

Rank	Author	Current affiliations and countries	Number of publications
1	Nirbhay N. Singh	Augusta University, USA	13
2	Cameron L. Neece	Loma Linda University, USA	10
3	Richard Hastings	University of Warwick, UK	9
3	Giulio E. Lancioni	University of Bari, Italy	9
3	Yona Lunsky	University of Toronto, Canada	9
6	Susan M. Bögels	University of Amsterdam, Netherlands	8
6	Jonathan A. Weiss	York University, Canada	8
8	Kevin Ka Shing Chan	Education University of Hong Kong, China	7
8	Esther I. de Bruin	University of Amsterdam, Netherlands	7
8	Yoon-Suk Hwang	Australian Catholic University, Australia	7

how mindfulness improves behaviors and reduces stress in these populations (de Bruin et al., 2015; Ho et al., 2021; Ridderinkhof et al., 2019; Ridderinkhof et al., 2021). Between 2017 and 2024, Weiss has concentrated on synchronous group mindfulness interventions for autistic individuals and their parents, investigating their feasibility and intervention effects (Lunsky et al., 2017; Maughan et al., 2024; Salem-Guirgis et al., 2019). Additionally, Kevin Ka Shing Chan from the Education University of Hong Kong, Esther I. de Bruin from the University of Amsterdam, and Yoon-Suk Hwang from the Australian Catholic University have each contributed seven articles. These authors' research has significantly advanced the application and understanding of MBIs for autistic individuals and their caregivers, promoting broader use and evidence-based evaluation.

3.4. Journal and publication analysis

146 journals published a total of 335 related articles. Using Bradford's Law, we categorized these journals based on the number of articles published. Bradford's Law divides journals into three groups, with each group containing roughly one-third of the total number of articles, helping to identify the core journals in this field (von Ungern-Sternberg, 2000). The data show that there are 5 journals in Zone 1, 33 journals in Zone 2, and 108 journals in Zone 3. The 5 journals in Zone 1 collectively published 119 articles, accounting for 35.52 % of the total publications, indicating a significant dominance in this field. We summarized the impact factors (IF), quartiles, and categories of the top 15 journals by publication count (see Table 3).

The Journal of Autism and Developmental Disorders, and Mindfulness are the top two journals by publication volume, each contributing 36 articles, or 10.75 % of total publications. Journal Autism follows closely, with 21 articles accounting for 6.27 % of the total. Other journals in the top 15 include Research in Autism Spectrum Disorders (n = 15), Journal of Contextual Behavioral Science (n = 11), Research in Developmental Disabilities (n = 11), Frontiers in Psychology (n = 10), Journal of Child and Family Studies (n = 7), AJIDD-American Journal on Intellectual and Developmental Disabilities (n = 5), Children-Basel (n = 5), Review Journal of Autism and Developmental Disorders (n = 5), BMJ Open (n = 4), Archives of Psychiatric Nursing (n = 3), Art Therapy in

Table 3
Top 15 journals by number of publications on MBIs in ASD.

Rank	Journal	Publications (%) a	cumPub (%) b	IF (2023) c	JCR Category (SCIE/SSCI)
1	Journal of autism and developmental disorders	36 (10.75 %)	36 (10.75 %)	3.2, Q1	Psychology, Developmental (SSCI)
1	Mindfulness	36 (10.75 %)	72 (21.49 %)	3.1, Q1	Psychiatry (SSCI) Psychology, Clinical (SSCI)
3	Autism	21 (6.27 %)	93 (27.76 %)	5.2, Q1	Psychology, Developmental (SSCI)
4	Research in autism spectrum disorders	15 (4.48 %)	108 (32.24 %)	2.2, Q1	Education, Special (SSCI) Psychiatry (SSCI) Psychology, Developmental (SSCI) Rehabilitation (SSCI)
5	Journal of Contextual Behavioral Science	11 (3.29 %)	119 (35.52 %)	3.4, Q1	Psychology, Clinical (SSCI)
5	Research in Developmental Disabilities	11 (3.29 %)	130 (38.81 %)	2.9, Q1	Education, Special (SSCI) Rehabilitation (SSCI)
7	Frontiers in Psychology	10 (2.99 %)	140 (41.79 %)	2,6, Q2	Psychology, Multidisciplinary (SSCI)
8	Journal of Child and Family Studies	7 (2.09 %)	147 (43.88 %)	1.6, Q2	Family Studies (SSCI) Psychiatry (SSCI) Psychology, Developmental (SSCI)
9	AJIDD-American Journal on Intellectual and Developmental Disabilities	5 (1.49 %)	152 (45.37 %)	1.9, Q1	Education, Special (SSCI) Rehabilitation (SSCI)
9	Children-Basel	5 (1.49 %)	157 (46.87 %)	2, Q2	Pediatrics (SCIE)
9	Review Journal of Autism and Developmental Disorders	5 (1.49 %)	162 (48.36 %)	2.9, Q2	Psychology, Developmental (SSCI)
12	BMJ Open	4 (1.19 %)	166 (49.55 %)	2.4, Q1	Medicine, General & Internal (SCIE)
13	Archives of Psychiatric Nursing	3 (0.90 %)	169 (50.45 %)	2.2, Q1	Nursing (SCIE/SSCI) Psychiatry (SCIE/SSCI)
13	Artis in Psychotherapy	3 (0.90 %)	172 (51.34 %)	1.5, Q3	Psychology, Clinical (SSCI) Rehabilitation (SSCI)
13	Autism Research	3 (0.90 %)	175 (52.24 %)	5.3, Q1	Behavioral Sciences (SCIE) Psychology, Developmental (SSCI)

a: Percentage of total published articles in the journal; b: Cumulative publications as a percentage of total publications; c: Journal impact factor (Journal Citation Reports 2023);

Psychotherapy (n = 3), and Autism Research (n = 24). The top 15 journals published 175 articles, or 52.24 % of the total, indicating a high output concentration in these core journals.

Analyzing local citation counts for articles in this field can help identify the foundational research and emerging hotspots. We ranked the 335 articles based on their local citations and summarized the top 10 most cited articles (see Table 4). The journal Mindfulness published the article with the highest local citation count in 2013, garnering 52 local citations. This study demonstrated that mindfulness interventions effectively improve the stress levels and overall health of parents of autistic individuals (Ferraioli & Harris, 2013). A 2013 randomized controlled trial (RCT) with 51 local citations in Research in Developmental Disabilities closely follows. This study found that MBIs significantly reduced depression, anxiety, and rumination in autistic adults while improving positive emotions (Spek et al., 2013). Two articles published in 2014 in Pediatrics and the Journal of Applied Research in Intellectual Disabilities both ranked third with 50 local citations. One article reported that MBSR programs improved attention problems and ADHD symptoms in children with developmental delays while reducing parental stress and depression and enhancing their quality of life (Neece, 2014). The other study showed that mindfulness-based stress reduction improved anxiety, depression, and sleep in mothers of autistic individuals, leading to an overall increase in their well-being (Dykens et al., 2014). With 49 local citations, a 2015 article in Autism placed fifth. This article highlighted the positive effects of the MYmind mindfulness program, which improved the quality of life for both autistic adolescents and their parents; enhanced social communication, cognitive functioning, and attention in autistic adolescents; and improved parenting skills and overall family functioning for the parents (de Bruin et al., 2015). Other highly cited articles introduced the effectiveness of acceptance and commitment therapy (ACT) in supporting parents of autistic individuals (Blackledge & Hayes, 2006), discussed how mindful parenting reduced aggression, noncompliance, and self-injurious behavior in autistic children while improving mothers' parenting skills and interaction satisfaction (Singh et al., 2006; Singh et al., 2007), and explored how mindfulness-based positive behavior support helped parents manage challenging and disruptive behaviors in autistic individuals, ultimately improving caregivers' health and well-being (Singh et al., 2014). Furthermore, systematic reviews demonstrated the effectiveness of MBIs in reducing stress and improving mental health and well-being in autistic individuals and their parents (Cachia et al., 2016; Hartley et al., 2019; Loftus et al., 2023).

3.5. Keyword and hotspot analysis

Co-occurrence analysis of keywords helps quickly identify the key topics in the field and explore the relationships between them. There were 808 keywords plus entries across the 335 papers included in this study. We selected the top 50 most frequent keywords for further analysis. Among them, "children" appeared the most frequently, with 77 occurrences, followed by "mindfulness" with 74 occurrences, and "stress" with 70 occurrences. These three keywords represent the most frequently studied topics. Researchers are primarily researching "mindfulness" as the primary intervention method, while "autism" (n = 53) represents the target population, specifically individuals with ASD. Keywords such as "children," "mothers" (n = 61), "adolescents" (n = 51), and "young children" (n = 48) indicate that researchers are particularly focused on how MBIs affect autistic individuals, as well as their mothers. Meanwhile, "stress," "depression" (n = 54), "mental health" (n = 48), and "anxiety" (n = 45) highlight the significant role MBIs play in alleviating stress, depression, anxiety, and improving the mental health of both autistic individuals and their caregivers (see Fig. 5A).

Table 4
Top 10 most locally cited publications on MBIs in ASD.

Rank	Title	First Author	Year	Journal	Local citations
1	Comparative Effects of Mindfulness and Skills-Based Parent Training Programs for Parents of Children with Autism: Feasibility and Preliminary Outcome Data	Suzannah J. Ferraioli	2013	Mindfulness	52
2	Mindfulness-based therapy in adults with an autism spectrum disorder: A randomized controlled trial	Annelies A. Spek	2013	Research in Developmental Disabilities	51
3	Reducing Distress in Mothers of Children With Autism and Other Disabilities: A Randomized Trial	Elisabeth M. Dykens	2014	Pediatrics	50
3	Mindfulness-Based Stress Reduction for Parents of Young Children with Developmental Delays: Implications for Parental Mental Health and Child Behavior Problems	Cameron L. Neece	2014	Journal of Applied Research in Intellectual Disabilities	50
5	MYmind: Mindfulness training for Youngsters with autism spectrum disorders and their parents	Esther I de Bruin	2015	Autism	49
6	Using Acceptance and Commitment Training in the Support of Parents of Children Diagnosed with Autism	John T. Blackledge	2006	Child & Family Behavior Therapy	43
6	Mindful Parenting Decreases Aggression, Noncompliance, and Self-Injury in Children With Autism	Nirbhay N. Singh	2006	Journal of Emotional and Behavioral Disorders	43
6	Mindful Parenting Decreases Aggression and Increases Social Behavior in Children With Developmental Disabilities	Nirbhay N. Singh	2007	Behavior Modification	43
9	Mindfulness, Stress and Well-Being in Parents of Children with Autism Spectrum Disorder: A Systematic Review	Renee L. Cachia	2016	Journal of Child and Family Studies	39
10	Mindfulness-Based Positive Behavior Support (MBPBS) for Mothers of Adolescents with Autism Spectrum Disorder: Effects on Adolescents' Behavior and Parental Stress	Nirbhay N. Singh	2014	Mindfulness	35

3.6. Thematic map analysis

Additionally, we performed a thematic map and evolution analysis of the keywords in this field to better understand the research hotspots and dynamics and predict future research directions. As shown in Fig. 5B, the thematic map categorizes the themes into four quadrants based on two dimensions: centrality and density.

(1) Upper Right - Motor Themes: This quadrant reflects themes with high centrality and high density, indicating they are core topics

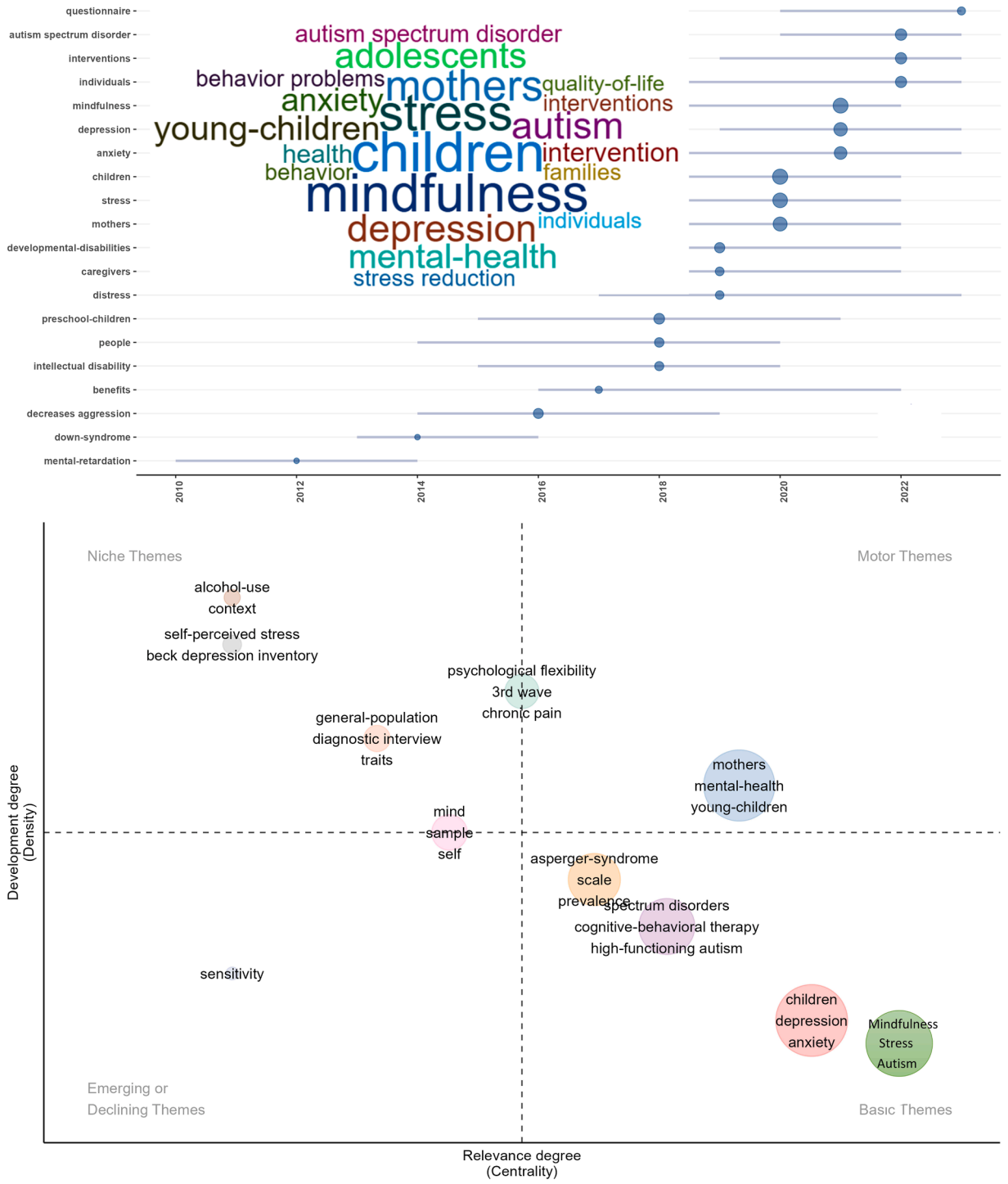


Fig. 5. A. Word Cloud and trend topics on MBIs in ASD. B. Thematic map on MBIs in ASD. C. Thematic evolution on MBIs in ASD.

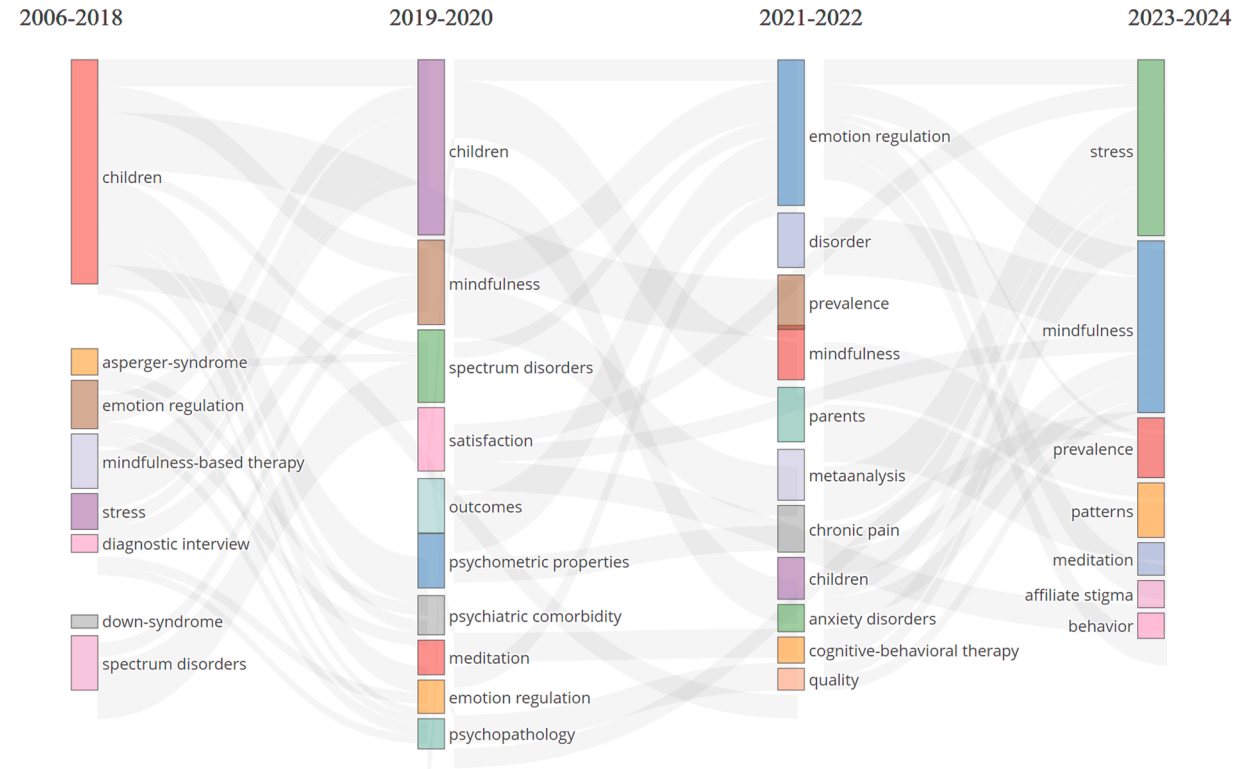


Fig. 5. (*continued*).

in the field and crucial to its development. The keywords "mothers," "mental health," and "young children" fall within this quadrant, suggesting that these are key groups for MBIs in ASD. The inclusion of parents, particularly mothers, in the intervention process underscores the importance of family-centered therapeutic approaches, emphasizing the need to address caregivers' well-being in the context of treating ASD. The prominence of the keyword 'mental health' suggests sustained research interest in exploring how MBIs might support the psychological well-being of autistic individuals and their caregivers. Notably, the prevalence of "mental health" studies does not equate to established efficacy, as many studies lack robust methodological designs.

(2) Upper Left - Niche Themes: This quadrant represents themes that are highly developed but not the primary focus of current research. Keywords such as "alcohol use," "context," and "self-perceived stress" are more indirectly related to the core challenges of ASD interventions, exploring whether MBIs are effective for ASD with comorbid substance use or other psychological disorders. The use of psychometric tools (like the Beck Depression Inventory, Parenting Stress Index, and Social Responsiveness Scale) shows that researchers depend on standard tests to evaluate the results of mindfulness interventions.

(3) Lower Right - Basic Themes: The themes in this quadrant, which are foundational to the field but have not yet received extensive research, exhibit high centrality but low density. These are likely to be major focuses of future research. Keywords in this area include "children," "depression," "anxiety," "mindfulness," "stress," and "autism." Several studies have supported the role of mindfulness in reducing stress, improving emotional regulation, and managing behavior in autistic children. One of the future research priorities will likely be the development of specialized mindfulness programs for autistic children.

(4) Lower Left - Emerging or Declining Themes: Themes in this quadrant are characterized by low density and low centrality. These themes represent either emerging trends in the field or areas of declining relevance. This quadrant is home to keywords such as "sensitivity," "self," "sample," and "mind." These keywords indicate the preliminary exploration of how mindfulness interventions relate to sensory processing sensitivity, self-awareness, and other less-studied areas in ASD. Notably, the areas related to sensory sensitivity and self-awareness will likely offer fresh insights, inspiring new developments in this evolving field.

3.7. Thematic Evolution

To further identify the evolution of research themes in this field, we divided the studies into four time periods and created a thematic evolution map (see Fig. 5C). In the initial phase (2006–2018), Research primarily focused on emotional regulation, anxiety reduction, and behavioral management in autistic children, establishing foundational evidence for MBIs.

During the 2019–2020 period, MBIs extended to include caregivers, particularly mothers, emphasizing the interrelated well-being of autistic individuals and their families. This period saw advancements in psychometric assessments and interventions addressing comorbid mental health issues.

In the 2021–2022 period, research developed further with studies that combined mindfulness and cognitive-behavioral techniques to tackle complicated issues like chronic pain and anxiety. Family involvement remained central, highlighting the comprehensive impact of family dynamics.

In the most recent period, 2023–2024, ongoing dominance of "stress," "mindfulness," and "prevalence" underscores continuous efforts to reduce stress among autistic individuals and caregivers. Emerging research explores underlying behavioral patterns, specific meditation techniques, and affiliate stigma, examining mindfulness's role in mitigating social stigma impacts.

4. Discussion

4.1. Overview of findings and research trends

Recently, there has been a growing body of research investigating MBIs as either stand-alone or adjunctive interventions for autistic individuals and their caregivers. While some studies integrate MBIs with behavioral therapy or psychoeducation, many others explore them as independent approaches to address stress, emotional dysregulation, and co-occurring anxiety or depression. This study employs bibliometric methods to provide a comprehensive overview of research on MBIs for autistic individuals and their caregivers. We systematically describe the current application of MBI in the field of ASD, analyze trends in development, and offer insights into key information about countries, institutions, authors, and journals involved in the research. Additionally, we discuss future research hotspots and directions, with the aim of helping researchers quickly identify key areas for collaboration and development in this field, thereby advancing the clinical application of MBIs and improving the physical and mental well-being of autistic individuals and their caregivers.

A total of 1213 authors have contributed to research on MBIs for autistic individuals and their caregivers, publishing 335 papers across 146 journals. Since 2013, there has been a marked increase in publications in this field, with the last six years accounting for 68.66 % of total publications, demonstrating the field's robust growth. In terms of global research contributions, the USA leads both in the number of published articles and total citations. The Netherlands ranks first in average citations per article, with 65.90 citations per paper, followed by Australia with 32.60 citations, and the USA with 32.20 citations per paper. China, Italy, and Sweden have relatively lower average citation rates in the field. In terms of corresponding author analysis, USA-based authors contributed 35.52 % of the articles, indicating a dominant presence in the field. From an institutional perspective, the University of Toronto leads with 23 publications, followed by the Education University of Hong Kong and Vanderbilt University, each with 18 articles. The top 10 institutions contributed 43.88 % of total publications, highlighting a trend of concentrated research output. Of the top 10 institutions, five are located in the USA, further underscoring the country's prominent role in this research area.

4.2. Thematic evolution and keyword analysis

From prospects of keywords, in the early stages of research, the primary focus was on how MBIs reduce stress and anxiety in autistic individuals, emphasizing the mental health benefits of mindfulness for these individuals. Tools such as the Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), and Depression Anxiety and Stress Scale (DASS) played key roles in assessing these mental health outcomes. This phase laid the foundation for how mindfulness techniques (e.g., breathing exercises, meditation, and acceptance-based therapies) help address the emotional and behavioral challenges commonly seen in autistic individuals.

As the field evolved, researchers began to focus on the physical and mental well-being of caregivers, particularly the mothers of autistic individuals. The Parenting Stress Index (PSI) became an important tool for measuring reductions in caregiver stress following mindfulness practice. This shift highlights the growing recognition that interventions for autistic individuals require a holistic approach that includes supporting their caregivers. Research has shown that family-based mindfulness interventions can reduce caregiver stress, enhance caregiver well-being, and improve the management of behavioral issues in autistic individuals. This period showed how autistic individuals and caregivers are interconnected. Researchers also began to focus on how mindfulness techniques could improve executive function and behavioral regulation in autistic individuals. Tools such as the Behavior Rating Inventory of Executive Function (BRIEF) and the Child Behavior Checklist (CBCL) became critical in assessing the impact of mindfulness on these domains. The extension of mindfulness into cognitive and behavioral fields demonstrates that mindfulness not only manages stress but also enhances cognitive flexibility, attention, and emotional regulation in autistic individuals.

Since 2021, researchers have increasingly explored the application of mindfulness in addressing comorbid conditions in autistic individuals, such as depression, substance abuse, and chronic pain. Researchers have widely used tools like the BDI and scales related to psychological flexibility in this area. Moreover, the use of artificial intelligence (AI) to deliver MBIs—such as through mobile applications or virtual reality—has become more prevalent. These technological solutions offer more accessible ways to provide mindfulness training, particularly for individuals who may face barriers to attending traditional therapy sessions. Integrating AI technology into mindfulness practice makes interventions more scalable, accessible, and personalized, marking a key future direction in the field.

As MBIs continues to evolve, there is increasing interest in how MBIs can help address core challenges in ASD, such as sensory processing issues and difficulties in social communication. Researchers have utilized tools like the Social Responsiveness Scale (SRS) to evaluate the effectiveness of MBIs in these domains. Future research that shows even more how MBIs can help autistic individuals improve their ability to control their sensory input and interact with others will make mindfulness an even more powerful way to help this group. Additionally, researchers have begun to pay closer attention to the long-term impacts of early MBIs. Understanding the lasting benefits of mindfulness for autistic individuals is crucial to establishing it not just as a short-term intervention but as a

sustainable method for improving lifelong emotional regulation, behavior, and mental health.

Although MBIs have been shown to enhance emotional self-awareness, social communication skills, reduce repetitive and maladaptive behaviors, anxiety and depression, and improve the subjective well-being of autistic individuals (Agius et al., 2024; de Bruin et al., 2015; Hwang et al., 2015; Kiep et al., 2015; Ridderinkhof et al., 2018; Ridderinkhof et al., 2020; Sizoo & Kuiper, 2017; Spek et al., 2013; White et al., 2018), findings remain mixed. For example, a recent study using an active social support comparison group found no significant differences in anxiety or depression between groups in autistic adults (Pagni, Hill et al., 2023). This suggests that the frequent use of waitlist controls in prior studies may overestimate intervention effects. Future trials should prioritize active comparators and stratify outcomes by age group and baseline symptom severity.

4.3. Mechanisms of MBIs

Meanwhile, research into the neurophysiological mechanisms by which MBIs exert their effects in autistic individuals remains in its early stages. The mindfulness-to-meaning theory (MMT) (van der Velden et al., 2015) and alterations in the brain's default mode network (DMN) (Pagni et al., 2020) are two prominent models currently accepted. Recent neuroimaging studies in autistic adults provide preliminary support for these mechanistic pathways. For example, Pagni, Williams, et al. (Pagni, Williams et al., 2023) reported that mindfulness-based anxiety reduction was associated with altered DMN connectivity in adults with ASD, potentially reflecting improvements in self-referential processing and internal focus. Complementary findings from source-localized EEG research demonstrate increased alpha and theta power following MBIs in this population, neurophysiological markers associated with reduced anxiety and enhanced attentional control (Lomas et al., 2015). These findings suggest that MBIs may exert their therapeutic effects by rebalancing brain activity linked to rumination, sensory integration, and emotional regulation—domains often disrupted in autism.

Mechanistic insights from broader populations further reinforce these pathways. Structural and functional imaging studies have consistently shown that MBIs induce changes in the sensory cortex, insula, frontopolar cortex, hippocampus, and anterior/mid-cingulate cortices (Fox et al., 2016; Vignaud et al., 2018). These alterations are thought to enhance interoceptive awareness, reduce emotional reactivity, and improve top-down regulation of attention and emotion (Burg & Michalak, 2011; Gu et al., 2015). The decrease in maladaptive rumination is, in turn, positively correlated with reductions in depression and anxiety, which are highly prevalent among autistic individuals (Spek et al., 2013).

Beyond neural changes, MBIs have also been found to influence peripheral physiological systems. Evidence from non-ASD populations suggests that MBI participation reduces cortisol levels, blood pressure, and heart rate (Pascoe et al., 2017) and modulates immune function by decreasing NF-kB activity and increasing telomerase expression (Black & Slavich, 2016). Although such biological effects have yet to be extensively replicated in ASD populations, they offer promising avenues for future mechanistic investigation.

Taken together, these converging lines of evidence suggest that MBIs may work through both central and peripheral mechanisms—modulating brain network dynamics and physiological stress responses. However, larger, well-controlled trials with neuroimaging and biomarker integration are needed to validate these pathways in autistic populations specifically.

4.4. MBIs for caregivers of autistic individuals

Additionally, it is important to emphasize that the mental and physical health of ASD caregivers has become a major focus of future research in this field. The immense caregiving burden associated with ASD increases the likelihood of physical and mental health deterioration among caregivers, which in turn can hinder effective interventions for ASD (Weitlauf et al., 2020). A 2011 study revealed that 80% of autistic adults still lived with their parents (Shattuck et al., 2011). Given that most autistic individuals are unable to live independently, caregivers often prioritize the needs of their children over their own health, which creates a unique dependence that intensifies psychological stress and negatively impacts caregivers' health (Larson, 2024). Many parents struggle to adjust their expectations for their children and are filled with concerns about their future, exacerbating their anxiety and leading to physical and emotional exhaustion.

Moreover, the psychological stress, anxiety, and depression experienced by caregivers can directly impact the condition and treatment outcomes of autistic individuals (Clifford et al., 2022; Weitlauf et al., 2020). Thus, addressing the mental and physical health of caregivers is critically urgent. From a mindfulness perspective, MBIs are particularly suited to alleviating the challenges faced by ASD caregivers. Mindfulness emphasizes self-regulation through introspection and non-judgmental reflection as a first step in dealing with external stress, followed by action. These principles can help ASD caregivers view their situations more objectively, accept their circumstances, and improve their emotional expression, reducing the buildup of stress. Experimental studies on MBIs have demonstrated that mindfulness programs effectively improve parent-child relationships, reduce parenting stress, anxiety, and depression, and enhance the overall health of parents of autistic children (Maughan et al., 2024; Neece et al., 2023; Weitlauf et al., 2020).

However, current research on the effects of MBIs on ASD caregivers remains limited. Many studies rely heavily on self-reported data, with no scales specifically designed for caregivers, which limits the overall quality of the research and the strength of the conclusions that can be drawn. Future research should aim to include more diverse populations of autistic individuals and caregivers, and use a combination of psychometric scales and physiological biomarkers to specifically explore the effects of MBIs on ASD caregivers. Additionally, researchers should examine whether these effects can serve as mediators to improve the well-being of autistic individuals themselves. In addition to MBIs, future interventions for ASD caregivers could incorporate other stress reduction techniques such as stress management and relaxation techniques, CBT, positive psychological strategies, and expressive writing. Caregivers could also benefit from comprehensive education programs designed to enhance their understanding of ASD. We believe that as ASD diagnosis rates continue to rise, establishing care plans centered around both autistic individuals and their caregivers will provide

much-needed support to both groups, leading to improved outcomes for autistic individuals and their families.

4.5. Recommendations for future research

Therefore, we call on researchers in this field to delve deeper into the following areas:

(1) Exploring MBIs acceptance and compliance among autistic individuals and their caregivers. Current research in this area rarely reports on participants' acceptance and completion of MBIs, significantly affecting the evaluation of MBIs effectiveness. It's crucial to recognize that some groups, such as those with ASD or ADHD, may exhibit lower compliance and overall completion rates. To address this, future research should explore behavioral nudging, digital gamification, and caregiver-supported participation models to enhance engagement with MBIs.

(2) Integrating MBIs with Other Therapeutic Modalities in Clinical Practice. Given the complex and heterogeneous nature of ASD, single-modality interventions often fall short in addressing the full range of clinical needs. Therefore, combining MBIs with other proven treatments might improve results by working together effectively. CBT, for example, remains a cornerstone treatment for anxiety and emotional dysregulation in ASD, but it often demands strong verbal and cognitive engagement (Sizoo & Kuiper, 2017). MBIs may offer a complementary pathway—especially for individuals who struggle with cognitive reframing—by providing an experiential and emotion-focused practice. Combining CBT with MBIs has been proposed as a promising avenue for improving stress management and emotional resilience in autistic individuals. Pharmacological interventions also remain common in autistic individuals, particularly for comorbid conditions such as depression, anxiety, or insomnia. MBIs may serve as non-pharmacological adjuncts to reduce medication burden or enhance the efficacy of psychotropic treatment. For example, mindfulness has shown potential in alleviating insomnia, somatic symptoms, and chronic pain—issues often poorly addressed by medication alone (Maddox et al., 2018).

Furthermore, low adherence is a recurring concern in MBI interventions, particularly among autistic individuals. Integrating MBIs with structured physical activity (e.g., yoga, aerobic exercise) may enhance compliance through embodied engagement and deliver additional physiological benefits (Kraemer et al., 2020). Similarly, combining MBIs with music or animal-assisted therapies may increase affective engagement, especially in pediatric and sensory-sensitive populations (Künzi et al., 2022; Xiao, Bagayi et al., 2024). With the rise of telemedicine and digital mental health, delivering MBIs through app-based platforms represents a promising frontier. Recent studies have begun applying habit-formation paradigms to promote sustained mindfulness practice via mobile apps in autistic adults (Stecher et al., 2024) and adolescents (Stecher et al., 2024). These findings show that it's possible to use flexible mindfulness-based interventions in areas with fewer resources, where access to traditional therapy is limited.

(3) Improving MBIs through artificial intelligence technology. Develop enhanced versions of mindfulness, such as Mindativity+ , to provide more personalized and precise interventions for autistic individuals. Any intervention should consider the characteristics of the target population. While personalized MBIs like the MYmind Program (Ridderinkhof et al., 2018) and Sole Meditation (Singh et al., 2003) are available for ASD and other neurodevelopmental disorders, these targeted interventions are insufficient. When autistic individuals undergo MBIs, the suitability of different ASD groups, such as those with intellectual disabilities, should be considered. For example, could the addition of behavioral strategies, social modules, and parent interaction enhance the applicability of MBIs for this group?

(4) Enhancing the psychological health of autistic caregivers. To enhance the health-related quality of life of ASD caregivers, actively explore factors affecting their well-being.

(5) Developing guidelines and regulations related to MBIs. We urge researchers to report adverse events and encourage practitioners to establish higher standards for MBIs implementation, safety, and security.

(6) Further investigation into the mechanisms of action of MBIs is necessary. This exploration will enhance our understanding of MBIs and lay a solid foundation for their promotion. By addressing these areas, future research can provide more personalized intervention tools for autistic individuals and further improve the care and quality of life for both autistic individuals and their caregivers.

4.6. Implications for clinical practice, research, and policy

(1) Clinical implications. This bibliometric analysis reveals that MBIs have gained increasing attention as promising tools for improving the psychological well-being of autistic individuals and their caregivers. However, current implementation practices remain limited by insufficient personalization, suboptimal adherence, and fragmented integration with existing clinical treatments. To maximize clinical impact, MBIs should be considered as part of a multi-modal treatment framework—especially when combined with CBT, pharmacological treatment, or structured physical activity programs. Such integrations may be particularly beneficial for autistic individuals who exhibit poor cognitive flexibility or are less responsive to traditional verbal therapies. Moreover, the adaptability of MBIs for distinct ASD subgroups (e.g., individuals with intellectual disability or sensory sensitivity) should be more systematically explored through modular design approaches incorporating social, behavioral, and family-involvement elements. MBIs may also play an essential role in caregiver support. Our findings confirm a strong research emphasis on mothers and caregivers, reflecting growing recognition of their vulnerability to psychological distress. Scalable MBI programs—delivered either in person or via digital platforms—could offer cost-effective support for caregivers mental health and potentially reduce burnout and secondary trauma. This has clear implications for improving family dynamics and treatment continuity.

(2) Implications for Research. Despite the rapid increase in publications, the field of MBIs research in ASD still faces several methodological limitations. First, many studies rely on waitlist controls, making it difficult to disentangle treatment-specific effects

from nonspecific support or expectancy effects. Future trials should prioritize active control groups and longitudinal follow-up designs. Second, neurophysiological mechanisms remain underexplored, particularly in autistic individuals. Recent evidence points to changes in the DMN, alpha/theta EEG activity, and affective regulation circuits, but larger, source-localized studies with concurrent biomarker data (e.g., cortisol, immune markers) are needed to validate these findings. Understanding the mechanisms of MBIs is not only scientifically valuable but will also help tailor interventions to the neurocognitive profiles of different autistic individuals. Technological innovation also offers an important future direction. AI-enabled interventions—such as adaptive mindfulness apps or intelligent feedback systems (e.g., Mindativity+)—have the potential to increase personalization, optimize real-time engagement, and improve adherence. While early app-based studies show promise in autistic youth and adults, greater emphasis is needed on usability, accessibility, and ethical safeguards. Furthermore, caregiver-facing digital platforms should be developed in parallel to maximize ecosystem-level benefits.

(3) Policy Implications. From a policy perspective, there is a pressing need to standardize the development, delivery, and evaluation of MBIs for autistic individuals. Regulatory frameworks should emphasize safety monitoring, therapist training, cultural adaptation, and the transparent reporting of adverse events—an area currently under-addressed in the literature. Our findings underscore the need for international guidelines that define best practices for MBI implementation in clinical and community settings. In addition, support for open-access dissemination of mindfulness tools—particularly for underserved or low-income communities—could expand access to effective non-pharmacological care worldwide.

Collectively, these insights support a multi-stakeholder roadmap for advancing MBIs in ASD, rooted in scientific rigor, clinical integration, and equitable accessibility. By bridging current gaps in personalization, mechanistic understanding, and implementation science, the field can move toward delivering precision-based, sustainable mental health care for autistic individuals and their families.

5. Limitations

This study relied exclusively on data from the WoSCC, which, while widely used in bibliometric research, does not include all relevant publications indexed in databases such as Scopus or PubMed. This may have led to the omission of studies published in other sources and reduced the comprehensiveness of the analysis. Additionally, the inclusion of only English-language publications may introduce citation and language bias, potentially overrepresenting English-speaking countries (e.g., the U.S. and U.K.) and underrepresenting valuable non-English contributions. Finally, citation-based metrics may disadvantage more recent articles that have not yet accumulated citations, possibly underestimating their scholarly impact.

6. Conclusion

To our knowledge, this is the first bibliometric study focused on MBIs for autistic individuals and their caregivers. Our findings indicate that 1213 authors have published 335 related articles across 146 journals. The USA leads in both output and impact in the field of MBIs for autistic individuals and their caregivers. Overall, the research output in this area remains relatively limited, and there is no clear trend of significant growth.

However, we believe that the field of MBIs for autistic individuals holds significant importance. Research has proven that MBIs effectively reduce anxiety and stress in both autistic individuals and their caregivers, decrease aggressive behaviors in individuals with ASD, and enhance the subjective well-being of parents. Focusing on the physical and mental health of both autistic individuals and their caregivers, as well as improving their quality of life, remains a core issue in this field.

As AI technology improves and more is learned about how MBIs work, we expect that remote virtual mindfulness interventions, family-group mindfulness interventions, and personalized mindfulness interventions will help autistic individuals even more with their behavior, emotions, cognitive abilities, and mental health. These advances will not only improve the quality of life for autistic individuals and their caregivers but also help them better integrate into society.

CRediT authorship contribution statement

Chereshnev Valery: Supervision, Project administration. **Tuzankina Irina:** Supervision, Project administration. **Ningkun Xiao:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Data curation. **Xinlin Huang:** Writing – review & editing, Writing – original draft, Software, Resources, Methodology, Conceptualization. **Tomenko Tatyana:** Validation, Supervision, Conceptualization. **Maosen Guan:** Writing – review & editing, Writing – original draft, Resources, Conceptualization.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.reia.2025.202640.

Data availability

Data will be made available on request.

References

Agius, H., Luoto, A.-K., Backman, A., Eriksdotter, C., Jayaram-Lindström, N., Bölte, S., & Hirvikoski, T. (2024). Mindfulness-based stress reduction for autistic adults: A feasibility study in an outpatient context. *Autism, 28*(2), 403–414.

American Psychiatric Association, D., & Association, A. P. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5, 5*. Washington, DC: American psychiatric association,.

Beato, A., Barros, L., & Pereira, A. I. (2018). Father's and mother's beliefs about children's anxiety. *Child: Care, Health and Development, 44*(5), 784–793.

Berry, D. R., Hoerr, J. P., Cesko, S., Alayoubi, A., Carpio, K., Zirzow, H., Walters, W., Scram, G., Rodriguez, K., & Beaver, V. (2020). Does mindfulness training without explicit ethics-based instruction promote prosocial behaviors? A meta-analysis. *Personality and Social Psychology Bulletin, 46*(8), 1247–1269.

Black, D. S., & Slavich, G. M. (2016). Mindfulness meditation and the immune system: a systematic review of randomized controlled trials. *Annals of the New York Academy of Sciences, 1373*(1), 13–24.

Blackledge, J. T., & Hayes, S. C. (2006). Using acceptance and commitment training in the support of parents of children diagnosed with autism. *Child & Family Behavior Therapy, 28*(1), 1–18.

Braden, B. B., Pagni, B. A., Monahan, L., Walsh, M. J., Dixon, M. V., Delaney, S., Ballard, L., & Ware, J. E. (2021). Quality of life in adults with autism spectrum disorder: influence of age, sex, and a controlled, randomized mindfulness-based stress reduction pilot intervention. *Quality of Life Research*, 1–14.

Burg, J. M., & Michalak, J. (2011). The healthy quality of mindful breathing: Associations with rumination and depression. *Cognitive Therapy and Research, 35*, 179–185.

Cachia, R. L., Anderson, A., & Moore, D. W. (2016). Mindfulness, stress and well-being in parents of children with autism spectrum disorder: A systematic review. *Journal of Child and Family Studies, 25*, 1–14.

Clifford, P., Gevers, C., Jonkman, K. M., Boer, F., & Begeer, S. (2022). The effectiveness of an attention-based intervention for school-aged autistic children with anger regulating problems: A randomized controlled trial. *Autism Res, 15*(10), 1971–1984. https://doi.org/10.1002/aur.2800

Conner, C. M., & White, S. W. (2018). Brief report: Feasibility and preliminary efficacy of individual mindfulness therapy for adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 48*, 290–300.

de Bruin, E. I., Blom, R., Smit, F. M., van Steensel, F. J., & Bögels, S. M. (2015). MYmind: Mindfulness training for youngsters with autism spectrum disorders and their parents. *Autism, 19*(8), 906–914.

Dykens, E. M., Fisher, M. H., Taylor, J. L., Lambert, W., & Miodrag, N. (2014). Reducing distress in mothers of children with autism and other disabilities: a randomized trial. *Pediatrics, 134*(2), e454–e463.

Fenning, R. M., Neece, C. L., Sanner, C. M., & Morrell, H. E. (2023). Efficacy and implementation of stress-reduction interventions for underserved families of autistic preschoolers across in-person and virtual modalities. *Mindfulness*, 1–17.

Ferraioli, S. J., & Harris, S. L. (2013). Comparative effects of mindfulness and skills-based parent training programs for parents of children with autism: Feasibility and preliminary outcome data. *Mindfulness, 4*, 89–101.

Fix, R. L., & Fix, S. T. (2013). The effects of mindfulness-based treatments for aggression: A critical review. *Aggression and Violent Behavior, 18*(2), 219–227.

Flook, L., Smalley, S. L., Kitil, M. J., Galla, B. M., Kaiser-Greenland, S., Locke, J., Ishijima, E., & Kasari, C. (2010). Effects of mindful awareness practices on executive functions in elementary school children. *Journal of Applied School Psychology, 26*(1), 70–95.

Fox, K. C., Dixon, M. L., Nijeboer, S., Girn, M., Floman, J. L., Lifshitz, M., Ellamil, M., Sedlmeier, P., & Christoff, K. (2016). Functional neuroanatomy of meditation: A review and meta-analysis of 78 functional neuroimaging investigations. *Neuroscience & Biobehavioral Reviews, 65*, 208–228.

Gillions, A., Cheang, R., & Duarte, R. (2019). The effect of mindfulness practice on aggression and violence levels in adults: A systematic review. *Aggression and Violent Behavior, 48*, 104–115.

Gosling, C. J., Cartigny, A., Mellier, B. C., Solanes, A., Radua, J., & Delorme, R. (2022). Efficacy of psychosocial interventions for Autism spectrum disorder: an umbrella review. *Molecular Psychiatry, 27*(9), 3647–3656. https://doi.org/10.1038/s41380-022-01670-z

Gu, J., Strauss, C., Bond, R., & Cavanagh, K. (2015). How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. *Clinical Psychology Review, 37*, 1–12.

Hartley, M., Dorstyn, D., & Due, C. (2019). Mindfulness for children and adults with autism spectrum disorder and their caregivers: A meta-analysis. *Journal of Autism and Developmental Disorders, 49*, 4306–4319.

Hilton, L., Hempel, S., Ewing, B. A., Apaydin, E., Xenakis, L., Newberry, S., Colaiaco, B., Maher, A. R., Shanman, R. M., & Sorbero, M. E. (2017). Mindfulness meditation for chronic pain: systematic review and meta-analysis. *Annals of Behavioral Medicine, 51*(2), 199–213.

Ho, R. Y. F., Zhang, D., Chan, S. K. C., Gao, T. T., Lee, E. K. P., Lo, H. H. M., Au Yeung, P., Lai, K. Y. C., Bögels, S. M., & de Bruin, E. I. (2021). Brief report: mindfulness training for Chinese adolescents with autism spectrum disorder and their parents in Hong Kong. *Journal of Autism and Developmental Disorders*, 1–13.

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of consulting and Clinical Psychology, 78*(2), 169.

Hourston, S., & Atchley, R. (2017). Autism and mind–body therapies: A systematic review. *The Journal of Alternative and Complementary Medicine, 23*(5), 331–339.

Hwang, Y.-S., Kearney, P., Klieve, H., Lang, W., & Roberts, J. (2015). Cultivating mind: Mindfulness interventions for children with autism spectrum disorder and problem behaviours, and their mothers. *Journal of Child and Family Studies, 24*, 3093–3106.

Jones, L., Hastings, R. P., Totsika, V., Keane, L., & Rhule, N. (2014). Child behavior problems and parental well-being in families of children with autism: The mediating role of mindfulness and acceptance. *American Journal on Intellectual and developmental disabilities, 119*(2), 171–185.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future.

Kiep, M., Spek, A. A., & Hoeben, L. (2015). Mindfulness-based therapy in adults with an autism spectrum disorder: Do treatment effects last? *Mindfulness, 6*, 637–644.

Kim, K.-H., & Lee, S.-M. (2020). Effects of hippotherapy on children with cerebral palsy: systematic review and meta-analysis. *Physical Therapy rehabilitation Science, 9*(1), 55–65.

Kraemer, K. M., Luberto, C. M., Hall, D. L., & Yeh, G. Y. (2020). The role of mind–body approaches in promoting healthcare engagement and positive behavior change. *Enhancing Patient Engagement in Pulmonary Healthcare: The Artelor and Science*, 157–182.

Künzi, P., Ackert, M., Grosse Holtforth, M., Hund-Georgiadis, M., & Hediger, K. (2022). Effects of animal-assisted psychotherapy incorporating mindfulness and self-compassion in neurorehabilitation: A randomized controlled feasibility trial. *Scientific Reports, 12*(1), 10898.

Larson, E. A. (2024). 5Minutes4Myself: Development of a Wellness Program for Caregivers of Children with Autism. *Canadian Journal of Occupational Therapy, 91*(1), 17–28.

Loftus, T., Mathersul, D. C., Ooi, M., & Yau, S. H. (2023). The efficacy of mindfulness-based therapy for anxiety, social skills, and aggressive behaviors in children and young people with autism spectrum disorder: a systematic review. *Frontiers in Psychiatry, 14*, 1079471.

Lomas, T., Ivtzan, I., & Fu, C. H. (2015). A systematic review of the neurophysiology of mindfulness on EEG oscillations. *Neuroscience & Biobehavioral Reviews, 57*, 401–410.

Lunsky, Y., Albaum, C., Baskin, A., Hastings, R. P., Hutton, S., Steel, L., Wang, W., & Weiss, J. (2021). Group virtual mindfulness-based intervention for parents of autistic adolescents and adults. *Journal of Autism and Developmental Disorders*, 1–11.

Lunsky, Y., P Hastings, R., Weiss, J. A., M Palucka, A., Hutton, S., & White, K. (2017). Comparative effects of mindfulness and support and information group interventions for parents of adults with autism spectrum disorder and other developmental disabilities. *Journal of Autism and Developmental Disorders, 47*, 1769–1779.

Lunsky, Y., Redquest, B., Albaum, C., Hutton, S., Share, M., Share-Strom, D., & Weiss, J. (2022). Virtual group–based mindfulness intervention for autistic adults: a feasibility study. *Mindfulness, 13*(7), 1706–1718.
Maddox, B. B., Kang-Yi, C. D., Brodkin, E. S., & Mandell, D. S. (2018). Treatment utilization by adults with autism and co-occurring anxiety or depression. *Research in Autism Spectrum Disorders, 51*, 32–37.
Maddox, B. B., & White, S. W. (2015). Comorbid social anxiety disorder in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 45*, 3949–3960.
Maughan, A. L., Lunsky, Y., Lake, J., Mills, J. S., Fung, K., Steel, L., & Weiss, J. A. (2024). Parent, child, and family outcomes following Acceptance And Commitment Therapy for parents of autistic children: A randomized controlled trial. *Autism, 28*(2), 367–380.
Maw, S. S., & Haga, C. (2018). Effectiveness of cognitive, developmental, and behavioural interventions for Autism Spectrum Disorder in preschool-aged children: A systematic review and meta-analysis. *Heliyon, 4*(9).
Neece, C. L. (2014). Mindfulness-based stress reduction for parents of young children with developmental delays: Implications for parental mental health and child behavior problems. *Journal of Applied Research in Intellectual Disabilities, 27*(2), 174–186.
Neece, C. L., Fenning, R. M., Morrell, H. E., & Benjamin, L. R. (2023). Comparative effects of mindfulness-based stress reduction and psychoeducational support on parenting stress in families of autistic preschoolers. *Autism*, 13623613231191558.
Neece, C. L., Fenning, R. M., Morrell, H. E., & Benjamin, L. R. (2024). Comparative effects of mindfulness-based stress reduction and psychoeducational support on parenting stress in families of autistic preschoolers. *Autism, 28*(4), 985–998.
Nieto, C., Lopez, B., & Gandia, H. (2017). Relationships between atypical sensory processing patterns, maladaptive behaviour and maternal stress in Spanish children with autism spectrum disorder. *Journal of Intellectual disability Research, 61*(12), 1140–1150.
Nikmat, A. W., Ahmad, M., Oon, N. L., & Razali, S. (2008). Stress and psychological wellbeing among parents of children with autism spectrum disorder. *ASEAN Journal of Psychiatry, 9*(2), 65–72.
Niles, B. L., Mori, D. L., Polizzi, C., Pless Kaiser, A., Weinstein, E. S., Gershkovich, M., & Wang, C. (2018). A systematic review of randomized trials of mind-body interventions for PTSD. *Journal of Clinical Psychology, 74*(9), 1485–1508.
Ninkov, A., Frank, J. R., & Maggio, L. A. (2022). Bibliometrics: methods for studying academic publishing. *Perspectives on Medical Education, 11*(3), 173–176.
Pagni, B. A., Hill, E., Walsh, M. J., Delaney, S., Ogbeama, D., Monahan, L., Cook, J. R., Guerithault, N., Dixon, M. V., & Ballard, L. (2023). Distinct and shared therapeutic neural mechanisms of mindfulness-based and social support stress reduction groups in adults with autism spectrum disorder. *Journal of Psychiatry and Neuroscience, 48*(2), E102–E114.
Pagni, B. A., Walsh, M. J., Foldes, E., Sebren, A., Dixon, M. V., Guerithault, N., & Braden, B. B. (2020). The neural correlates of mindfulness-induced depression reduction in adults with autism spectrum disorder: A pilot study. *Journal of Neuroscience Research, 98*(6), 1150–1161.
Pagni, B. A., Williams, C., Abrams, G., Blais, C., Brewer, G., & Braden, B. B. (2023). Neurophysiological Signatures of Mindfulness-Based Stress Reduction in Adults with Autism: Putative Mechanism of Anxiety Alleviation. *Mindfulness, 14*(9), 2124–2136.
Pascoe, M. C., Thompson, D. R., Jenkins, Z. M., & Ski, C. F. (2017). Mindfulness mediates the physiological markers of stress: Systematic review and meta-analysis. *Journal of Psychiatric Research, 95*, 156–178.
Rash, J. A., Kavanagh, V. A., & Garland, S. N. (2019). A meta-analysis of mindfulness-based therapies for insomnia and sleep disturbance: moving towards processes of change. *Sleeping Medicine clinics, 14*(2), 209–233.
Ridderinkhof, A., de Bruin, E. I., Blom, R., & Bögels, S. M. (2018). Mindfulness-based program for children with autism spectrum disorder and their parents: Direct and long-term improvements. *Mindfulness, 9*, 773–791.
Ridderinkhof, A., de Bruin, E. I., Blom, R., Singh, N. N., & Bögels, S. M. (2019). Mindfulness-based program for autism spectrum disorder: A qualitative study of the experiences of children and parents. *Mindfulness, 10*, 1936–1951.
Ridderinkhof, A., de Bruin, E. I., van den Driesschen, S., & Bogels, S. M. (2020). Attention in Children With Autism Spectrum Disorder and the Effects of a Mindfulness-Based Program. *J Attention Disord, 24*(5), 681–692. https://doi.org/10.1177/1087054718797428
Ridderinkhof, A., Elmose, M., de Bruin, E. I., Blom, R., Salem-Guirgis, S., Weiss, J. A., van der Meer, P., Singh, N. N., & Bögels, S. M. (2021). A person-centered approach in investigating a mindfulness-based program for adolescents with autism spectrum disorder. *Mindfulness, 12*(10), 2394–2414.
Rotheram-Fuller, E., & MacMullen, L. (2011). Cognitive-behavioral therapy for children with autism spectrum disorders. *Psychology in the Schools, 48*(3), 263–271.
Ruiz-Robledillo, N., Sariñana-González, P., Pérez-Blasco, J., González-Bono, E., & Moya-Albiol, L. (2015). A mindfulness-based program improves health in caregivers of people with autism spectrum disorder: A pilot study. *Mindfulness, 6*, 767–777.
Salem-Guirgis, S., Albaum, C., Tablon, P., Riosa, P. B., Nicholas, D. B., Drmic, I. E., & Weiss, J. A. (2019). MYmind: A concurrent group-based mindfulness intervention for youth with autism and their parents. *Mindfulness, 10*, 1730–1743.
Sancho, M., De Gracia, M., Rodriguez, R. C., Mallorquí-Bagué, N., Sánchez-González, J., Trujols, J., Sánchez, I., Jiménez-Murcia, S., & Menchon, J. M. (2018). Mindfulness-based interventions for the treatment of substance and behavioral addictions: a systematic review. *Frontiers in Psychiatry*, 95.
Shattuck, P. T., Wagner, M., Narendorf, S., Sterzing, P., & Hensley, M. (2011). Post–high school service use among young adults with an autism spectrum disorder. *Archives of pediatrics & Adolescent Medicine, 165*(2), 141–146.
Singh, N. N., Lancioni, G. E., Karazsia, B. T., Myers, R. E., Hwang, Y.-S., & Anālayo, B. (2019). Effects of mindfulness-based positive behavior support (MBPBS) training are equally beneficial for mothers and their children with autism spectrum disorder or with intellectual disabilities. *Frontiers in Psychology, 10*, 385.
Singh, N. N., Lancioni, G. E., Manikam, R., Winton, A. S., Singh, A. N., Singh, J., & Singh, A. D. (2011). A mindfulness-based strategy for self-management of aggressive behavior in adolescents with autism. *Research in Autism Spectrum Disorders, 5*(3), 1153–1158.
Singh, N. N., Lancioni, G. E., Medvedev, O. N., Hwang, Y.-S., & Myers, R. E. (2021). A component analysis of the mindfulness-based positive behavior support (MBPBS) program for mindful parenting by mothers of children with autism spectrum disorder. *Mindfulness, 12*, 463–475.
Singh, N. N., Lancioni, G. E., Medvedev, O. N., Hwang, Y.-S., Myers, R. E., & Townshend, K. (2020). Using mindfulness to improve quality of life in caregivers of individuals with intellectual disabilities and autism spectrum disorder. *International Journal of Developmental Disabilities, 66*(5), 370–380.
Singh, N. N., Lancioni, G. E., Singh, A. D., Winton, A. S., Singh, A. N., & Singh, J. (2011). Adolescents with Asperger syndrome can use a mindfulness-based strategy to control their aggressive behavior. *Research in Autism Spectrum Disorders, 5*(3), 1103–1109.
Singh, N. N., Lancioni, G. E., Winton, A. S., Fisher, B. C., Wahler, R. G., Mcaleavey, K., Singh, J., & Sabaawi, M. (2006). Mindful parenting decreases aggression, noncompliance, and self-injury in children with autism. *Journal of emotional and Behavioral Disorders, 14*(3), 169–177.
Singh, N. N., Lancioni, G. E., Winton, A. S., Karazsia, B. T., Myers, R. E., Latham, L. L., & Singh, J. (2014). Mindfulness-based positive behavior support (MBPBS) for mothers of adolescents with autism spectrum disorder: Effects on adolescents' behavior and parental stress. *Mindfulness, 5*, 646–657.
Singh, N. N., Lancioni, G. E., Winton, A. S., Singh, J., Curtis, W. J., Wahler, R. G., & McAleavey, K. M. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31*(6), 749–771.
Singh, N. N., Wahler, R. G., Adkins, A. D., Myers, R. E., & Group, M. R. (2003). Soles of the feet: A mindfulness-based self-control intervention for aggression by an individual with mild mental retardation and mental illness. *Research in developmental disabilities, 24*(3), 158–169.
Sizoo, B. B., & Kuiper, E. (2017). Cognitive behavioural therapy and mindfulness based stress reduction may be equally effective in reducing anxiety and depression in adults with autism spectrum disorders. *Research in developmental disabilities, 64*, 47–55.
Spek, A. A., van Ham, N. C., & Nyklicek, I. (2013). Mindfulness-based therapy in adults with an autism spectrum disorder: a randomized controlled trial. *Res Dev Disabil, 34*(1), 246–253. https://doi.org/10.1016/j.ridd.2012.08.009
Stecher, C., Pagni, B. A., Cloonan, S., Vink, S., Hill, E., Ogbeama, D., Delaney, S., & Braden, B. B. (2024). App-based meditation habits maintain reductions in depression symptoms among autistic adults. *Autism, 28*(6), 1487–1502.
van der Velden, A. M., Kuyken, W., Wattar, U., Crane, C., Pallesen, K. J., Dahlgaard, J., Fjorback, L. O., & Piet, J. (2015). A systematic review of mechanisms of change in mindfulness-based cognitive therapy in the treatment of recurrent major depressive disorder. *Clinical Psychology Review, 37*, 26–39.
van Steensel, F. J., & Heeman, E. J. (2017). Anxiety levels in children with autism spectrum disorder: A meta-analysis. *Journal of Child and Family Studies, 26*(7), 1753–1767.

Vignaud, P., Donde, C., Sadki, T., Poulet, E., & Brunelin, J. (2018). Neural effects of mindfulness-based interventions on patients with major depressive disorder: A systematic review. *Neuroscience & Biobehavioral Reviews, 88*, 98–105.

von Ungern-Sternberg, S. (2000). Bradford's law in the context of information provision. *Scientometrics, 49*(1), 161–186.

Wachob, D., & Lorenzi, D. G. (2015). Brief report: Influence of physical activity on sleep quality in children with autism. *Journal of Autism and Developmental Disorders, 45*, 2641–2646.

Weitlauf, A. S., Broderick, N., Stainbrook, J. A., Taylor, J. L., Herrington, C. G., Nicholson, A. G., Santulli, M., Dykens, E. M., Juarez, A. P., & Warren, Z. E. (2020). Mindfulness-Based Stress Reduction for Parents Implementing Early Intervention for Autism: An RCT. *Pediatrics, 145*(1), S81–S92. https://doi.org/10.1542/peds.2019-1895K

White, S. W., Simmons, G. L., Gotham, K. O., Conner, C. M., Smith, I. C., Beck, K. B., & Mazefsky, C. A. (2018). Psychosocial treatments targeting anxiety and depression in adolescents and adults on the autism spectrum: Review of the latest research and recommended future directions. *Current Psychiatry Reports, 20*, 1–10.

Wright, S., Day, A., & Howells, K. (2009). Mindfulness and the treatment of anger problems. *Aggression and Violent Behavior, 14*(5), 396–401.

Xiao, N., Bagayi, V., Dandan, Y., Huang, X., Zhong, L., Kiselev, S., Bolkov, M. A., Tuzankina, I. A., & Chereshnev, V. A. (2024). Effectiveness of animal-assisted activities and therapies for autism spectrum disorder: a systematic review and metaanalysis. *Frontiers in Veterinary Science, 11*, Article 1403527. https://doi.org/10.3389/fvets.2024.1403527

Xiao, N., Huang, X., Li, B., Sun, L., & Kiselev, S. (2024). Effects of digital environments on children's cognitive function and mental health: a bibliometric study. *Current Psychology*, 1–15.

Xiao, N., Huang, X., Zang, W., Kiselev, S., Bolkov, M. A., Tuzankina, I. A., & Chereshnev, V. A. (2024). Health-related quality of life in patients with inborn errors of immunity: a bibliometric analysis. *Frontiers in immunology, 15*. https://doi.org/10.3389/fimmu.2024.1371124

Xiao, N., Shinwari, K., Kiselev, S., Huang, X., Li, B., & Qi, J. (2023). Effects of equine-assisted activities and therapies for individuals with autism spectrum disorder: Systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 20*(3), 2630.

Zang, W., Chen, H., Yan, J., Li, D., Xiao, N., Zheng, X., & Zhang, Z. (2023). Research trends and hotspots of exercise for people with sarcopenic: A bibliometric analysis. *Medicine, 102*(50), Article e35148.

Zhang, D., Lee, E. K., Mak, E. C., Ho, C., & Wong, S. Y. (2021). Mindfulness-based interventions: an overall review. *British Medical Bulletin, 138*(1), 41–57.

Zhang, J., Díaz-Román, A., & Cortese, S. (2018). Meditation-based therapies for attention-deficit/hyperactivity disorder in children, adolescents and adults: a systematic review and meta-analysis. *BMJ Ment Health, 21*(3), 87–94.

Zhang, N., Fan, F. m, Huang, S. y, & Rodriguez, M. A. (2018). Mindfulness training for loneliness among Chinese college students: A pilot randomized controlled trial. *International Journal of Psychology, 53*(5), 373–378.