

Prevalence of neurodevelopmental disorders (NDDs) in looked after children (Lac) versus children that are not looked after (non-Lac) and adverse outcomes: A systematic review and Meta-analysis

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Abstract

Background

Looked after children (Lac) continue to attain suboptimal health and social outcomes and have a high prevalence of mental, developmental and behavioural disorders. Limited in research is the exploration of neurodevelopmental disorders (NDDs) in this vulnerable population. This review aims to compare prevalence rates of NDDs in children who are looked after (Lac) versus children not looked after (non-Lac) and identify any impacts on Lac diagnosed with a NDD.

Methods

Articles were identified in PubMed, ASSIA, IBSS, Web of Science, PsychINFO, Scopus, Psych articles, Social Care Online. Studies that provided primary data on the prevalence of a ND for both Lac and non-Lac under the age of < 25 years were included. Two reviewers appraised the articles using the Joanna Briggs Institute critical appraisal tools. Risks ratio and 95% confidence intervals (CI) using the Mantel-Haenszel random-effects model were used to express and estimate the mean effect,

Results

Of a total 5,611 records, 12 studies met eligibility. Six studies that met inclusion criteria for a meta-analysis highlight how Attention-deficit hyperactivity disorder (ADHD) RR = 2.69 [1.44, 5.01] and autism spectrum disorder (ASD) RR = 2.23 [1.63, 3.05] have a higher prevalence in Lac compared to non-Lac. The remaining six studies that compared prevalence of NDDs but were not eligible for the meta-analysis are described as a narrative and highlight the adverse outcomes that effect the Lac with a NDD. Findings related to foster care placement, mental health service usage and medication, physical, emotional abuse and criminal justice involvement are discussed.

Conclusion

Results show that the prevalence of NDDs is higher in Lac versus non-Lac and propose that Lac with a NDD experience more adverse outcomes compared to their non-Lac peers with a NDD. More research is needed to explore the prevalence of NDDs in both populations and further investigate the adverse outcomes that may affect the Lac with a NDD.

Background

Lac remain to date, one of our most vulnerable populations in society and continue to attain poor health and social outcomes associated with mental health, suicide, criminal system involvement, teenage parenthood, substance misuse and poor educational attainment on both a national and international

level (1–6). In view of their poor outcomes, there is still limited literature on them on as a population (7–9). It is well documented in literature that Lac have a higher prevalence of mental, behavioural and developmental disorders compared to their peers which is often attributed to the developmental impact of Adverse Childhood Experiences (ACEs) or poor socioeconomic environments (1, 3, 5). However, these prevalence studies, although significant, are often depicted and categorised under broad headings. Limited within primary and secondary literature is a more in-depth, individual analysis of what specific disorders represent these broad categories (2, 5).

Neurodevelopmental disorders (NDDs) are still relatively new to the field of psychiatry (10–12). The diagnosis of NDDs have been notably increasing in the general population, suggested to be attributed to increased awareness and improvements in diagnostic assessment accuracy (13–15). However, there has been limited research applied to the prevalence of NDDs in respect of Lac (3, 16, 17). A recent study found that NDDs were highly prevalent in the Lac population and a recent systematic review found that attention deficit hyperactivity disorder (ADHD) was higher in Lac compared to those individuals not in the care setting (non-Lac) (18, 19). Although a significant finding, the systematic review used a national estimated prevalence from each country of study to compare rates. Attaining an estimated prevalence of what specific NDDs exist in this population would be beneficial for stakeholders to ensure specialist services meet the individualistic needs of these children.

NDDs remain for life and can sometimes be complex and span across a broad clinical spectrum (20). Many NDDs such as Prader-Willi Syndrome can be diagnosed with a medical test, however many NDDs are diagnosed solely based on behaviour (13, 15). NDDs such as Attention-deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) are examples of such NDDs, which can be diagnosed in children regardless of socioeconomic environment, and in those children who have or have not experienced ACEs (21, 22).

Many NDDs frequently co-occur and share similar behavioural characteristics in areas of social communication and interaction, sensory and motor dysfunctions, sleeping, eating difficulties, attachment issues and attention problems (15, 20, 23–25). As a result of these similar characteristics, early support and diagnosis can often be difficult to attain as clinicians find these similarities confusing and many children do not attain a diagnosis until adulthood (26–30). This lack of specific early diagnosis and intervention can have a detrimental effect on the child and family, leaving them with no specialist support or understanding (31–33). Although, many children with a NDD go on to flourish within society, many can experience poor health and social outcomes in areas of mental and physical health, self-harm, suicidal ideation, eating disorders, family breakdown and low educational attainment (23, 25, 34–36). Considering the adversity, vulnerabilities and poor outcomes already associated with Lac, there is an lack of literature that explores the impacts or outcomes for the Lac with a NDD.

The legal term or definition for a ‘Looked After Child’ (Lac) varies on a national and international level and can cross a wide range of children with varying, complex and safeguarding needs (3, 37). Lac can represent children placed in a variety of settings such as institutions, residential care, kinship care, pre-

adoptive settings, foster care and respite care. They can also fall under the umbrella term of children in protection or children in need. Due to the scope of this review, the term 'Lac' only represents those children placed in either foster, residential or kinship care.

This review aimed to (a) estimate the prevalence of NDDs in Lac and if feasible compare with those children who were not looked after and (b) further identify if there are any impacts on Lac diagnosed with a NDD.

Methods

The PI/ECO approach has been used to help define the primary research questions and formulate the search strategy. (P) Population-All children/young persons, (I/E) Intervention or Exposure-Looked after, (C) Comparison-Non-looked after children/young persons, (O) Outcome-Neurodevelopmental disorders. This review was registered on PROSPERO (Identifier: CRD4201913103) and a systematic review protocol was created which was guided by the Preferred Reporting items for Systematic Reviews and Meta-Analyses (38, 39). Databases were selected based on their relevancy and those identified in other peer reviewed studies that had explored similar outcomes of interest (40, 41). Articles were identified from PubMed, ASSIA, IBSS, Web of Science, PsychINFO, Scopus, Psych articles, Social Care Online. Exploring citations and reference lists to further identify any new primary articles can be a rich information source and potentially alleviate publication bias (42, 43). Therefore, further articles were identified through systematically hand searching published and unpublished secondary, grey and governmental literature. Key words such as 'mental', 'developmental', 'disorder', 'looked after child' and 'prevalence' were used to identify relevant literature and synonyms were used to expand the results. The rationale for this was based on the extensive array of terminology that is often associated with both Lac and the NDDs that were being explored. A full representation of the key words, synonyms and an example of a search strategy can be found in supplementary **Tables 1 & 2** as the diagnostic codes and terminology for many of these NDDs have evolved over time (44, 45).

Eligibility Criteria

No restriction was placed on country, design or year of publication due to the anticipated low number of articles available for this review. Filters on language limits were applied to only include published articles in the English language. Databases that had distinctive processes that required adaptation in searching tools were guided and supervised by the residing university librarian to ensure consistency.

Lac represented those children who had been placed in either/or residential, foster or kinship care (46, 47). Non-Lac represented all those children who had not been placed in the care setting at the time when the articles had conducted their research. This included children who accessed respite care, often referred to a 'child in need' or 'child in protection' as they had not been removed from home and remained with the parent/s (48). Although, children who transition to adoption are frequently removed from the biological

home for varying reasons, they were excluded from the review as they do not always fall under the umbrella term of being 'looked after' after being adopted (49).

As there is a duty of care to support some of these children up to the age of 25 in the UK guided by the Children and Families Act (2014), this limit was applied to the inclusion criteria (50). This enabled the review to capture those individuals who might have been diagnosed later in their life with these NDDs. Studies that provided a comparative prevalence between Lac and non-Lac and detailed primary data on the prevalence or incidence of NDDs for individuals < 25 years of age, supported by either/or a diagnostic code, standardised diagnostic assessment tool or survey response were included. Studies that used national estimated rates of prevalence as a comparator were excluded as it was agreed that the processes for attaining prevalence in these studies might differ from the other studies that used primary data in their research, potentially invalidating the results of the review.

The DSM V and now revised ICD 11th Revision guidelines, acknowledge that many of these NDDs now co-occur and can be dual diagnosed (51). Therefore, the review included studies that had prevalence rates for children who had more than one diagnosis (52, 53).

Studies that did not contain defined primary prevalence data for the meta-analysis but compared prevalence and examined impacts on those Lac and non-Lac with a NDD were considered for inclusion to conduct a narrative analysis. No impacts were predefined as this may have excluded important information due to the limited number of available studies with regards to these vulnerable children and the specific NDDs being explored.

Study selection

The study selection process was overseen by two reviewers (NH, HH). Firstly, searches were conducted, and all duplicate studies removed. All studies were then initially screened by title and then abstract, applying the pre-defined exclusion and inclusion criteria to remove studies that did not fit the specified criteria. Two reviewers independently screened and critically analysed the full text of the remaining papers. A third reviewer (AJ) was assigned as mediator to reach consensus should there have been any disputed articles (54).

To ensure that new literature was not missed, intermittent hand searches were also conducted while the review was being undertaken up to November 2021 (58). One further study was added to the selection of studies (67). A reviewer's meeting was scheduled to seek consensus and to agree if any more primary studies should be included in the review; to aid in addressing the research questions.

Quality and Bias assessment

The Joanna Briggs Institute (JBI) critical appraisal tools were utilised to screen and assess the quality of the literature in this review (55). These tools which have been used in other reviews were applicable due to the diversity of the designs that were included in the systematic review. Appraisal tools used in the study were designed for prevalence studies, analytical cross-sectional studies, case control and cohort

studies. All tools consisted of domains that assessed and appraised the design, quality, conduct and analysis of the selected articles (56).

Adopting the same approach as in other studies, the review followed the same format scoring the studies using a point system 1–11 (57). Studies were all critically analysed and evaluated as a low/medium or high risk using the predefined questions detailed in the JBI appraisal tools. If the question was evaluated as a 'Y = Yes' it would score one point, a N = No' or 'U = unclear' would score zero points (**See supplementary table 3**). Those studies that were scored as ≥ 7 were rated as high quality and a low risk of bias, 4–6 moderate quality and medium risk of bias or < 4 , low quality and high risk of bias (57). Two reviewers assessed and appraised the studies and any divergence in assessment was mediated by the third reviewer (AJ). There were no discrepancies identified.

Data Synthesis & Analysis

An extraction form based on other similar studies was adapted to collate the information related to the areas of interest (40, 41). Characteristics were extracted from each study which included study name, country, total sample size, age range, type of placement, NDD specified, diagnostic system used, and any impacts on the Lac with a NDD (**See supplementary table 3**). One other reviewer additionally screened the extraction form to verify the accuracy of the data collated (HH). Any disputed data were discussed with the third reviewer (AJ) to reach consensus. There was none.

Firstly, the review screened the studies for primary data on the prevalence rates of NDDs that were the outcomes of interest. Studies that had defined primary data and studies that had defined primary data that included subgroups were pooled together to provide two distinct subgroups (Lac & non-Lac) (**See supplementary table 3**). Studies that detailed primary data on other NDDs of interest but did not have enough data to conduct a meta-analysis were presented in a descriptive format. Review Manager 5.3 software was then used to conduct a meta-analysis.

Studies that did not meet eligibility for the meta-analysis but detailed prevalence on the NDDs of interest and explored impacts on the Lac with a NDD were explored as a narrative by means of thematic analysis where similarity existed.

Due to high heterogeneity between studies, risks ratio and 95% confidence intervals (CI) using the Mantel-Haenszel random-effects model were used to express and estimate the mean effect. Utilising this model enabled the review to provide a more balanced weight to smaller and larger studies and estimate a more standardised mean effect (58). As all studies used in the meta-analysis included prevalence studies, the risk ratio was considered the more appropriate approach to calculate the effect estimates (59). Risks ratio (RR) results that did not cross one and had a narrow confidence interval were considered to be significant. If the risks ratio crossed one and had wider confidence intervals, they would have been considered to be inconclusive indicating no effect. Forest plots were used for representation of the studies. It was intended to use funnel plots to show publication bias, but limited data precluded this (60–

62). Age, gender and ethnicity were explored during the synthesis and but could not be analysed due to the high heterogeneity between studies.

Results

The search strategy generated 5,598 studies and an additional 12 studies derived from hand searching. One more was added after intermittent hand searching (**see** Fig. 1). Following the removal of duplicates, review by title, abstract and fully assessed articles. 12 studies met eligibility for the review (1, 63–73). A review meeting was scheduled to reach consensus on six studies that compared prevalence of the NDDs but did not provide defined primary data that could be used for the meta-analysis (1, 63, 64, 68, 69, 72, 73). These studies were deemed appropriate for the review as they compared prevalence of the NDDs of interest but additionally explored impacts on the Lac with a NDD. The corresponding author of the (71)Vanderwerker et al (2014) study was directly contacted to try and attain additional prevalence data on schizophrenia, bipolar, autism which had been included in the primary research but had been excluded from the results (71). However, no response was received. All twelve studies were then further examined for impacts on the Lac with a NDD.

Six studies met eligibility for a meta-analysis and the Review Manager 5.3 software was used to compared prevalence rates between Lac (those only in foster, kinship or residential care) and non-Lac (those not in foster care) (64, 66, 67, 70, 71, 73). The remaining six studies that compared prevalence of the NDDs of interest but did not meet eligibility for the meta-analysis are described as a narrative and detailed within the results (1, 63, 65, 68, 69, 72).

All 12 eligible studies shared some similarities in terms of research design, definition of care setting, population samples, diagnostic systems and criteria. The majority of the studies were conducted in the USA (n = 8). The remainder of the studies were conducted in the United Kingdom (UK) (n = 1), Denmark (n = 1), Sweden (n = 1) and Finland (n = 1). Using the pre-defined JBI critical appraisal tools and format scoring, 12 of the studies scored < 7 and were deemed to be of high quality (see supplementary **Table 3**). The table also details reasons for the exclusion on inclusion of studies in the meta-analysis.

Meta-analysis: Prevalence of ADHD

Findings from six eligible studies show that ADHD was prevalent in 17.22% of Lac (n = 308,086) vs 6.57% of non-Lac (n = 5,331,304) with a RR = 2.69 [1.44, 5.01] (64, 66, 67, 70, 71, 73). Lac was associated with having a higher prevalence of ADHD compared to their non-Lac peers (**see** Fig. 2).

Meta-analysis: Prevalence of ASD

Findings from two eligible studies show that ASD was prevalent in 2.4% of Lac (n = 1,705) vs 1.01% of non-Lac (n = 96,051) with a RR = 2.23 [1.63, 3.05] (64, 67). Lac was associated with having a higher prevalence of ASD compared to their non-Lac peers (**see** Fig. 3)

Although risks ratios did not cross one in the ADHD and ASD forest plot, both had a narrow CI. It is important to interpret these figures with caution due to the small number of studies and large amount of heterogeneity within studies.

In relation to the other NDDs of interest in this review, only two eligible studies for the meta-analysis provided comparative primary data for other NDDs of interest but due to the limited studies could not be utilised for a meta-analysis (64, 66). Specific developmental disorder of scholastic skills, Specific developmental disorder of motor function and Tic Disorder were found to be higher in the Lac population. However, Bipolar disorder had a higher prevalence in the non-Lac population. See **Fig. 4** for detail.

Figure 4. Prevalence of bipolar, specific developmental disorders of scholastic skills & tic disorders in looked after children (Lac) versus children that are not looked after (non-Lac)

Descriptive findings are detailed for six of the studies as they explored the NDDs of interest between Lac and non-Lac but did not have defined primary prevalence data that met the eligibility for the meta-analysis.

- Ford et al (2007) found that all children that were defined as 'looked after' by local authorities had a higher ADHD (Hyperkinesis) (8.7%) and ASD (Autistic-spectrum disorder) (2.6%) prevalence compared to children living in a private disadvantaged household (ADHD = 1.3%, ASD = 0.1%) and the remaining children who lived in a private household (ADHD = 1.1%, ASD = 0.3%). Obsessive-compulsive disorder (OCD) (0.2%) had the same prevalence as the remaining children in a private household but lower than those children living in a private disadvantaged household (0.5%).
- Zill & Bramlett (2014) found that children adopted from foster care had the highest prevalence rate for ADHD (35.7%) compared to children in foster care (21.8%), children living with single mothers (10.7%) and children living with two biological parents (5.3%).
- Côté et al (2018) found that younger adults who had been placed as children in out of home care had greater odds of having a NDD (3.59, 1.17–11.02). However, the results did not provide individual prevalence of the NDDs. The same was true for psychotic and bipolar disorders (3.98, 1.80–8.80).
- Tordön et al (2019) explored a Lac population which ranged between two values (n = 35–38) and the results showed that 20 participants out of the sample had either ADHD, eating disorders or ASD. Children in out of home care had a higher prevalence of ASD (Lac 5.7% vs non-Lac 1.9%) and ADHD (inattention problems) (Lac 31.4% vs non-Lac 7.1%) compared to those children without out of home care involvement. The prevalence rates were significantly higher than their non-Lac peers and compared to the national expected prevalence rate.
- Mandell et al (2008) explored ASD and even though the Lac sample included children in independent living, ASD was suggested to be highly prominent in those children in foster care, but no defined primary data were available.
- Gonzalez et al (2019) conducted their study over two waves found that ADHD was highly associated with being placed in in foster care.

Adverse Impacts on the Lac with a NDD

Understanding the prevalence of NDDs is important for this population however, the second objective of this systematic review was to explore impacts on Lac with a NDD. The full twelve studies were examined for impacts on the Lac with a NDD. Adverse outcomes such as higher mental health service usage and prescription, emotional, physical abuse, foster care involvement and criminal justice involvement are highlighted for the Lac with ADHD, ASD and Bipolar, which are discoursed more in depth in the discussion section.

Mental health usage - DosReis et al (2001) found that Lac with mental disorders, including ADHD, depression and developmental disorders aged (6–14) had higher rates of mental health service usage compared to the comparison groups. This finding was also reflected in the Tordön et al (2019) study, where Lac with ADHD were more likely to pursue help from mental health care services compared to their non-Lac peers with ADHD.

Medication prescription – The Mandell et al (2008) study explored Medicaid, which is a federal and state program that works together with the Children’s Health Insurance Program (CHIP), in the USA to provides health coverage to millions (68). They found that that 20.8% of the autistic children were Lac and had the highest use of psychotropic drugs (71%) and prescribed medication. Out of this population, 18% of the children aged 0–2 years and 32% aged 3–5 had been prescribed medication.

Emotional abuse - González et al (2019) found that emotional abuse had a robust association with having an ADHD diagnosis. The study also found that boys were more likely to experience this form of abuse compared to girls.

Physical abuse - González et al (2019) identified a negative association with physical abuse and ADHD. In this study, the presence of physical abuse in Lac was (OR = 2.2) compared to their non-Lac peers and in this case affected more girls than boys.

Foster care placement - González et al (2019) found robust associations with foster care placement and having ADHD, even after adjusting for all maltreatment. Zill et al (2014) also found that 22% of foster-care children had been diagnosed with ADHD in their childhood. Similarly, Ford et al (2007) found ADHD and ASD to be more prevalent in the foster care setting.

Criminal justice involvement - Zill & Bramlett (2014) found that 36% of Lac had received a criminal conviction between the ages (18–25yrs) compared with 21% of non-Lac. Criminal convictions in Lac with bipolar and psychotic disorders, remained substantial even after regression analysis.

Discussion

This is the first review of its kind that explores the prevalence of specific NDDs in Lac and highlight the adverse outcomes that some Lac with a NDD may experience. The aim of the study was to explore the

prevalence of specific NDDs that are often very difficult to diagnose as a result of the similarities in characteristics and of which can be often missed, misdiagnosed or over diagnosed in the general population (26–30). Furthermore, it aimed to identify if there were any impacts on the Lac who had been diagnosed with a NDD. The results in this review support similar primary studies that have explored prevalence in Lac but also contribute to the dearth of literature that has explored the adverse outcomes on the Lac with a NDD.

Prevalence of NDDs

It was not a revelation that out of the twelve eligible studies, ADHD and ASD emerged as the most prominent and studied NDDs as this is reflective of the existing NDD literature available at this time. A much-needed research focus has been placed on both ASD and ADHD which has aided in highlighting the awareness of the prevalence, challenges and impacts on individuals with these NDDs (74–77). However, this review also highlights the dearth of literature conducted on the other specific NDDs of interest, such as dyslexia, tic disorders, dyspraxia and dyscalculia in relation to the Lac. It is well documented in literature that many of these NDDs co-occur with ADHD and ASD and prevalence rates for NDDs such as dyslexia in the general population are suggested to range from 5-17.5% (78). Dyslexia, itself can create challenges in reading, writing and processing information which are all key part of the learning process (79, 80). The impact on educational attainment, if not supported correctly can be detrimental for the child which can often lead to poor outcomes in education and have a direct impact on social mobility, which are both recognised concerns for many Lac on a global level (37).

The reasoning behind the high prevalence rates for ADHD (Lac 17.22 vs non-Lac 6.57%) and ASD (Lac 2.4 vs non-Lac 1.01%) found in Lac in this review is an area that requires more attention. A recent systematic review found similar global rates of ADHD in children and adolescents from the general population which support the results of this review for those categorised as non-Lac (81). However, an additional study explored mental health rates across nine countries and found a prevalence of 15.9% for ADHD in the general population which reflects more closely to the Lac percentage. Although a significant finding, this was based on survey results where self-reporting bias may have had an impact on the findings (82). Nevertheless, the prevalence rates for ADHD in Lac found in this review were significantly higher compared to their non-Lac peers. The same applies to the prevalence rates of ASD in Lac. However, it is important to note that this was only based on two studies. A recent systematic review found a global prevalence rate of 1% (1/100) in the general population, in which the majority of studies had included children, which supports the results of this review for non-Lac (83). Although, there is a dearth of literature on Lac with ASD, a study that explored awareness of autism within local authorities found a 3% prevalence rate of ASD in Lac and suggested that this may be an underestimation as a result of missing or unreported data.

Nevertheless, there are several factors to consider that might contribute to these differing prevalence rates between Lac and their non-Lac peers. It could be suggested that a reason for the lower prevalence rates in non-Lac might be attributed to clinicians under-diagnosing, misdiagnosing or missing ADHD or

ASD within the general population. Many screening tools are still suggested to lack sufficient specificity and sensitivity to diagnose NDDs, particularly if we take gender, age or cultural differences into account (84–87). Females with a NDD, particularly ASD and ADHD often find it very difficult to attain an early diagnosis as a result of their differing display of behavioural symptomology compared to their male counterparts. Diagnostic assessments are improving and being enhanced to encompass the differences in the female phenotype but there are still areas that need addressing as suggested by other literature (23, 88–90). There are also demographic or geographical variations in the diagnostic process or improved documentation and data entry to consider (91–95). However, the same factors would apply for the prevalence rates for Lac.

Therefore, one could suggest that being a Lac may be a protective factor in attaining an early diagnosis and intervention as they are often embedded in health and social care services. Many children can be over-diagnosed in the general population as a result of male biased assessment tools, lack of knowledge and training and differing diagnostic pathways, and we must consider this same occurrence in the Lac population (27). However, for the Lac there are additional factors to consider that may contribute to this outcome. Professionals who are involved with the care of these children have to unravel their complex ND related characteristics with the characteristics associated with trauma and attachment as a result of ACEs. This complexity could create a confusion and uncertainty for many professionals and potentially hinder or influence their professional judgement when assessing these children. To add to this complexity, the diagnosis of children with NDDs are often attained through the evaluation of historical and current behaviour provided by the parent, combined with intensive educational and psychological testing. It is well recognised in Lac literature that even though reunification with the parent is priority, this does not always happen which leaves a significant lack of parental consent, parental involvement and contribution around childhood history which would cause a complex scenario when trying to assess these children with a NDD (96, 97).

There is also another factor to take into consideration and discourse for possible higher prevalence rates in this group and that is the hereditary or genetic origins associated with these NDDs. Many individuals in the general population have received an ADHD or ASD diagnosis much later in life after historically being misdiagnosed or diagnosed with other co-morbid conditions (98, 99). Therefore, it could be possible that the parents of these Lac may have fallen under the diagnostic radar and been misdiagnosed or even missed altogether as the need to treat other conditions may have overridden- more in-depth exploration of potential NDDs. Particularly, if we take into account that parents of Lac often have challenges in areas of mental health, substance misuse, domestic abuse and learning difficulties or disabilities which may be masking the characteristics of a ND (100, 101). The higher prevalence rates as already discussed require further investigation to ensure that the children/young adults who have been placed in the care system receive the most up to date specialist, holistic therapeutic interventions to enable them to flourish within society and attain positive health and social outcomes.

Adverse Outcomes for the Lac with a NDD

The second objective of the systematic review was to explore the impacts on the Lac with a NDD. Many Lac continue to attain poor health and social outcomes, which is a global concern for this vulnerable group (1, 3, 5, 6). This review found several studies that highlighted that Lac with ADHD, had higher mental health service usage, physical and emotional abuse, higher medication prescription, foster care involvement and criminal justice involvement compared to their non-Lac peers and even their Lac peers who had not been diagnosed with a NDD (63, 65, 68, 69, 72, 73).

It is well noted in research that Lac have a higher prevalence of mental health problems compared to their peers and some are embedded in services which provide them with direct access to appropriate health and social care provision (1, 3, 5). This might contribute to the findings of the dosREis et al (2001) and Tordön et al (2019) studies where mental health service usage was high. However, this finding that Lac with a NDD had a higher usage compared to their peers without a NDD is something to be further explored. Having NDDs, coupled with additional ACEs, and additional factors would have a significant impact on mental health needs. Additionally, many of these NDDs co-occur with debilitating anxiety and other mental disorders which could further contribute to their need for mental health services (102, 103).

The higher usage of mental health services for Lac could be a contributory factor to the findings detailed in the Mandell et al (2008) study. Medication prescription and usage has been noted as high in the Lac population in several studies (19, 104, 105). The number of children aged between 0–5 years who had been prescribed medication raises some concern. However, psychotropic medication as suggested by Mandell et al (2008) can be used for both mood-stabilizing and/or or antiepileptic properties and many autistic children have epilepsy and take these forms of medication (106). The medication used for some children with ASD and ADHD has raised some discourse within literature. Some studies have reported improved behaviours as a result of administering medications while others report negative associations and debilitating side effects (107–109). The long-term effects are still unknown and continue to be explored. However, they further propose that the high use of psychotropic drugs may be attributed to the changing environments that foster children often experience (96, 110). Changes to placements and routines for autistic Lac could exacerbate external behaviours and potentially lead to medicating the child to stabilise the care placement (68).

Only one study in this review found robust associations with foster care placement and having ADHD (65). However, Zill et al (2014) also found that 22% of foster-care children had been diagnosed with ADHD in their childhood. Another study found a high prevalence of ADHD (52%) within the sample Lac population but also added that only quarter of the parent foster carers involved had received interventions (111). Although, it is suggested that a multi modal support plan which includes pharmacological treatment should be considered when creating a care and support plan for children with ADHD. Interventions involving the child and parent/carer is equally important, to ensure that the plan meets the individualistic needs of the child with ADHD (112). Interestingly, in the Zill et al (2014) study it was children who had been adopted from foster care that had the highest prevalence of ADHD (36%)². Several studies have also found similar rates in adopted children which is an area that requires further exploration as their individualistic needs would also need to be met (113–115).

Similar findings from the Ford et al (2007) study also found ADHD and ASD to be more prevalent in this care setting and suggested that the higher prevalence rates may be more attributed to the inadequate support and services available to families who have children with a NDD which has been highlighted in research (116–118). Additional literature supports these findings and ascertain that some parents voluntarily place their autistic children in foster care with no history of maltreatment, due to a lack of available and accessible specialist support or treatments (119). Many autistic children struggle with overwhelming sensory deficits and debilitating anxiety which can often result in self-injury, aggression or elopement (120). Therefore, it could be suggested that many parents would find it difficult to safeguard their children, especially if there is a lack of support. Autism can also frequently be associated with many other co-existing conditions such as OCD, eating disorders and anxiety, creating an even more complex situation and environment for the child and wider family (102, 103, 121). However, the González et al (2019) study detailed in the review proposed that children with NDDs such as ADHD or those that had ADHD characteristics might be more vulnerable to experiencing maltreatment, which conflicts with Cidav's proposed no experience of maltreatment (Cidav et al., 2018). Nevertheless, one could suggest that this could be attributed to the fact that ADHD is a NDD that is often (not always) associated with more externalising behaviours and aggression than ASD, possibly increasing the risk of abuse.

Relevant, specialised support services are still scarce for many families pre/post diagnosis (116–118). From an economic and wellbeing perspective, specialist, holistic, early service provision is needed to better support these children. The average length of stay for autistic Lac is suggested to be 1.6 times longer than Lac without ASD and they are also less likely to be placed in a family setting (31% versus 53%) (122). More importantly, the kinship setting might provide a more stable placement setting as many autistic children react positively to familiar and recognisable surroundings; attributed to sharing familiarity with their biological kin (8).

Abuse and neglect are often the primary reasons for children entering the care system. Therefore, it was anticipated that some of these adverse outcomes would exist in literature on Lac with a NDD. However, the results highlight that Lac with a NDD may be at more risk of experiencing emotional and physical abuse compared to their peers and Lac peers. Emotional abuse has a wide definition in the context of social work and is often a major contributing factor for children becoming looked after (Trickett et al., 2009). It can be attributed to a variety of factors such as maltreatment, neglect, harmful or destructive social conditioning, poor socioeconomic environment or parental mental health (123–126). This could contribute to the findings presented in the González et al., (2019) study where emotional abuse had robust association with having an ADHD diagnosis. Although it is important to note that self-report bias could have influenced the results. It is well documented in research that children in the general population with ADHD are at higher risk of experiencing maltreatment compared to those individuals with no ADHD diagnosis (127, 128). González et al (2019) found that boys who were Lac were more likely to experience this form of abuse compared to their female counterparts. Another study found similar findings and further observed an association between maternal hyperactivity/impulsivity and male gender of the child which further increased the risk of emotional abuse (129). ADHD is often associated with externalised

behaviours therefore this type of abuse could be further exacerbated and place these children at more risk if not supported correctly (128).

González et al (2019) also identified a negative association with physical abuse and ADHD and found that the prevalence of this abuse was much higher in Lac compared to their non-Lac peers and affected more girls. Physical abuse, alike emotional abuse is also often associated with the child who has ADHD in the general population (130, 131). Girls with ADHD can be vulnerable to intimate partner violence and physical maltreatment suggesting that they might be at more risk of experiencing physical abuse (132, 133). This is important to note and further explore for girls who are Lac and have ADHD, as this could place them at further risk if we factor in the addition of ACEs and their often-vulnerable environment.

Only one study in this review found a higher prevalence of criminal convictions in the Lac population compared to their non-Lac peers. The estimated criminal convictions in Lac with bipolar disorders and psychotic disorders, remained substantial even after regression analysis (Cote et al., 2018). Bipolar has been associated with criminal involvement in several studies however, research is still limited in respect of the Lac, particularly within this age group (134, 135). Characteristics associated with bipolar can be complex, very difficult to diagnose and can have varying subtypes such as Bipolar 1 and 11, which has not been detailed within this study (134, 136). Nevertheless, Bipolar is often diagnosed later in adulthood which could have attributed to the lack of findings (137). There have been studies that have explored bipolar in the criminal justice system and some have found that many of the adults had experienced ACE's (138, 139). That is not suggesting that having bipolar and experiencing ACE's place the individual at higher risk of being involved in the criminal justice system as there are so many confounding variables that evolve around this population. We know that unmanaged or unsupported ADHD or ASD can result in poor outcomes in drug use/addictive behaviour, antisocial behaviour, services use and occupation (140). Therefore, we must also consider that the lack of early diagnoses for these adults may have prohibited therapeutic intervention and support during their childhood. This lack of support would have significant safeguarding implications for the young adult with a NDD who has been placed in a juvenile facility (141–143). Many individuals with NDDs can self-harm and are frequently misunderstood in the youth justice system due to their cognitive differences. The behavioural characteristics can often be misinterpreted by their peers placing them in yet more vulnerable situations (141–143). More qualitative research on the experiences of adults with bipolar who were previously Lac would contribute to a better understanding of why some of these adults end up in the criminal justice system (144).

The aim of this review was to highlight to policies and stakeholders that prevalence of NDDs are high in this population and therefore require a specialist support system to meet the individualistic needs of this group. However, this can only be achieved by providing specialist services that have an in depth understanding of NDDs and currently there is no literature to support whether that is the case or not. It adds further value as it highlights the adverse outcomes that some of these children experience, even when compared to their own Lac peers with no diagnosed NDD. More research is needed to explore whether these children may be at more risk of experiencing these adverse outcomes.

Limitations of the review and to the evidence

Some limitations of this review were high heterogeneity between studies; subgroup analysis, and some study characteristics which may have influenced the results. The Lac and non-Lac groups detailed in this review, although detailed a priori in the protocol, could have been reunified with their biological parent/s. However, reunification is not always sustained as a result of varying factors such as poor parental physical and mental health and continuous substance misuse abuse (7, 145). Nevertheless, Lac can transition into different care settings and the children in these articles may have previously entered the care setting prior to or after the study collated the data or the data did not disclose that the child had ever been in a care setting. Many children move in and out of the care system at different points in their lifetime which could have impacted on the results attained.

Only publications in the English language were searched. Language bias can often occur as a result of using this approach as the studies identified might not have been a complete, accurate representation of the evidence (146). The I² test was not scrutinised in the overall results as research proposes that this test can have low statistical power when there are a small number of studies and the confidence intervals (CI) large, which was the case for this review. More importance has been placed on the 95% CI (62).

A few of the studies were conducted across several European countries, however, eight of the studies reviewed were conducted in the USA. As each country has a different approach and process associated with becoming a Lac, this could have had an impact on the findings.

The high prevalence of ADHD found in this review could have been attributed to the majority of studies (n = 5/6) having been conducted in the USA as they have an overall higher prevalence of ADHD in the general population which might have influenced the results (147). However, the same higher prevalence in Lac compared to non-Lac does not differ.

There are also suggested limitations to attaining prevalence rates on NDDs based on either/or a diagnostic code, standardised diagnostic assessment tool or survey response. Varying factors such as self-reporting bias, coding of NDDs applied without clinician interviews and diagnostic codes would have changed over time for some of these NDDs (27). However, the review followed other studies of similar methodology and include in the collated characteristics the description of the tools, codes and diagnostic manual used for transparency purposes (40).

The findings from the Tordön et al (2019) was based on a small sample and was self-reported which could have resulted in self-reporting bias. Although, mental health service usage was high in Lac, the reasons for accessing these services could not be determined and therefore could be contributed to a multitude of complex factors associated with this vulnerable population.

To conclude this review there were a limited number of research studies comparing Lac versus non-Lac in this context. Therefore, the findings should be interpreted with caution as there are a multitude of contributory factors that could have attributed to these higher prevalence rates. It is important to acknowledge that the findings did not ascertain whether it was the actual NDD, lack of support, the

complex dynamics surrounding the Lac, or a combination of both, that might have contributed to the increased adverse outcomes for these children.

The significant higher prevalence of NDDs in this population is something that stakeholders should make note of to ensure that specialist services and support are made available to this vulnerable population as early as possible. The adverse outcomes found raise even further discussion from a protective and safeguarding perspective.

Abbreviations

Lac = Looked after child/children

NDD = Neurodevelopmental disorder

Non-Lac = Children that are not looked after

ADHD = attention deficit hyperactivity disorder

ASD = autism spectrum disorder

ACE = adverse childhood experience

DSM - Diagnostic and Statistical Manual of Mental Disorders

ICD - International Classification of Diseases

Declarations

Ethical Approval

No ethics or consent was needed for this study.

Competing interests

The authors declare there are no competing interests.

Authors' contributions

All authors detailed on the title page were involved in the analysis and interpretation of results. All authors have been involved in the design of the study and will revise and approve the final manuscript.

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Figures

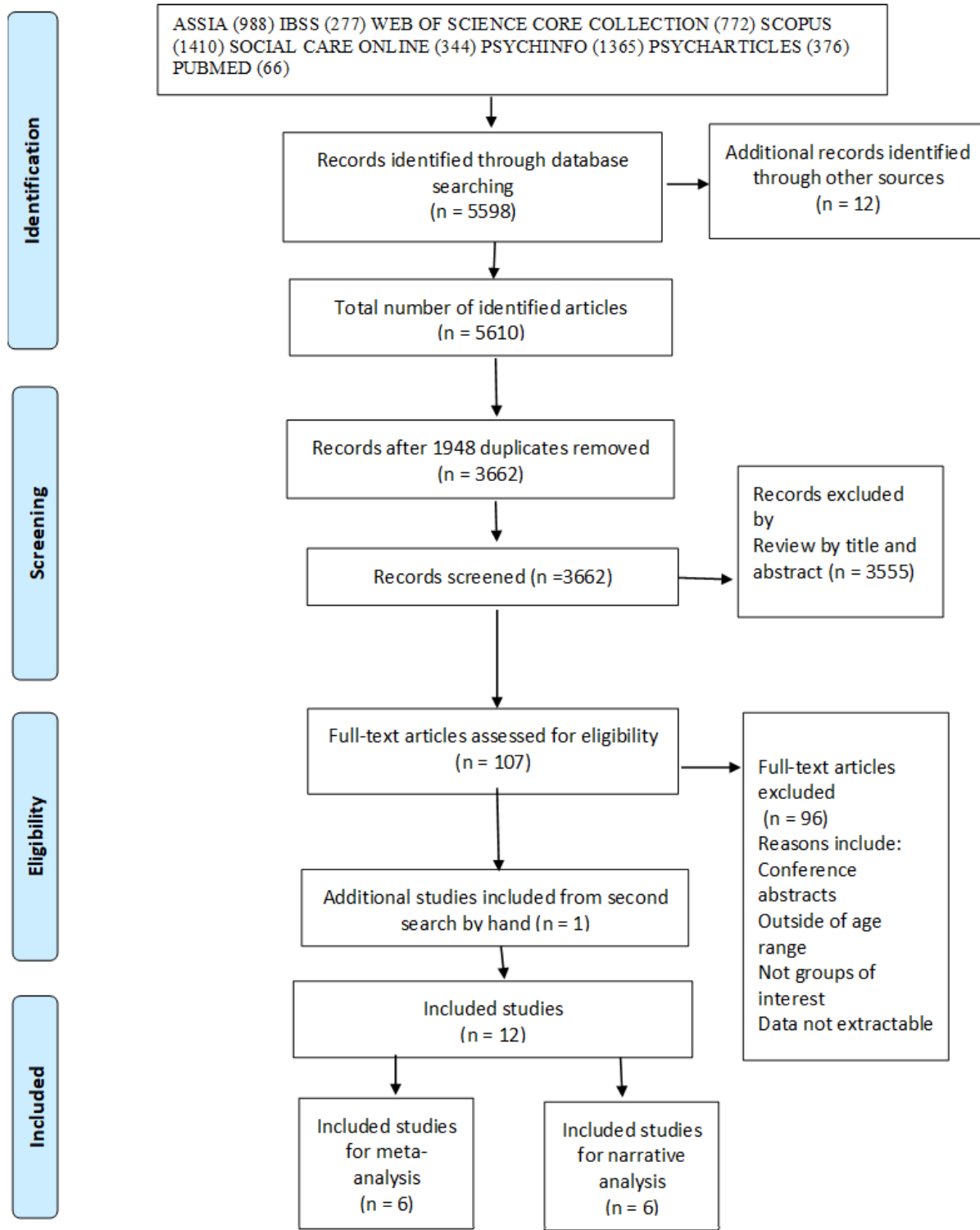


Figure 1

Flowchart of study selection

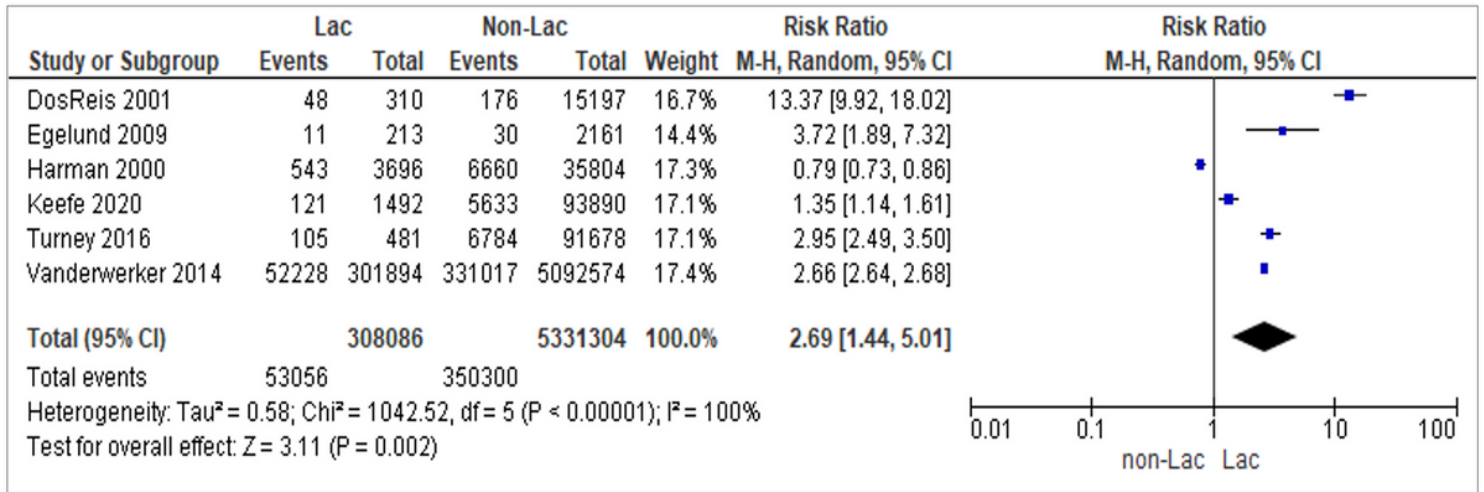


Figure 2

Prevalence of attention deficit hyperactivity disorder in looked after children (Lac) versus children that are not looked after (non-Lac)

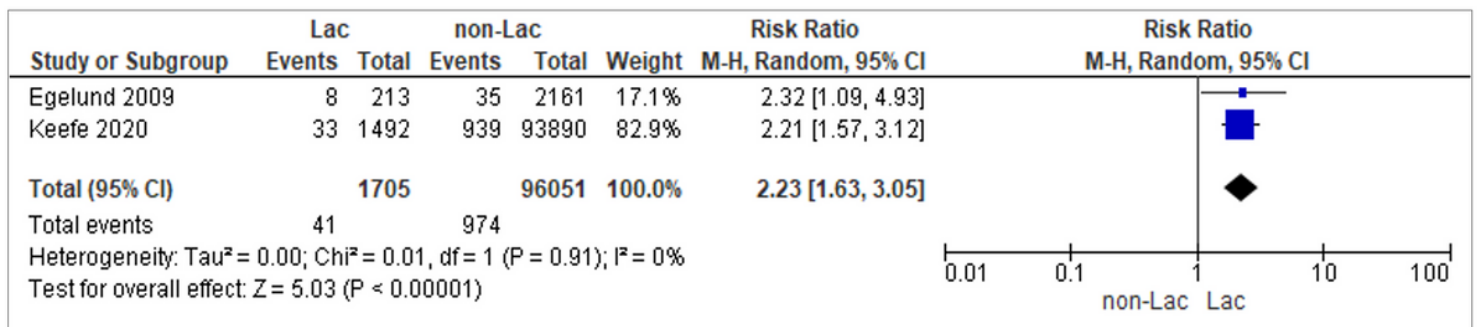


Figure 3

Prevalence of autistic disorders in looked after children (Lac) versus children that are not looked after (non-Lac)

Study	Neurodevelopmental disorder	Non-Lac (n = 35804)	Lac (n = 3696)
Harman et al 2000	Bipolar disorder	1.2*	1.0*
Study	Neurodevelopmental disorder	Non-Lac (n = 2161)	Lac (n = 213)
Egelund et al 2009	Specific developmental disorder of scholastic skills	0.1*	0.5*
	Specific developmental disorder of motor function	0.2*	0.5*
	Tic disorders	0.2*	0.9*
*Prevalence in percentage of cohort			

Figure 4

Prevalence of bipolar, specific developmental disorders of scholastic skills & tic disorders in looked after children (Lac) versus children that are not looked after (non-Lac)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1ListofNDDsand synonyms.docx](#)
- [Table2ExamplesearchstrategyProQuest10June2019.docx](#)
- [Table3.StudyCharacteristics.docx](#)