

Immunisation of looked-after children and young people: a review of the literature.

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Abstract

Background

Numbers of looked-after children and young people (LACYP) in the UK have risen over the last seven years. LACYP should receive regular health assessments, including establishing immunisation status and if needed, developing a health plan to achieve full immunisation. The Department for Education publish data on immunisations among LACYP to monitor both how well they are immunised, and service performance.

Methods

A literature review was conducted using four databases (PubMed, Embase, Scopus and Web of Science) on immunisation status of LACYP, factors affecting uptake and challenges to immunisation, and interventions to improve immunisation rates.

Results

32 papers were identified, 16 of which were UK based. LACYP are less likely to be 'up-to-date' with their immunisations than children in the general population. LACYP are less likely to receive timely immunisations and older LACYP are less likely to be 'up-to-date' than younger LACYP. Barriers to immunisation include failure to attend health checks, absence from school, and frequent placement moves. Unknown and discrepant immunisation histories, name changes, sharing of information between organisations and obtaining consent for immunisations are also challenges.

Conclusions

In recent years, immunisation of LACYP has been given a higher priority. However, the immunisation figures produced by the Department for Education are problematic because of challenges in determining whether the child is 'up-to-date', and data are not comparable with the general population; ideally this should be changed to correspond to routine immunisation data. In the interim, for reporting purposes, the use of a tool to assist with determining a child's immunisation status would be beneficial. When a child's immunisation status is incomplete or unknown Public Health England's algorithm for vaccination of individuals with uncertain or incomplete status should be used. Practice to improve immunisation uptake amongst LACYP, needs to be evaluated to develop evidence based recommendations.

Introduction

According to the Children Act 1989, a child is looked after by a local authority (LA) if he or she is in their care or is provided with accommodation for more than 24 hours by the LA. Looked-after

children fall into four main groups: those who are accommodated under voluntary agreement with their parents; who are the subject of a court order or interim court order; who are the subject of emergency orders for their protection and children who are compulsorily accommodated. “Looked after children” also includes unaccompanied asylum seeking children (The Royal College of Nursing and The Royal College of Paediatrics and Child Health 2012).

Numbers of looked-after children and young people (LACYP) have steadily increased over the last seven years. In England, on the 31st March 2015 there were 69,540 LACYP, a rate of 60 per 10,000 of the child population. Of these, 61% were looked-after due to abuse or neglect. Over a third of LACYP were between 10 and 15 years of age and 73% from a White British background. Just 4% were unaccompanied asylum seeking children. The majority (75%) were placed in foster care (Department for Education 2016). In Wales on the 31st March 2015 there were 5,615 LACYP (StatsWales 2015) and in Scotland on the 31st July 2015, there were 15,404 LACYP (National Statistics 2016).

It is widely accepted that LACYP have greater physical, emotional and health promotion needs than their peers and that these are less likely to be met (Anderson *et al.* 2004, Office for National Statistics 2004, Scott and Hill 2006, Simkiss 2012, McSherry *et al.* 2015). “Most children become looked after as a result of abuse and neglect. Although they have many of the same health issues as their peers, the extent of these is often greater because of their past experiences. For example, almost half of children in care have a diagnosable mental health disorder and two-thirds have special educational needs.” (Department for Education and Department of Health 2015)

The Department for Education (DfE) publishes annual statistics on numbers of children looked-after for at least 12 months, who have received dental checks, an annual health assessment and are ‘up-to-date’ with their immunisations (Department for Education 2016). A footnote to the DfE data defines up-to-date as “by 31 March the child has had all the immunisations that a child of their age should have received, according to the immunisations timetable reproduced by the Department of Health” and provides a link to the current schedules (NHS Choices 2016). Using these data, graphs of uptake were drawn for 2010 to 2015. Figure 1 shows that over the last six years, immunisation rates amongst LACYP have increased and that variability in immunisation rates between the different regions has decreased. Figure 2 also shows an improvement between 2010 and 2015 in the percentages of children who are up-to-date with their immunisations. LACYP who are 16 years or older, are less likely to be up-to-date with their immunisations than younger LACYP. Similar pictures were observed when examined by gender. Immunisation figures at local authority level indicate even greater disparity. In 2013 the percentages of LACYP who were up-to-date with their

immunisations at a local authority level ranged from 0% to 100%, in 2014 from 27% to 100% and in 2015 from 65% to 100%. Despite some improvement, these figures still suggest significant differences either in immunisation practice or in data capture and reporting, or both.

Direct comparison of immunisation uptake among LACYP with the general population is not possible using routine statistics. The cover of vaccination evaluated rapidly (COVER) programme, which monitors uptake in the general population provides quarterly immunisation uptake figures for each vaccine individually; this information is not available for LACYP where all vaccines are considered together. Additionally, the denominators for the two datasets are not comparable. The DfE figures include all LACYP above the age when the vaccine was due, whereas COVER data are based on children who reached their first, second or fifth birthday during the evaluation quarter and no data are available for older children.

The DfE and Department of Health (DH) have updated statutory guidance for LAs, clinical commissioning groups (CCG) and NHS England (Department for Education and Department of Health 2015). The LA must arrange for a child entering their care to have an initial health assessment with a registered medical practitioner. This assessment should result in an individual health plan for the child which is available for a first case review; this must happen within 20 working days of the child being taken into care. The health plan should be reviewed at least once every six months for children less than five years of age, and yearly for those over five years. Both the initial health assessment and subsequent reviews should include a review of the child's immunisation status. Similar guidance exists in Scotland (The Scottish Government 2014) and in Wales (Welsh Government 2015). The Children Act 1989 guidance and regulations (Department for Education 2015) says "When drawing up a health plan for a child, responsible authorities are required to ensure that s/he is provided with health care, including any specifically recommended and necessary immunisations and any necessary medical and dental attention." NICE's guidelines (National Institute for Health and Care Excellence 2010) and quality standards (National Institute for Health and Care Excellence 2013) for looked-after children and young people recommend that core health services such as immunisations should be provided. NICE's guidelines on increasing immunisation uptake among children and young people in groups and settings where immunisation uptake is low (National Institute for Health and Care Excellence 2009) include looked after children amongst those at risk of not being fully immunised. Recommendations made include the use of targeted interventions. Whilst guidance says that LACYP's immunisation status should be addressed, there are

no detailed national guidelines for clinicians on assessing and reporting their immunisation status, in order to achieve consistency of approach. (Lorek 2013)

The aim of this paper is to examine the immunisation status of LACYP, identify challenges and factors affecting uptake, and describe interventions aimed at improving immunisation status. We identify a number of initiatives which need to be systematically evaluated to develop a robust evidence base of interventions to improve immunisation uptake among LACYP.

Methods

The aim of the literature review was to identify studies/articles relating to uptake of routine childhood immunisations amongst LACYP. Firstly, a structured database search was used to identify research studies describing (1) the immunisation status of LACYP, (2) factors affecting uptake and challenges in immunisation and (3) interventions to improve immunisation rates amongst LACYP. Secondly, an internet search (Google) was used to identify policy documents, reports from NHS Trusts and CCGs, and any other relevant documents.

Search Strategy

Four databases were searched on 12th May 2016, using terms related to looked-after children and young people and immunisations. The databases searched were PubMed, Embase, Scopus and Web of Science.

Appropriate Mesh terms were identified in PubMed. The authors were already aware of some relevant papers, so reviewed the Mesh terms associated with those papers in PubMed to identify relevant Mesh terms for the literature search. The search terms used in PubMed were:

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("immunisation"[All Fields] OR "vaccination"[MeSH Terms] OR "vaccination"[All Fields] OR "immunization"[All Fields] OR "immunization"[MeSH Terms]) AND (((("looked after"[All Fields] OR "looked-after"[All Fields]) OR "public care"[All Fields]) OR "foster home care"[MeSH Terms]) OR "child, institutionalized"[MeSH Terms]) OR "adolescent, institutionalized"[MeSH Terms]).
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The PubMed search was then adapted to develop comparable searches in the other databases. Within Scopus and Web of Science, searches were based on the following: (“looked after” OR “looked-after” OR “foster care” OR “public care” OR “foster home care” OR “out-of-home care”)

AND (Immunization OR Immunisation OR vaccin*). Within Embase, relevant subject headings were used (immunization, foster care and institutional care (limited to children, age unspecified)) in conjunction with text word searches (looked after or public care or out-of-home care).

Inclusion and exclusion criteria

Initially titles were reviewed and for those that appeared relevant, abstracts were read. Likewise, if abstracts appeared relevant, full papers were reviewed. If an abstract was unavailable, the full paper was reviewed. To obtain a comprehensive overview of the issues, we included all types of research articles (full publications, conference abstracts, and letters). Discussion articles were excluded, but where relevant, are referred to in the broader discussion. Articles not written in English were excluded, along with those that focused on LACYP in a developing country setting.

Results

We identified a total of 288 articles which decreased to 172 after removing duplicates (see Figure 3). Thirty two papers, 16 from the UK, met the inclusion criteria and were included in the review. Table 1 summarises the UK based studies and Table 2, the non-UK studies.

Immunisation status of LACYP

In both UK and non-UK settings looked-after children were reported to have poorer immunisation status than the general childhood population in the same area (Ashton-Key and Jorge 2003, Rodrigues 2004, Beasley *et al.* 2015, Kling *et al.* 2016, Kaltner and Rissel 2011). One study which reported high MMR immunisation rates amongst LACYP (84%), also showed that a number of those considered to be fully immunised (32.5%), had received the vaccines late (Garry and John-Legere 2015). Barnes also found LACYP were less likely to receive timely immunisations (Barnes *et al.* 2005). Older LACYP are less likely to be up-to-date with their immunisations than their younger peers (Hill *et al.* 2003, Kaltner and Rissel 2011, Arora *et al.* 2014, Kling *et al.* 2016).

Amongst LACYP, there is heterogeneity; unaccompanied minors have a poorer immunisation status than other LACYP (Garry and John-Legere 2015). Morrirt found that children with chronic disability for whom the LA provides respite care, tend to have a better immunisation status than children who are accommodated for difficulties arising from parenting (Morrirt 2003). Studies from the USA also report differences according to whether the child is placed with their natural parents, relatives or

unrelated foster carers. Children with unrelated foster caregivers were less up-to-date with their vaccinations. (Schneiderman *et al.* 2010).

Factors affecting uptake and challenges in immunisation of LACYP

In auditing immunisation status from medical reviews, Morrirt found that “full coverage could not be obtained as some children, particularly adolescents, refuse health checks” (Morrirt 2003). Absence from school (Payne *et al.* 1998, Bundle 2001) and frequent placement moves (Payne *et al.* 1998) were also seen as barriers to immunisation, especially amongst older LACYP.

Immunisation status may be unknown for some LACYP and this is especially the case amongst unaccompanied minors (Rodrigues 2004, Garry and John-Legere 2015). Various discrepancies in immunisation status also exist depending on the source of the information used (Payne *et al.* 1998, Morrirt 2003, Snow and Lorek 2013). Problems also arose from changes of name within a family, as computerised immunisation systems could not accommodate these (Morrirt 2003).

Even when health assessments are completed, there may be issues around sharing of information between relevant organisations and obtaining consent for immunisations. Morrirt said “Reports are usually filed on British Association of Adoption and Fostering (BAAF) medical forms which provide a checklist of conditions and fail to highlight the child’s specific problems” (Morrirt 2003), (since this observation, these forms have been extensively revised (CoramBAAF 2016) and this should no longer apply if they are used as intended). The Social workers and foster carers had failed to arrange for immunisations to be given, because they had not understood what was required. Lack of joint health and social services databases hinder the sharing of data and can contribute to low immunisation coverage (Hill *et al.* 2003). Obtaining consent can also be a barrier to immunisation of LACYP (Shortall and Bedford 2015).

Interventions to improve vaccine uptake amongst LACYP

In Northern Ireland where health and social services have been integrated for many years, immunisation rates amongst LACYP are closer to those amongst the general population (Farrell 2003).

In a study conducted in 1999/2000, although detailed immunisation status and instructions about immunisations required were provided to the social services manager, it did not result in improved immunisation coverage (Ashton-Key and Jorge 2003).

Findings from other articles obtained via the internet search

In London in 2009, work was done looking at emerging practice with respect to LACYP. Examples of good practice from case reviews focussing on improving immunisation status, included collecting a full immunisation history as soon as the child enters care, applying knowledge about the immunisation schedule, good team work and communication across all agencies, robust data collection systems, and offering a flexible immunisation service for older children e.g. the looked after children (LAC) nurse immunising at health assessments rather than referring on (Department for Children Schools and Families and Government Office for London 2010). Similarly, Print gave examples of partnership working to improve immunisation uptake amongst hard to reach groups including LACYP (Print 2013).

In one London area, a review of case notes of LACYP who had an initial health assessment revealed that only a half of specific health recommendations had been carried out; obtaining immunisation histories and administering outstanding vaccines was a particular problem. Several initiatives were introduced to improve the situation: LACYP health staff were given access to the LA database providing them with up-to-date information including general practitioner (GP) details; children requiring immunisation were referred to the LAC nurse; parents were encouraged to attend the initial health assessments enabling better capture of medical histories and referrals made were copied to the social worker with clear responsibilities and timescale stated (Croft 2009).

A number of annual reports from NHS Trusts and CCGs describing initiatives to improve immunisation uptake among LACYP were found. In Leicestershire, designing a specific code for LACYP on the child health information systems improved immunisation data quality (Harrison J *et al.* 2012). In Cumbria, increased immunisation uptake was attributed to improved data cleaning and more robust systems in place for reviewing children at point of entry to care and at review health assessment stage (NHS Cumbria Clinical Commissioning Group 2015). In Northumberland immunisation of older LACYP was described as challenging but a flexible approach by community nursing staff, including delivery at home and negotiation enabled these to be completed (Northumbria Healthcare NHS Foundation Trust 2014). In Southwark, plans to give missed immunisations were not always followed up. "Deciding what immunisations a child or young person has had is difficult. We have developed a detailed recording form for immunisations, that also indicates what immunisations are outstanding and when they need to be given which is now sent to the GP for up to date information." A monthly immunisation catch up clinic was introduced, but

attendance was low. “More effective particularly for the out of borough placements is to target the GPs to provide appointments where catch-up immunisations are required.” (Southwark Council 2015).

Discussion

Vaccines are one of the most successful and cost-effective means to help children grow into healthy adults (World Health Organization 2016) and therefore steps should be taken to improve uptake wherever possible, and especially amongst vulnerable groups such as LACYP. In view of the frequency of health assessments, the immunisation status among LACYP should be as good as, if not better than, the general population (Barnes *et al.* 2005, Butler and Payne 1997). Statutory guidance and guidelines for LACYP now place priority on ensuring immunisation status is assessed and action taken to ensure that they are immunised. Annual reports from NHS Trusts, CCGs and LAs suggest they consider immunisation status to be important. The DfE statistics also suggest an improvement in immunisation status of LACYP. This increased activity needs to be sustained and extended to areas that are not performing as well.

Few recent studies have explored immunisation status of LACYP and those we identified were predominantly described in conference abstracts, limiting the information available. NHS structures, policies and practice have changed in the UK since many of the papers were written. However, there are a number of consistent findings highlighted from this literature review which are likely to still be relevant.

Morritt (Morritt 2003) found that some children, particularly adolescents, refused health checks. This was also reported from Northern Ireland and was felt to be because “they did not see it necessary and because this provision instilled feelings of difference from their peers” (McSherry *et al.* 2015). This is of concern as DfE data shows that adolescent LACYP are least likely to be up-to-date with their immunisations. DfE statistics for 2015 showed that 10% of LACYP did not receive their annual/biannual health assessments.

There are challenges in obtaining full immunisation histories for LACYP (Barnes *et al.* 2005, Rodrigues 2004) and discrepancies in immunisation status exist between different record types (Snow and Lorek 2013). Statutory guidance (Department for Education and Department of Health 2015) now says “The lead health record for a looked-after child should be the GP-held record. The initial health assessment and health plan, and subsequent review assessments and plans, should be a part of that

record.” “To ensure the child’s health plan is of high quality, the health assessment should use relevant information drawn together beforehand and fast-tracked by all involved to the health professional undertaking the assessment. This will include information in the GP-held record and also, if not in that, the additional information held ... on the Child Health Information System (CHIS), especially immunisation status to date.” This guidance is helpful as it specifies a lead health record and states where additional information should be drawn from.

In some studies immunisation status was not verified (Anderson *et al.* 2004, Williams *et al.* 2001), and others did not report how it was defined (Beagley *et al.* 2014, Panwar and Wilson 2011). There were also differential definitions of immunisation timeliness. For example, Barnes considered a primary course received by 12 months of age to have been given on time (Barnes *et al.* 2005) whereas in other studies it appeared that any time beyond the recommended vaccination age was considered to be 'late' (Garry and John-Legere 2015). Whilst these factors make comparisons between studies difficult, it is unlikely to have affected the overall findings.

Although the DfE reporting of immunisation status of LACYP is positive as it requires LAs to report immunisation figures, thus raising their profile, it is problematic. First, as already mentioned, the method of data collection prevents comparison with immunisation figures for children in the general population using COVER data: it is neither possible to examine uptake of individual vaccines nor to compare uptake by age. Secondly, because it can be difficult to determine whether a child is actually 'up-to-date', it is likely that practice varies across the country, with resulting inaccuracies in the data. In view of this, we have concerns about the validity of the DfE immunisation data as currently reported. Ideally, a system should be introduced that makes it possible to compare immunisation uptake among LACYP with the general population as a routine.

Two separate but related issues also need to be addressed to improve the management of LACYP’s immunisation needs as well as data quality. These concern reporting practice and determining whether a child is up-to-date with their immunisation, as well as clinical management of children whose immunisation status is incomplete or unknown. In this latter situation, the use of Public Health England’s (PHE) algorithm for vaccination of individuals with uncertain or incomplete status (Public Health England 2016) enables practitioners to determine the vaccines needed to bring the child up-to-date. This guidance is regularly updated and referred to in statutory guidance for promoting the health and well-being of LACYP (Department for Education and Department of Health 2015) but the extent to which it is used in this context is unknown.

In considering how healthcare staff determine children's immunisation 'up-to-date' status for reporting purposes, it may not be clear, even when immunisation records are complete. The DfE immunisation data for LACYP references the current immunisation schedule as the means of determining whether a child is 'up-to-date' with their immunisations, but this is not sufficient as knowledge of the schedule that was in place when they reached particular ages is also needed to make this assessment (Snow and Lorek 2013). For example, a child for whom a vaccine was not indicated when it was introduced because of their age may, if assessed according to the current schedule, appear not to be up-to-date. Some vaccines, for example pneumococcal vaccine, are no longer indicated after a specific age as a child's susceptibility to some infections changes (Public Health England 2013). To address this issue, Snow describes a tool developed by the Sheffield Looked After and Adoptive Children's Health team (Snow and Lorek 2013) that takes account of the child's birth and the immunisation schedules that applied to them over time. Used in an interactive online format, it could be possible to incorporate an output which would specify which immunisations were required to bring that child 'up-to-date'. As with the PHE algorithm the tool would need to be regularly updated, but such an investment could improve the quality of care for individual patients, standardise care across the UK and improve the validity of immunisation data. It could also help practitioners manage other children or adults requiring immunisations. The definition of 'up-to-date' still requires further consideration and standardisation since a child who is fully immunised according to the current UK vaccination schedule and a child vaccinated according to the PHE algorithm are both 'up-to-date', but their immunisation histories may be very different. A child's 'up-to-date' status also needs regular review as children reaching an age where another immunisation is indicated, are no longer 'up-to-date' until it has been received.

Challenges in obtaining consent for immunisations (Shortall and Bedford 2015) were also reported by Miles (Miles 2002) and are highlighted in Dorset CCG's annual report on looked after children: "there are occasions when consent is declined making it impossible to complete the immunisation programme for some children in care. This is particularly relevant for children in care under Section 20 (Voluntary Care). In these cases the nurses review this annually as part of the Review Health Assessment with the person who has parental responsibility, usually the birth parent" (Earney and Gould 2015).

Data sharing also continues to pose a challenge. In Hertfordshire where many LACYP are placed out of the county, the Community NHS Trust observed "Poor transfer of information can lead to children

missing out on immunisations and other vital interventions” (Hertfordshire Community NHS Trust 2015). Likewise, frequent moves are a potential barrier to immunisation. In Scotland the majority of looked after children have more than three placement moves during their time in care (The Scottish Government 2014).

Recent, annual reports from NHS Trusts and CCGs on looked-after children, suggest that immunisation of LACYP is being given priority. However, although it was encouraging that we identified examples of interventions to improve immunisation uptake in reports identified via the Internet search, there were few described in peer review papers leaving an important evidence gap. Reported interventions and other practices need to be investigated systematically, to develop evidence based recommendations to improve immunisation uptake among LACYP.

Consideration also need to be given to the most effective methods for sharing information about a child’s immunisation requirements with foster carers, social workers and adolescents themselves, who need to act on the information. In the past, BAAF forms have been widely used, but current practice is not clear. Information for non-health professionals needs to be clear and appropriate for a lay audience. We suggest that this issue should be reviewed and action taken to develop best practice and standardisation across the UK.

Key Messages

- LACYP are less likely to be fully immunised than children in the general population. Older LACYP are less likely to be up-to-date than their younger peers.
- Routine reporting of immunisations amongst LACYP is problematic in that comparisons with rates within the general population are not possible and there are difficulties in determining the main indicator which is whether a child is ‘up-to-date’. Ideally reporting should be changed to allow comparisons with routine immunisation data.
- The use of a tool that takes into account the child’s date of birth and the schedules that were in place as that child developed would be of help. This could improve the quality of care for individual patients, standardise care across the UK and improve the validity of immunisation data.
- When a child’s immunisation status is incomplete or unknown, Public Health England’s algorithm should be used to determine which vaccines are needed to ensure that child is appropriately immunised.

- Examples of good practice to improve immunisation uptake amongst LACYP need to be evaluated to develop evidenced based recommendations.

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Tables

Table 1 – Articles found relating to a UK setting

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
1	Shortall	2015	Conference abstract	* Five in-depth interviews conducted with expert healthcare professionals. * Survey to 32 Looked-after Children's teams	Focus on unaccompanied asylum seeking children and young people	N/a		The study "provided insights into parental consent as a barrier to immunisation."
2	Garry	2015	Conference abstract	Retrospective analysis of electronic data	* 422 LAC (all for a minimum of 12 months), of which: * 244 placed with alternative care to their parents (local LAC) * 178 children arriving in UK alone as unaccompanied minors (UM)	5 to 18 years	Croydon	* Overall, 69.2% of LAC (local LAC and UM) were fully immunised with MMR. * 84% local LAC and 48.9% UM were fully immunised with MMR. * Local LAC MMR immunisation coverage above expected, as non-looked after children having received 2 MMR vaccinations in borough (74.2%) and in London (80.8%). * In UM - MMR coverage low and there is a lack of data.

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
3	Beasley	2015	Conference abstract	Review of immunisation status from Wales Child Health Database	* 157 looked after young women * 2555 matched controls	12 to 18 years	Swansea, Wales	* Those who were 'looked after' were significantly less likely to be vaccinated with HPV * 90.3% of young women who had completed year 9 and who were not 'looked after' had completed a 3 dose HPV vaccination course. In those who were 'looked after', this was 83.4%.
4	Beagley	2014	Conference abstract	Case Note review	297 LAC		"one of the most deprived boroughs in England"	* "86% of children were fully immunised"
5	Snow / Lorek	2013	Paper	* Audit of Immunisation records * Immunisation look-up tool created	100 Initial Health Assessments for LAC	0 to 16 years	Sheffield Local Authority	* Overall, 73% of LAC were fully immunised * The % of LAC fully immunised varied according to record type: 86% according to Red Book, 49% according to Child Health Computer Record (CHCR), 70% according to GP records * Large discrepancies between immunisation status record in GP records vs CHCR - in 44% the GP recorded fewer immunisations than the CHCR record; in 36% CHCR and GP records corresponded; and in 20% the CHCR recorded fewer immunisations than GP record. * "The immunisation status of LAC can be difficult to ascertain."

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
6	Panwar	2011	Conference abstract	Review of clinical records	19 LAC who had been in continuous care for 12 months on 30/09/07	aged >10 years	North East Lincolnshire	* 3 out of 19 (16%) had 'Incomplete immunisation'
7	Barnes	2005	Paper	Comparative study	*119 children in care for 6 months *119 matched controls	4 to 17 years	4 Unitary Authorities in South West Wales	* A complete immunisation record was documented for 28.4% of looked after children and 43.8% of children in the comparison group * Children in public care significantly less likely to have received immunisations against diphtheria, tetanus, pertussis and polio, than the comparison group * Looked after children were less likely to have received immunisations 'on time'
8	Rodrigues	2004	Paper	Review of case notes and child health immunisation data	* 269 Children looked after by Surrey Social Services on 1 June 2001 * 136 randomly selected case notes reviewed * child health surveillance and immunisation records reviewed	mean age 10.3 years	East Surrey	* Immunisation status was not known for 11 children (8%). * Immunisation status was "very poorly recorded in the case notes and was often not available to medical practitioners conducting the examinations." * Immunisation rates were much lower among looked-after children than among the general population of children in East Surrey. * Primary immunisations complete: 56% LAC, 93% children in East Surrey * Meningitis C complete: 61% LAC, 84%

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
								children in East Surrey * MMR 1: 76% LAC, 83% children in East Surrey * Pre-school booster: 76% LAC, 80% children in East Surrey
9	Anderson	2004	Paper	Postal questionnaires, then telephone interview / home visit of foster carers	56 children in foster care	6 -12 years	2 local authorities - covering an inner city and semi-urban / rural areas	* "Only one foster carer was aware of any vaccinations missing while five (9%) were unsure whether the children had had appropriate vaccinations."
10	Morritt	2003	Paper	Immunisation audit	* 267 children in public care and seen by a community paediatrician * audit period 1.4.99 to 31.3.00		Boroughs of Middlesbrough and Redcar & Cleveland	* "Children in public care have lower immunisation rates and more incomplete schedules than the local population." * 57.3% children were up-to-date with their immunisations and 42.7% were not * At one year of age, 67.4% had received primary immunisations (local health district 92.5%) * At two years of age 74.5% had received MMR1 (local boroughs 89%)

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
11	Hill	2003	Paper	Cross sectional survey	<ul style="list-style-type: none"> * 3028 children in public care * 501,516 children at home * meningococcal C immunisation status on 31 March 2001 from district immunisation databases 	0 to 18 years	Southampton; Greenwich; Basildon; Shropshire, Telford, and Wrekin; Stoke-on Trent; South Tyneside; Calderdale and Huddersfield; Edinburgh; and Cardiff and the Vale of Glamorgan.	<ul style="list-style-type: none"> * Overall, children looked after by local authorities were more than twice as likely to not receive meningococcal C vaccine than children at home * 33% of children in public care did not receive meningococcal C vaccine compared with 15% of children at home. * Immunisation status unknown for 6.5% children in public care * Uptake decreased with age in both groups. * Retrieving data was difficult in all but one district, which had electronic records of looked after children. * No district had a joint health and social services database.
12	Farrell	2003	Letter	Review of child health system data	<ul style="list-style-type: none"> * 75 looked after children * 23,936 'other children' * October 2001 		Craigavon and Banbridge Health and Social Services Trust, Northern Ireland	<ul style="list-style-type: none"> * "In Northern Ireland, health and social services have been integrated since the 1970s" * 89.3% LAC completed primary immunisations compared with 96% of 'other children' * 90.6% LAC had meningococcal C immunisation compared with 93% of 'other children' * 92% LAC had measles, mumps and rubella compared with 96% of 'other children'

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
13	Ashton-Key	2003	Paper	Intervention study	* 252 children looked after by the unitary authority on 31 March 1999 * Community child health immunisation records identified for 227 of these (90.1%)	0 to 18 years	an urban unitary authority in England	* 53.3% of looked after children had received all their age appropriate immunisations compared with 90% for the district as a whole * Differences more marked for pre-school boosters and beyond * They provided social services with detailed immunisation histories for every child looked after by the unitary authority. This included instructions for those immunisations needed to bring them up-to-date * Immunisation status reviewed after 1 year * The provision of this information did not improve immunisation coverage in these children
14	Williams	2001	Paper	Case control study using home interviews	* 142 children in local authority care for more than 6 months * 119 matched controls	5 to 16 years	Welsh unitary authorities of Swansea, Neath Port Talbot, and Bridgend	* Compared with children at home, those looked after by local authorities were significantly more likely to have incomplete immunisations * Looked after children were significantly less likely to be fully immunised for their age, although the difference was not apparent for younger children.

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
15	Bundle	2001	Paper	Comparison of children's home records with community child health records	* 36 children in a residential children's home (national facility for those with previous placement breakdown and school failure) * August to Nov 1998	13 to 16 years	UK	<ul style="list-style-type: none"> * The children's home records contained partial information about immunisations for only five young people, of which three had dates. * Full details of immunisations, with dates, were available in the child health records for 12, and partial information, with dates, for a further 17. * Recorded immunisation uptake from 29 sets of child health records was as follows: completed primary course 86%; preschool booster 69%; MMR or measles 76%; MR 65.5%; BCG 38%; school leaver tetanus, low dose diphtheria, and polio 0%. * "The particularly poor uptake of BCG and school leaver tetanus, low dose diphtheria, and polio boosters may reflect absence from school and the difficulty of keeping track of immunisations and other health needs when there are frequent placement changes."

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
16	Payne	1998	Paper	Review of routinely collected immunisation statistics	1 year re-audit of a random sample of 93 LAC enrolled with social services on a given day	2 to 5 years	A single local authority in an urban area of Wales	<ul style="list-style-type: none"> * Immunisation records were available for 67% of the sample * "Looked after children are significantly less well protected against infectious diseases by immunisation with diphtheria, tetanus, and polio, HiB and MMR, compared with the whole county population of 2-5 year olds." * Immunisation rates for Diphtheria, tetanus and polio (primary course): 90.3% for LAC, 96.9% amongst non-looked after children * Immunisation rates for Pertussis: 67.7% for LAC, 89.8% amongst non-looked after children * Immunisation rates for Diphtheria, tetanus and polio (booster): 32.2% for LAC, 43.4% amongst non-looked after children * Immunisation rates for measles, mumps and rubella: 85.4% for LAC, 94.7% amongst non-looked after children * Immunisation rates for Hib: 46.7% for LAC, 70.7% amongst non-looked after children * "Information on immunisation rates in looked-after children is incomplete owing to many missing records secondary to placement moves."

Table 2 – Articles found relating to Non-UK settings

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
1	Kling	2016	Paper	Assessment by an experienced paediatrician	120 children recently placed in foster or residential care	0 to 17 years	Sweden	<p>* "The percentage of children who had completed the vaccination programme recommended by the National Board of Health and Welfare was 86% for children up to six years of age and 68% for older children."</p> <p>* These immunisation rates "were much lower than the rates found in the general population in other studies."</p>
2	Ferrara	2016	Paper	Case control study using vaccine certificates	<p>* 60 children in foster care (second generation immigrants)</p> <p>* 91 children living with their parents (second generation immigrants)</p> <p>* 112 healthy Italian children</p> <p>* Jan 2010 to June 2011</p>	birth to 3 years	Italy	<p>Of those in foster care:</p> <p>* Hexavalent vaccine: 65% had received it correctly, 26.7% received it late, 8.3% had not received it</p> <p>* MMR: 47.5% received it on time, 12.5% received it late and 40% had not received it</p> <p>* Pneumococcal vaccine: 66.7% appropriately immunised</p> <p>* Meningococcal C: 16.7% appropriately immunised</p> <p>* Comparing adequate immunisation at age 2 years of children in foster care to second generation immigrants living with parents, there were statistically significant differences in relation to the Hexavalent vaccine and MMR, with</p>

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
								lower rates amongst those in foster care. * All the Italian children had vaccine coverage of 100%
3	Ferrara	2016	Paper	Case control study using medical records	* 112 children in "group-homes" (temporary care facilities / institutions & awaiting adoption) * 112 controls from general population * Sept 2011 to April 2012	2 to 17 years, mean age 10.5 years	Rome, Italy	Amongst children from the group-homes: * 81.2% had hexavalent vaccine (controls: 100%) * 78.6% had MMR (controls: 100%) * 8.9% meningococcal vaccine (controls: 100%) * 13.4% pneumococcal vaccine (controls: 100%) * All these difference were statistically significant * 17% did not have immunisation records available (0% of controls)
4	Kohler	2015	Paper	Case control study using data from the Swedish Child Health Services	* 100 children, born between 1992 and 2008 who had been in family foster care * 100 matched controls	mean age 10 years	Sweden	* "the family foster care children were less likely to participate in the national immunisation programme (87%) than the control group (97%)"

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
5	Raman	2014	Paper	Analysis of clinic records of all children attending community paediatric clinics for vulnerable children	* 98 children attending community paediatric clinics for vulnerable children (for 12 months from December 2007) * 57% of these were in foster care	1 month to 15 years, mean age 4.6 years	South Western Sydney, Australia	* 34% had incomplete immunisation status * "There were no significant differences in health/support needs between those in foster care and those in parental care."
6	Arora	2014	Paper	Retrospective chart review and subsequent analysis of data from the first assessments of the children placed in care	239 children placed in care from January 2005 to April 2011	72% were between 2 and 12 years	Queensland, Australia	* 15% needed immunisation initiation or catch-up * Adolescents in care were 2–5 times more likely to be deficient in immunisation compared with the other children in care.
7	Jaudes	2012	Paper	Comparative study using data from Medicaid Management Information System	* 28,934 children in foster care between July 2001 and June 2009 * 1,486,706 controls - other children receiving	0 to 17 years	Illinois, USA	* 80% of all children in foster care were up-to-date with their immunisations * for children <3 years old, 86% to 90% completed their immunisations (72% to 75% across the State of Illinois, 69% to 77% nationally) * "Having a medical home for children in foster care improved immunization status compared to

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
					health services via Medicaid			both the state and national data for this most vulnerable age group."
8	Sahu	2011	Conference abstract	Reviewed clinic records of all children attending community paediatric clinics for "at-risk" children (2008)	* 98 children attending community paediatric clinics for "at-risk" children * 57% of these were in out-of-home-care (OOHC)	mean age 4.6 years	South Western Sydney, Australia	* 34% had incomplete immunisation histories * "There were no significant differences in the health or service needs between those in OOHC or parental care." (NB all were 'at-risk' children).
9	Raman	2011	Paper	Analysis of records from multidisciplinary clinics	100 Aboriginal children entering out-of-home-care	2 months to 12.5 years (mean age 4.7 years)	South Western Sydney, Australia	* Immunisation status was unknown in 16% and overdue in 34%.
10	Kaltner	2011	Paper	Multidisciplinary child health assessments	63 children entering out-of-home care	2 months to 16 years (mean age 4 years 10 months)	North Brisbane, Australia	* "Only 68% of the sample was found to be fully immunised." * Incomplete immunisation was identified in 22% of children * Immunisation history was missing for a further 10% of children * Older children exhibited higher levels of incomplete immunisation than younger children (21.5% of children aged <5 years, and 40% of children age

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
								5 or older were incompletely immunised). * Immunisation rates compared "very unfavourably with immunisation rates within the general Queensland child population"
11	Schneiderman	2010	Paper	Surveys administered to caregivers in the waiting room of an outpatient pediatric clinic	* 237 caregivers (birth parents, kin, and unrelated foster) of children who had sustained abuse or neglect. * July to Nov 2006	mean age 6.4 years	Los Angeles, California, USA	* Children with unrelated foster caregivers were less up-to-date on their vaccinations (74%) than those with birth parents (94%) or kin caregivers (88%). * "Difficulty understanding doctor," "waiting for an appointment" and "inconvenient office hours" were cited by all caregivers as access barriers.
12	Henderson	2006	Paper	Analysis of Oregon Health Plan and the Alert Immunization Registry records	39,708 infants born in 2000 to 2001 who had both records		USA	* Overall, 83.7% of the infants had initiated immunisation by age 3 months and 16.3% had not. * Infants were less likely to have initiated immunisation if they were in foster care.
13	Olivan	2002	Letter	psychosocial interview and health screening	100 runaway adolescents admitted to a short-term institutional foster-care		Spain	* 10% had incomplete immunisation status

	Lead Author	Publication Year	Nature of article	Nature of study	Subjects	Ages	Location	Key findings
					facility (1992 to 2001)			
14	Ensign	2001	Paper	Health passport audit	* 84 shelter-based foster care adolescents * between January and September 1994	mean age 14.5 years	Baltimore, USA	* Only 11% had documented up-to-date immunisations * 1% had documentation of delayed immunisation status * 88% had no documentation of immunisation status
15	Gennaro	1998	Paper	Telephone Interview	13 preterm, low birth weight infants in kinship care (foster care provided by relatives)	0 to 6 months	USA	* "Only 4 out of the 13 infants (31%) were adequately immunised." * These infants had poorer immunisation status than similar preterm infants, not in kinship care
16	Schor	1982	Paper	Review of random sample of medical records of children enrolled with a health care plan	387 children in foster care	0 to 22 years	Baltimore, USA	* Immunisation records were available for 61% of the children * Records were available for fewer of those children older than 12 years (55%) than for those younger (81%). * Records were much more likely to be available for children placed in foster homes at a young age, 0 to 4 years (75%), than those placed at 5 years or older (45%). * 70% of the children were found to be inadequately immunised

Figures

Figure 1 - % LACYP with immunisations up-to-date by region of England

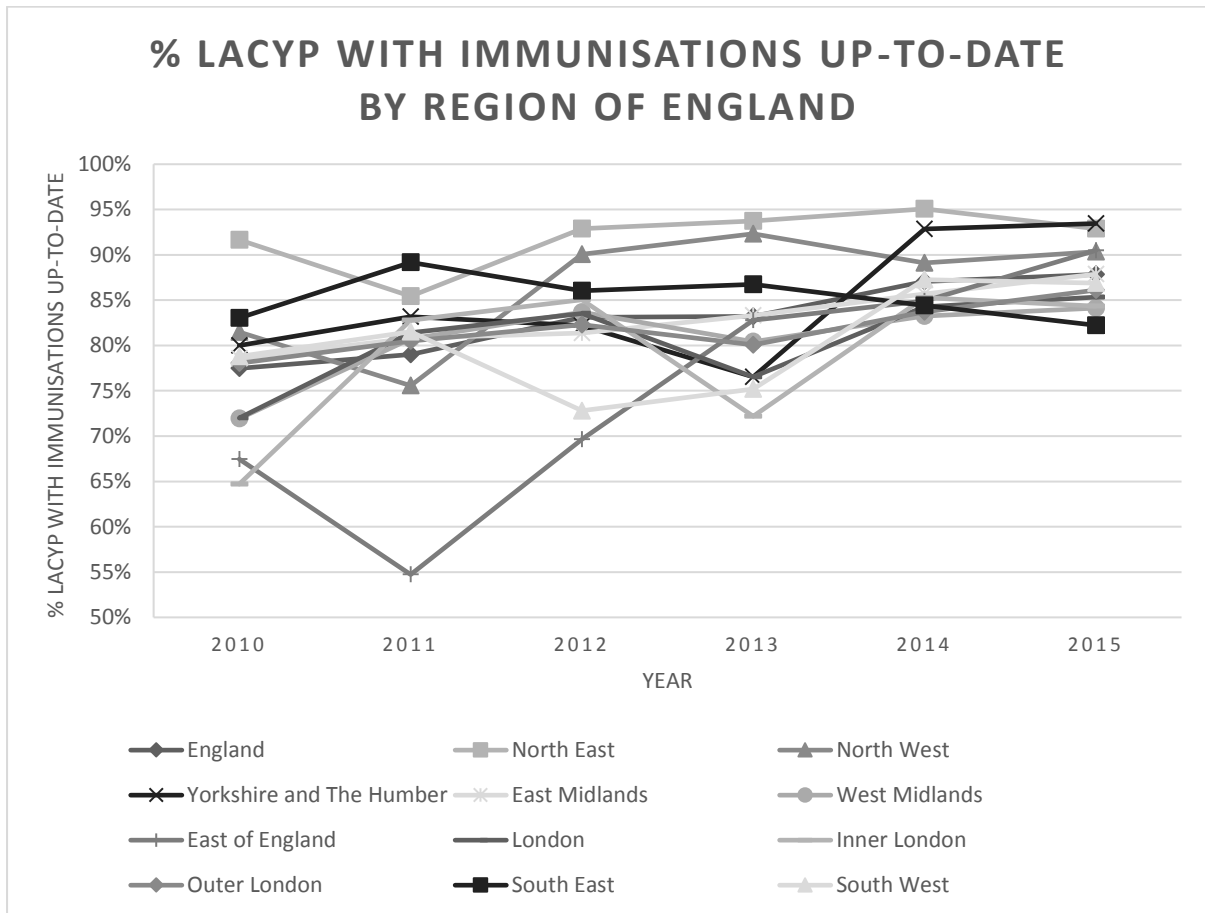


Figure 2 – % LACYP with immunisations up-to-date by age group

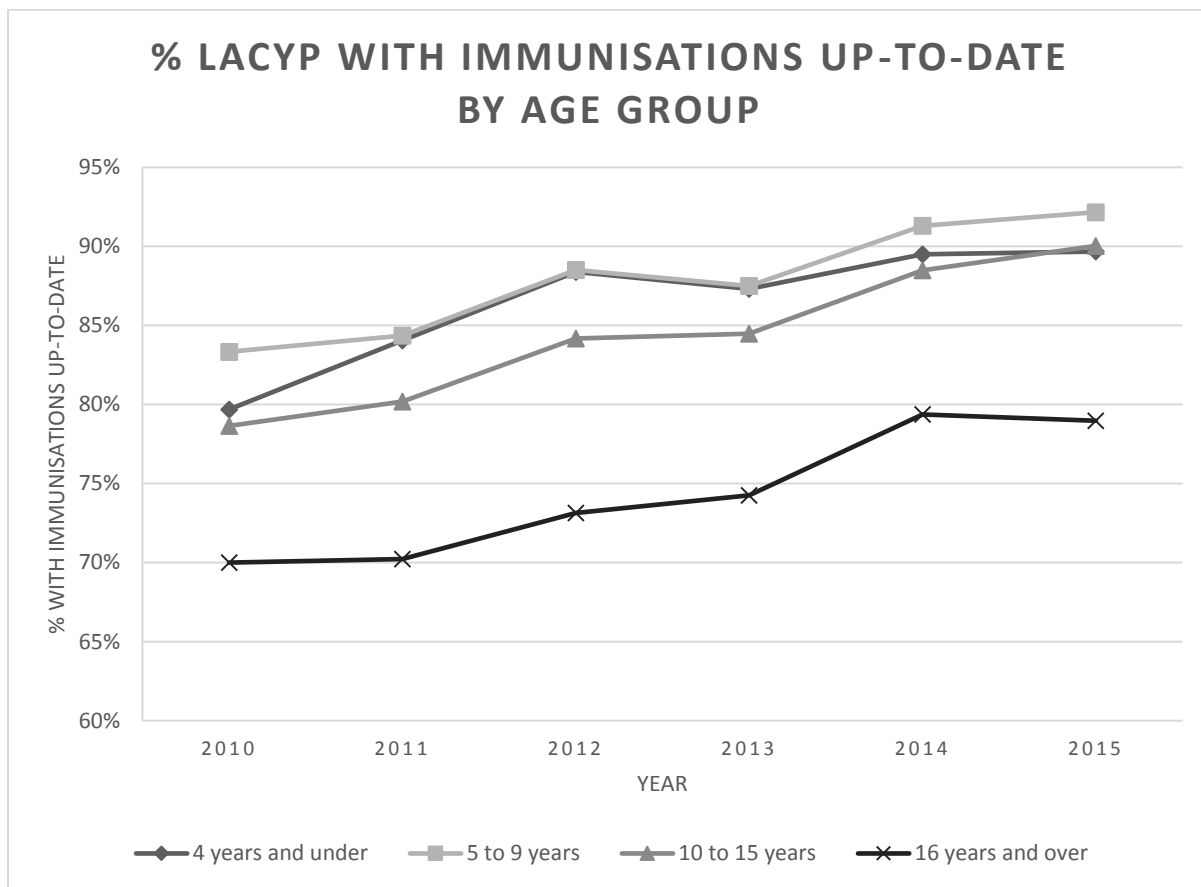
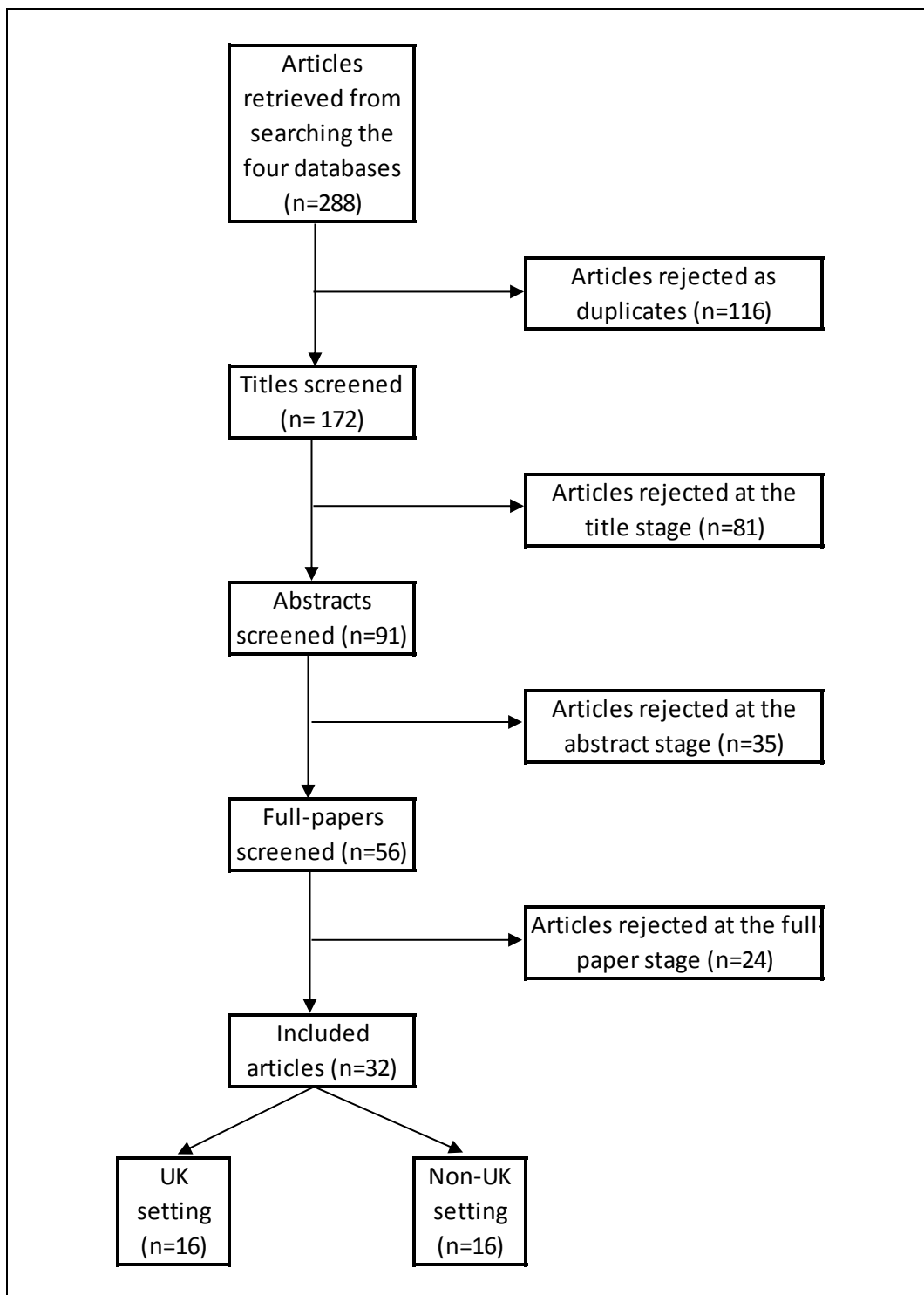


Figure 3 – Flow diagram of articles identified and selected



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