Children's language development and supplementary gesture production following a home visiting programme

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Thesis submitted in partial fulfilment of the requirement for the degree of D.Clin.Psy. at Cardiff University and the South Wales Doctoral Programme in Clinical Psychology.

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Abstract

This thesis explores the impact that Home Visiting Programmes (HVPs) have on the language development of young children.

Paper one reports a systematic review conducted to explore whether HVPs have an effect on the language development of the children they support. This process yielded 11 studies, all of which were rated using a quality appraisal tool. Data was extracted from each of these studies and analysed in order to identify which programs have supported children's language development and why this might be. The findings illustrated that the HVP model of intervention are able to make positive changes to children's language development, but not all programs achieve this outcome. The variance in the ways in which HVP are delivered makes for cautious conclusions, but the review suggests that the frequency and duration of visits might play an important role.

Paper two describes an empirical study that measured 24-month-old children's supplementary gesture-speech production. The data was analysed to investigate whether there was a difference in language ability of the children, half of whom had received support from the Family Nurse Partnership program HVP (UK). 483, three-minute long video recordings of mother-child dyads were coded for the child's gesture production, with a particular focus on their use of supplementary gesture-speech combinations (an advanced form of gesture production associated with children's language development). The study did not find a difference between the two groups with regards to supplementary gesture production, but did find a significant association between supplementary gesture production and children's Mean Length of Utterance (MLU) score across the whole sample. Furthermore, children born to younger mothers were less likely to produce a supplementary gesture.

Paper three provides a reflective and critical evaluation of the above papers. The paper reflects on the research processes and decisions made, as well as the clinical implications for the findings.

Terminology: Home Visiting Program (HVP); Mean Length of Utterance (MLU); Family Nurse Partnership (FNP); Early Language Milestone scale (ELM)

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Do Home Visiting Programmes improve children's language development? A systematic review

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Abstract

Introduction: Home visiting programmes have become a popular form of intervention to support vulnerable, underprivileged women and families who are either pregnant or have recently become new mothers. Home visiting programs often have a broad range of aims and outcome measures. The purpose of this paper is to systematically review how effective home visiting programs are in helping to improve the young children's language development.

Method: A comprehensive search of four online databases (Embase, Emcare, Psycinfo and Medline) between 1990 and 2018 was conducted, as well as a hand search of the references of relevant studies. Screening the studies produced from the database search identified eleven randomised control trials, home visiting programme studies that included an assessment of children's language development and met the inclusion criteria. The risk of bias of each study was assessed and relevant data extracted so as to enable a comparison of the programmes.

Results: Most of the home visiting programmes had been set up in America. Seven of the eleven studies reported positive language outcomes for children. Analysis revealed that there was a significant degree of variance between the studies ruling out a meta-analysis. Nine different language measures reporting varying aspects of language were used, making comparisons across programmes difficult. However, there was a trend for home visiting programmes which started prenatally and had longer home visits times to show more promising results.

Conclusion: Home visiting programmes clearly have the potential to influence the language development of the young children within their services. However, the review makes clear that not all measure this developmental process, and not all programmes achieve positive outcomes. Initiating early interventions and higher frequent and duration of home visits appears to improve the outcomes. Future research with home visiting programmes should consider the language assessment tools selected and how the language results are reported.

Key words: Home visiting programme; Language; Children; Systematic review

Introduction

Becoming a parent can be both an exciting and stressful time. For many, this new experience is often challenging, though this can be particularly felt when the mother lives within poor financial circumstances, has limited or no access to family and social support or has added complications such as an addiction or unstable domestic life (Parkes, Sweeting and Wright, 2015). For children (particularly infants and toddlers) who face growing up in financial hardship, this places them at high risk for adverse childhood experiences that can lead to a lifelong negative effect on their health, education and vocational success (Garner et al. 2012). To help mitigate the potential negative consequences for both mothers' and children living in such challenging circumstances, interventions delivered during the first years of a child's life can lead to improvements in health-related outcomes that persist into adulthood (Campbell and Scott, 2011; Marmot et. al.2008).

In order to support those mothers and families that are deemed to be socially at risk, many countries have established Home Visiting Programmes (HVPs). HVPs are interventions that provide voluntary, family-focused services in the family's primary residence and often aim to address health, social service and educational needs (Ivan et al. 2009). HVPs have many appeals due to their ability to circumnavigate barriers to service usage. In addition, they allow the home visitor to assess the home environment and neighbourhood (Wasik, 1993) and tailor the service to meet the needs of the family. In many cases, the HVP uses a two-generational approach to simultaneously focus upon the vulnerable families social and economic needs (Finello et al. 2016). These services tend to start during pregnancy or early infancy and continue over the course of the first few years of the child's life. Those delivering the home visits can vary in their background experience, but are often healthcare professionals, paraprofessionals or volunteers. In most cases, the home visitors will have received some level of training for the role from the service provider, with the aim of

supporting the parent and the child through pregnancy and / or during a set time period following the child's birth (Gomby et al. 1999).

A review of the published literature surrounding HVPs reveals that the programmes vary considerably with regards to their target population, the frequency and duration of visits, the implementation method and the outcomes targeted for change. Outcomes that are typically targeted by HVPs include, but are not limited to, improving birth outcomes (e.g. increased birth weight, attendance at antenatal classes (Issel et al. 2011; Ichikawa et al. 2015), increasing the rate of breastfeeding (McInnes and Stone, 2001), improving immunization rates (Johnson et al. 1993), reducing child abuse and neglect (Chaffin, Hecht, Bard, Silovsky and Beasley, 2012), reducing the number of hospitalisations (Johnson et al. 1993), supporting the child's physical growth (Le Roux et al. 2010), supporting the child's cognitive development (Grantham-McGregor et al. 1991; Hamadani et al. 2006), improving the child's behaviour (Caldera et al. 2007), and supporting the mental health and wellbeing of the mother (Barnet et al. 2002). Despite their differences, HVPs across the world generally share a number of commonalities. They deliver a structured service within the family's home and aim to have a positive impact upon the knowledge, beliefs and parenting practices of the caregiver in order to improve children's outcomes (Wasik and Bryant, 2000).

The evidence to support the use of HVPs is rather mixed. For example, whilst several randomised control trial studies have found positive outcomes for HVPs (for example, Bugental, et al. 2002; Lee, Mitchell-Herzfeld, et al. 2010), other studies have not found significant outcomes (for example, Barth, 1991; Kartin, et al. 2002; Duggan et al. 2004). It is apparent that not all HVPs may be effective for improving the health and wellbeing of mothers and their children. In addition to the single study randomised control trials, several systematic reviews and meta-analyses have explored the use of HVPs with socially at-risk families. Systematic reviews such as Peacock, et al. (2013) have explored the effectiveness of

HVPs across multiple domains of child development. Stamuli et al. (2015) studied the economic effectiveness of HVPs, whilst other reviews have examined specific outcomes such as child maltreatment and violence (Avellar and Supplee, 2013; Bilukha et al. 2005) or improvements in parenting skills and the home environment (Hadian, et al. 2018). However, to our knowledge, the impact of HVPs on children's language development has not been systematically studied.

The acquisition of language is a key developmental milestone during early childhood that has a significant impact upon other areas of life, such as providing the foundation for future reading comprehension (Oakhill et al. 2003; Muter, et al.2004), and protecting against the development of behavioural problems (Stevenson et al. 1985). Language development is also a sensitive indicator of neuromotor impairment, hearing loss, general learning disabilities and specific language and communication difficulties (Dockrell, 2001). Multiple studies have found that children growing up in lower socio-economic status households (the families typically targeted by HVPs) show poorer language skills than their peers (Arriaga et al. 1998; Huttenlocher, et al. 2002; Rescorla and Alley 2001). This deficit can be identified as early as 18 months of age, with children brought up in higher socioeconomic status households knowing 60% more words and being faster at comprehending words than their lower socio-economic status peers (Fernald et al. 2013). In the United Kingdom, children who qualify for free school meals and live within deprived neighbourhoods are 2.3 times more likely to be identified as having speech, language and communication needs (Dockrell et al. 2012). Similarly, at school entry, children from low income families are almost one year behind their higher family income peers in terms of vocabulary development (Waldfogel and Washbrook, 2010). This difference is perhaps most starkly underlined by the research of Hart and Risley (1995) who estimated that by 3 years of age, children brought up in low socio-economic status households are exposed to approximately thirty-million fewer spoken words than

children brought up in higher socio-economic status households. Increased awareness of this 'word gap' in children's language between socio-economic classes has led the UK government to announce a multi-million pound scheme, launched to help support parents and carers improve their children's language, vocabulary and social skills (Department for Education, 2017).

Amongst the many reasons for this disparity, a growing body of literature has shown that parents from low socio-economic status households speak and gesture significantly less with their children (Rowe and Goldin-Meadow, 2009), use a greater number of directives in their speech (Hart et al. 1995; Hoff 2006), and use shorter utterances and a reduced vocabulary (Hoff, 2003). Several reasons for this have been hypothesised for this discrepancy, including the impact of lower levels of parental education (Raizada and Kishiyama 2010), the neurological impact of stress when living within lower socio-economic status (Noble, et al. 2005; Farah, et al. 2006) and parenting style (Hashima and Amato, 1994).

Nonetheless, studies have shown that if parents can be supported to be more verbally responsive to their offspring during early childhood, improvements in children's language skills can be made (Nicely, Tamis-LeMonda and Bornstein, 1999; Paavola Paavola et al., 2005; Tamis-LeMonda and Bornstein, 2002). Given the heterogeneity in the outcomes targeted by HVPs, it is less clear whether such multi-faceted interventions that aim to improve multiple domains of child development lead to improvements in children's language and communication skills. To address this gap in the literature, the aim of this systematic review is to determine whether HVPs lead to a documented improvement in children's language development.

Method

Literature Search Strategies

An experienced librarian assisted in searching the Embase, Emcare, Psychinfo and Medline databases. Broad search terms were used to make the review wide ranging. The search terms were identified through an examination of the language and terms used within the research literature that has focussed on HVPs. The search terms (see appendix B) were chosen in order to identify children (child* OR exp/infant OR baby OR babies OR preschool), language (language OR speech OR word* OR vocab*), home visiting (home visit* OR house call OR home intervention OR home based), low socioeconomic status (low SES OR low socioeconomic OR poor fami* OR poverty OR disadvantaged) and mothers or women who were pregnant (mother* OR pregnant OR post partum OR prenatal OR neonatal OR perinatal). Results were restricted to those published during and after 1990 and those studies published in the English language. In addition to the database search, the references cited in the identified papers were also examined for further relevant papers. The search was conducted in February 2018.

Study screening against inclusion criteria

Each of the studies identified through the literature search was screened by examining the title and/or abstract. Each study was categorised into those deemed to be potentially relevant and those that were clearly irrelevant to the aims of this systematic review. Those studies deemed potentially relevant were explored in further detail to determine whether they met the following eligibility criteria: 1) the study involved an evaluation of a HVP delivered by healthcare professionals or paraprofessionals: 2) the study used a randomised control trial design: 3) the study population was pregnant women or women supported by a HVP that began within the first three months of the birth of their child: 4) the women involved were defined as living in social deprivation, were on a low income, or were defined as being

socially at risk: 5) the study involved an assessment and reported the outcomes with regards to the child's language development following a period of home intervention support: 6) home visiting was the primary service delivery strategy. The screening of studies was carried out by the principal researcher.

Assessing study quality

Those studies that met the inclusion criteria were assessed for their risk of bias using the Cochrane Risk of Bias Tool (Higgins et al. 2010) and the Cochrane handbook (Higgins and Green, 2011). Biases were rated as being low risk, high risk or an unclear. The principal researcher assessed the bias of all papers, whilst a second researcher used the same tool to independently assess the risk of bias of a random sample of 4 studies, comprising 24 items, representing 36% of the total study sample and above the 10% minimum sample suggested by NICE (2012). Agreement between the coders was calculated as $\kappa = .69$; n=24.

Data extraction

Data extraction was performed on those studies that met the inclusion criteria using an adapted version of the Cochrane Data Extraction and Assessment form. This adapted version was pilot tested on two studies in order to establish its viability for the task, before being used for each paper.

A wide range of data points were collected for each study that allowed for the analysis and comparison of each study across four key categories: 1) Study aims and design; 2) participant details; 3) HVP process and procedure; and 4) language assessment and outcomes.

Results

Literature search

The database search identified a total of 9447 studies. This was reduced to 4454 once duplicates were removed. A search of reference lists of all potentially relevant studies identified a further 21 relevant papers, resulting in 4475 published studies assessed for their relevance.

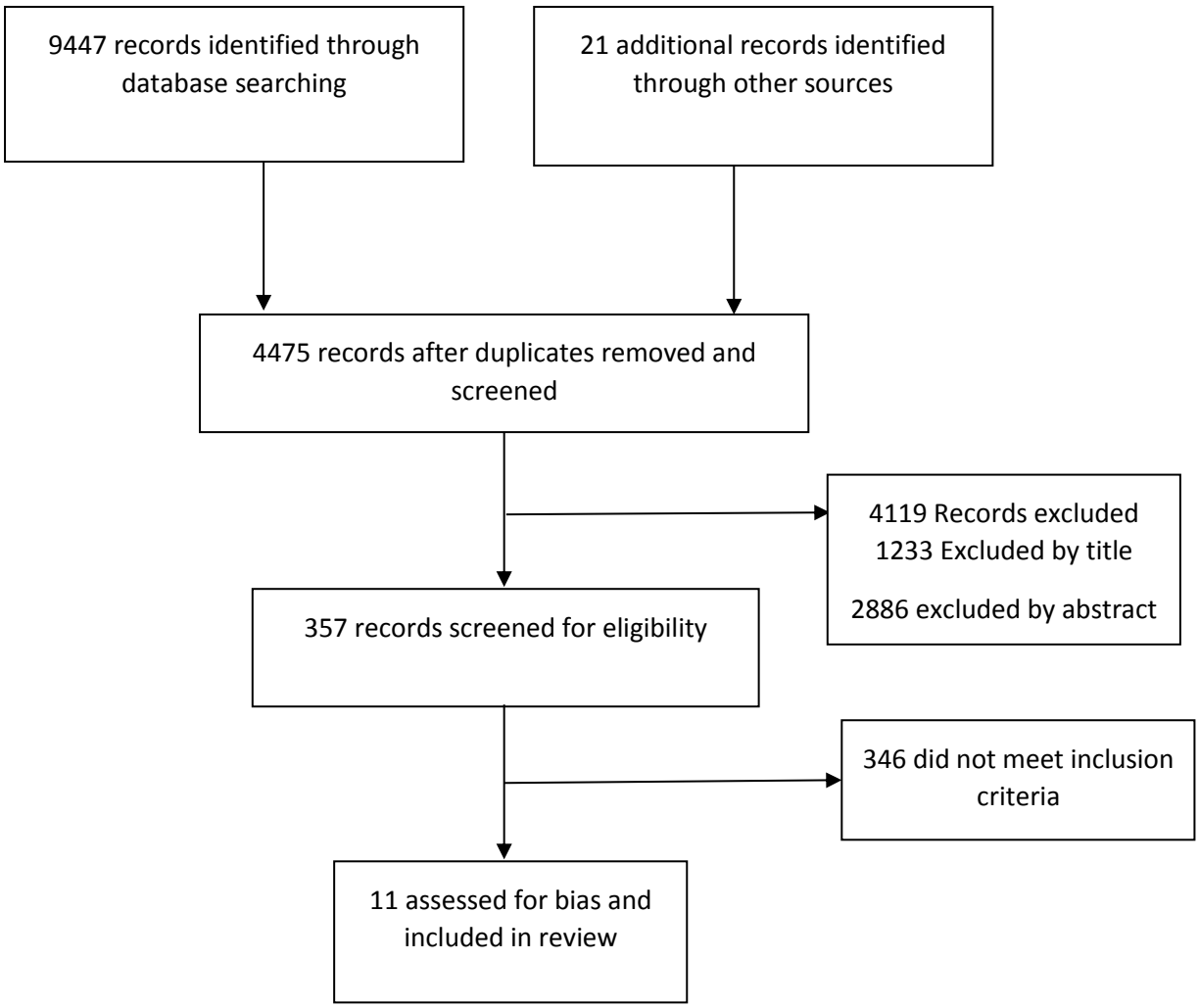


Figure 1. Flow chart detailing the study selection process

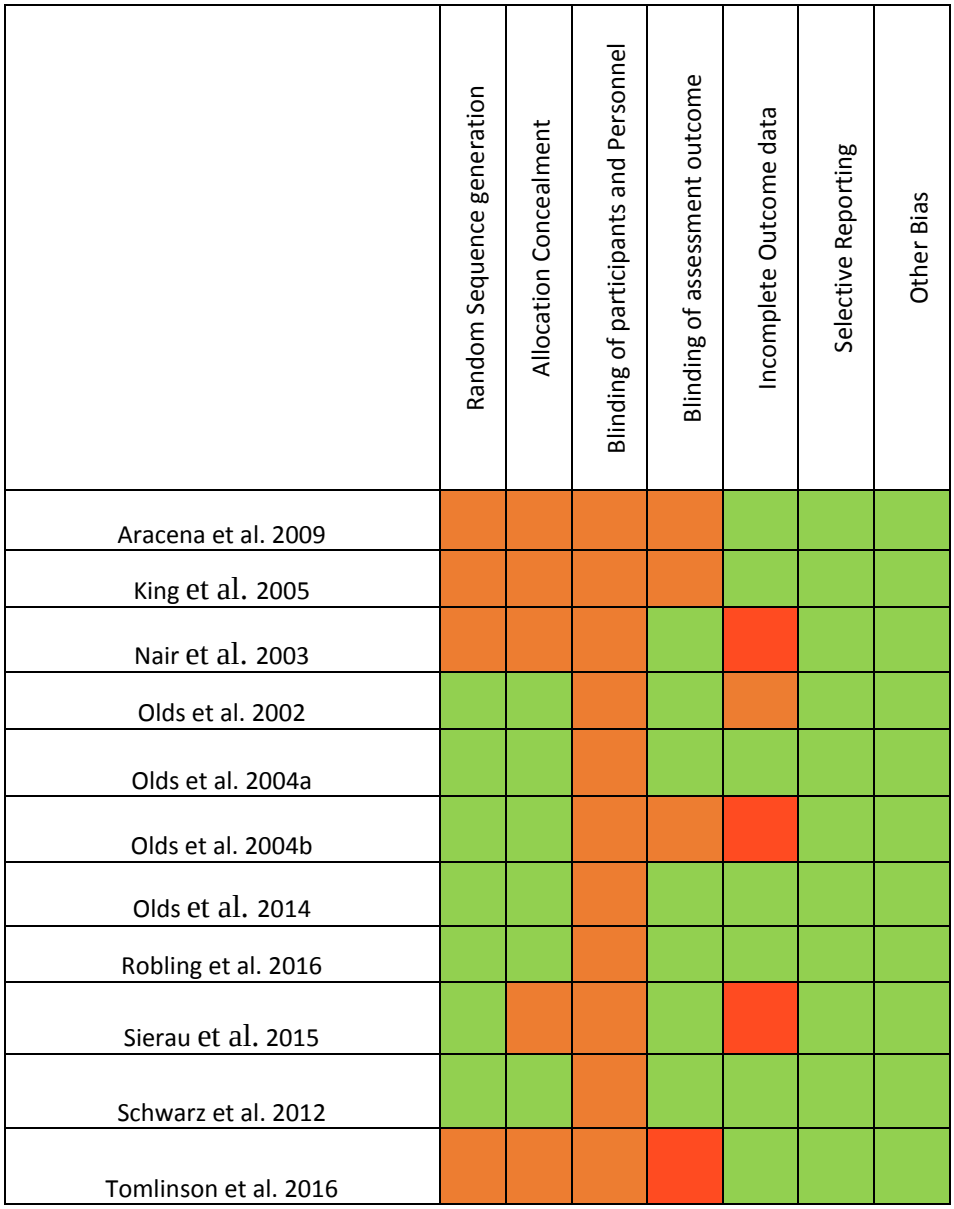
Relevance and validity

Of the 4475 studies, 1233 were excluded by title alone, with an additional 2886 studies excluded following a review of their abstracts. A detailed examination of the remaining 357 studies was conducted against the inclusion criteria, resulting in 346 studies being deemed ineligible. This process yielded a final total of 11 studies (see figure 1). A quality assessment was carried out on each of the 11 studies, with all studies assessed for their risk of bias (Table 1). The quality assessment process did not lead to the exclusion of any study. The risk of bias tables for each study can be seen in appendix C. Given that the nature of the intervention procedure for all the included studies involved home visits over a significant period, it was not possible for any study to blind its participants and personnel as to which intervention group they had been allocated to. Therefore, this risk of bias was assessed as unknown for all the involved studies.

The quality assessment showed that although there were several unknown areas of bias, the majority of the studies were judged to have a low level of bias. Only two judgements of high risk of bias were made, both relating to incomplete data outcomes, given the way in which the language outcomes were reported in the papers.

Table 1

Quality Assessment Outcomes



NB. Green = low risk, orange = unknown risk, red = high risk.

Table 2

Study Characteristics

Author	Home Visit Program name and location	Home Visitor	Home visitor guidelines and training	Number of mother participants	Intervention period	Average number & average duration of home visit
Arcena et al. 2009	Un-named (Chile)	Health educators (under the guidance of nurse-midwives)	Trained in adolescence, adolescent pregnancy, infant development, transgenerational conflicts and couple relationships. Guidelines and weekly supervision provided.	Total n=90; HVP n=45; Control n=45	Pregnancy to 12 months old	Monthly visits. Duration - one hour
King et all. 2005	Hawaii Healthy Start Program (USA)	Trained paraprofessionals	Six weeks of training.	Total n=643; HVP n=373; Control n=270	Pregnancy to 35 months old	Weekly to quarterly visits. Unknown duration.
Nair et al. 2003	Un-named (USA)	Trained lay visitors	Trained using the HELP at Home Curriculum from the Hawaii Early Learning Program (HELP, 1991), a comprehensive curriculum	Total n=171; HVP n=84; Control n=87	Birth to 24 months	Weekly to bi- weekly visits - 6.3 prenatal visits; 26 postnatal visits. Duration - 30.1 minutes (SD = 5.8).

			containing 650 developmental skills from birth to 36 months.			
Olds et al. 2002, 2004a, 2014	Nurse Family Partnership (USA)	Paraprofessionals & nurses	One month of extensive training	Total n=735; HVP Paraprofessional n=245 and nurse n=235; Control n=255	Pregnancy to 24 months old	Paraprofessional visits - 6.3 prenatal visits (range: 0–21); 16 visits during infancy (range: 0–78). Nurse visits - 6.5 prenatal visits (range: 0–17); 21 visits during infancy (range: 0–71). Unknown duration.
Olds et al. 2004b	Un-named (USA)	Nurses	Detailed visit by visit guidelines provided for the nurse home visitors	Total n=543 HVP n=228; Control n=515	Pregnancy to 24 months old	7 prenatal visits (range: 0–18 visits) and 26 visits (range: 0–71 visits) during first 2 years. Unknown duration.
Robling et al. 2016	Family Nurse Partnership (UK)	Family nurses (comprising nurses and midwives)	All family nurse visitors received training in the delivery of the programme	Total n=1529 HVP n=719; Control n=810	Pregnancy to 24 months old	Medium of 10 prenatal visits, 19 visits (infancy), 13 visits (toddler). Duration - 79.14 minutes (ranging from half hour to 3 hours)

Sierau et al. 2015	Pro-Kind - based on Nurse Family partnership (Germany)	Trained midwives and social education workers and one paediatric nurse	Training on the basic program principles.	Total n=755 HVP n=394; Control n=361	Pregnancy to 24 months old	Weekly visits from prenatal to one month old, bi-weekly and then monthly for the last six months. Unknown - duration.
Schwarz et al. 2012	The MOM program (USA)	Masters level nurse practitioners and two trained community workers	Extensive training for each home visit and followed a manualised, detailed visit by visit protocol	Total n=302 HVP n=152 Control n=150	3 months old to 36 months old	8 home visits over 3 years. Duration - 15 minutes.
Tomlinson et al. 2016	Philani Intervention Program (South Africa)	Trained township women	One months training in cognitive-behavioural change strategies. Bi-weekly supervision. Structured home visits.	Total n=1238 HVP n= 644 Control n=594	Pregnancy to 36 months	6 prenatal visits (SD = 3.8); 5 postnatal visits (birth - 2 months old - SD=1.9); 1.4 visits per month (2-6 months old (range=0.1–6.4). Biannual visits after 6 months. Duration - 31 minutes each visit.

Included studies

All studies included in this review were randomized control trials, with over half the studies based on HVPs within America (n=7), with one study based in each of the following countries: UK, Germany, South Africa and Chile respectively. Of the 11 studies, two (Olds et al. 2004a & 2014) were long terms follow up studies that were based on the HVP research by Olds (2002). Both papers assessed the children's language development at varying stages, so were included in this review. The number of mothers recruited to the studies ranged greatly, from 90 mothers (Arcena et al. 2009) to 1529 mothers (Robling et al. 2016). The rate of attrition across the studies ranged from 20% (King et al. 2005) to 56% (Olds et al. 2004b). A majority of the home visits across the studies were carried out by trained healthcare professionals, including nurses, midwives, health care and social care professionals. Four of the studies used 'paraprofessionals' (individuals not fully licenced or fully qualified) as part of their home visits (King et al. 2005; Olds et al 2002, along with follow up studies Olds et al. 2004 and Olds et al. 2014). It is noteworthy that a more specific definition of the employment background of 'paraprofessionals' was not provided. Two studies used non-healthcare professionals (Nair et al. 2003 and Tomlinson et al. 2016), though training was provided. Four of the studies specified the gender balance of the children who were assessed as part of the intervention (Aracena et al. 2009, King et al. 2005, Robling et al. 2016, and Schwarz et al. 2012), with Robling et al. (2016) reporting the largest gender bias towards more female children (69% to 31%). Aracena et al. (2009) reported the intervention group having a bias towards more male children (61% to 39%). All other studies that specified their gender balance were close to equal. The vast majority of the mothers involved in the included studies were in their teens or early twenties. The range of average ages was from 17.3 years old, SD=0.23 (Aracena et al. 2009) to 23.1 years old, SD=5.6 (Tomlinson et al. 2016). All the mothers recruited to the included studies came from poor socioeconomic backgrounds and

were deemed socially at risk by the study researchers. Additionally, the aims of each HVP were set out in the research papers. Across all the studies, there was a broad range of aims, though the aims can be categorised into one of 3 categories:

- *Supporting the mother* – Developing her identity and supporting her life plans, helping her become economically self-sufficient and developing her parenting skills
- *Supporting the child* – Healthy child development, developing the child's relationships with those around them and developing a healthy home environment.
- *Health promotion* - Improving the health of the mother , foetus and child, reducing alcohol and substance misuse, increasing links to medical and early intervention services and reducing HIV infection and transmission.

Table 3 provides a summary of the HVP aims, with a more specific breakdown of each HVP aims, and support available to the control group is outlined in table 4.

Table 3

Overview of the aims of each Home Visiting Programme

Study	***Support the mother***	***Child's development***	***Improve family Health***
Arcena et al. 2009	***X***	***X***	***X***
King et al. 2005	***X***	***X***	***X***
Nair et al. 2003	***X***	***X***	***X***
Olds et al. 2002, 2004a, 2014	***X***	***X***	***X***
Olds et al. 2004b	***X***	***X***	***X***
Robling et al. 2016	***X***	***X***	***X***

Sierau et al. 2015	***X***	***X***	
Schwarz et el. 2012			***X***
Tomlinson et al. 2016		***X***	***X***

Table 4

Summary of each Home Visiting Programmes targeted aims, control group support and home visitor guidelines

Author	Targeted aims of the Home Visiting Programme	Control group support
Arcena et al. 2009	(1) Development of mothers identity (2) Develop mothers life plans (3) Reinforce her parenting skills (4) Promote basic health care practices for both mother and child (5) Strengthen the adolescent's relationships with those around her.	Standard care from the health centres – an average of 10 prenatal consultations with the nurse midwife of the community health centre.
King et al. 2005	1) Teaching parents about child development 2) Role-modelling parenting skills 3) Linking families to a medical home	Standard care - not specified in further detail
Nair et al. 2003	1) Increase maternal empowerment to manage problems (substance related and other) by linking with other services, family and social supports. 2) Promote child development by teaching mothers how to interact with their children.	Standard care, plus brief monthly tracking visits and follow-up assessments at 6, 12, 18 and 24 months and then annual visits.
Olds et al. 2002, 2004a, 2014	1) Improve maternal and foetal health during pregnancy 2) Improve the health and development of the child after birth 3) Enhance parents' personal development (future pregnancies, education, employment).	Children's developmental screening and referral services at 6, 12, 15, 21, and 24 months old.
Olds et al. 2004b	(1) Improve pregnancy outcomes by promoting women's healthy prenatal behaviours (2) Improve the health and development of children by promoting parents' competent care of their children (3) Enhance parents' life-course development by encouraging parents to plan subsequent pregnancies, complete their education, and find work.	Free transportation for scheduled prenatal care appointments plus developmental screening and referral

		services for the child at 6, 12, and 24 months of age.
Robling at el. 2016	1) Improve pregnancy outcomes 2) Improve child health and development 3) Improve parents' economic self-sufficiency.	NHS care as usual, including statutory and non-statutory services.
Sierau et el. 2015	1) Improve family environment such as quality of home, access to social support 2) Improve maternal self-sufficiency, maternal empathy and parenting skills 3) Support child development	Support from existing health care and social services. No further details provided.
Schwarz et al. 2012	1) Increase participation in child primary health care services 2) Promote participation in early intervention programs	Mothers received an information booklet on child and family services.
Tomlinson et al. 2016	1) Reduce mother's risk of acquiring HIV 2) Prevent Maternal to Child Transmission 3) Improve maternal and child health including TB and illness detection 4) Reduce maternal alcohol use 5) Improve infant and child nutrition 6) Foster children's growth and development.	Standard antenatal clinic care within 5km of each neighbourhood.

Table 5

Participant Characteristics

Author	Average age of mothers at time of recruitment	Socioeconomic description of mothers	Child Gender (as specified in study)
Arcena et al. 2009	HVP - 17.3 (SD = 0.23) Control - 17.15 (SD=0.22)	First time mothers living within an extremely poor neighbourhood of Santiago de Chile.	HVP - 39% female and 61% male. Control group - 55% female and 45% male.
King et al. 2005	HVP - 23.7 (SD=5.9) Control - 22.9 (SD=5.4)	Mothers socially at risk through poor socioeconomic circumstances and high stress levels. Deemed at risk of poor health and developmental outcomes or child abuse and neglect.	HVP - 43% male and 57% female. Control - 49% boys, 51% girls
Nair et al. 2003	Age not specified	Substance abusing mothers living within risky environments	Gender not specified
Olds et al. 2002, 2004a, 2014	19 years old (SD - 3.99)	Women from a low income background	Gender not specified
Olds et al. 2004b	64% were 18 years of age at registration	Unmarried mothers with a household income at or below the federal poverty line	Gender not specified

Robling et al. 2016	Median age 17.9 years	Living within the catchment area of a Family Nurse Partnership Team. 65% not in employment, education or training.	Male - 31% Female - 69%
Sierau et al. 2015	21 years old.	Economic risk factors (e.g., unemployment, over-indebtedness), at least one social risk factor (e.g., poor education, experiences of violence, or neglect).	Gender not specified
Schwarz et el. 2012	23.1 years (*SD* = 5.6)	Women living in an area of high poverty	Male – 46% Female - 54%
Tomlinson et al. 2016	Age not specified	Socially deprived women, low income, high unemployment	Gender not specified

Language Outcomes

A meta-analysis could not be performed on the language outcomes from the identified studies as the measures used varied considerably.

Five of the nine HVPs reported significant improvements in children's language outcomes. In addition, Olds et al. (2004a) and Olds et al. (2014), the two follow up studies to Olds et al. (2002) both found that children's language development continued to improve ahead of the control group's language development, as the child got older. Four studies did not find that HVPs made a significant difference to the children's language development. All studies and their language outcomes are shown in Table 6.

Table 6

Summary of Language Outcomes

Author	No. of children	Child age when language was assessed	Language measure	Area of language reported	Summary of language outcomes
Arcena et al. 2009	n=79	54% - 12 months old. 46% - 12 to 15 months old.	Psychomotor Development Scale (Rodriguez, Arancibia & Undurraga, 1974). *Child assessment*	Delayed language, normal language and superior language development.	Yes, improvements in language outcomes. A significant statistical difference found, with a higher frequency of superior language skills for children in the HVP group.
King et al. 2005	n=513	Between 36 and 40 months old	PLS-3 (Zimmerman, Steiner & Pond, 1992), *Child assessment*	Total Language Score	No improvements in language outcome observed. Mean PLS-3 score did not significantly differ between the control and intervention group. No significant difference was found between the children with severe language delay and any language delay across the HVP group or the control group.
Nair et al. 2003	n=161	6months, 12 months and 18 months	The REEL (Bzoch & League, 1971) *Parental assessment*	Receptive and expressive language ability	No improvements in language outcome observed.
Olds et al. 2002,	n=560	21 months,	PLS-3 (Zimmerman, et al. 1992) & PPVT-R (Dunn, 1981) *Child assessment*	21 months – delayed, normal or superior development.	At 21 months - Nurse visited children less likely to exhibit language delay and had superior average language development Vs control group; particularly those children born to women with low psychological resource.

Olds et al. 2004a	n=605	48 months	PLS-3 (Zimmerman, et al. 1992) *Child assessment*	48 months – Overall Language score based on the PLS assessment	At 48 months - No statistically significant language outcome for the paraprofessional visited group. Nurse visited children (born to low psychological resource mothers) had better language development.
Olds et al. 2014	n=518	72 months	PLS-3 (Zimmerman, et al. 1992) & PPVT-R (Dunn, 1981) *Child assessment*	72 months - Overall Language & Receptive language ability	At 72 months - No statistically significant language outcome for the paraprofessional visited group. Nurse visited children (born to low psychological resource mothers) had better receptive language scores averaged over 2, 4 and 6 years, although the difference at 72 months was not statistically significant.
Olds et al. 2004b	n=615	72 months	PPVT-III (Dunn, 1997) *Child assessment*	Receptive language	Yes, modest improvements in language outcomes.
Robling et al. 2016	12 months, n=1004; 18 months, n=975; 24 months, n=954	12 months, 18 months & 24 months old	Questionnaire & ELM (Coplan, Gleason, Ryan, Burke & Williams, 1982) *Parental and Child assessment*	Attainment of language milestones at 12 and 18 months (maternal report) and ELM assessment at 24 months	Yes, improvements in language outcomes. Significantly less developmental language concern in the HVP arm at 12 and 18 months. ELM scores at 24 months were significantly better for the HVP arm compared to the control arm.

Sierau et al. 2015	Not specified	12 months old and 24 months old	ELFRA 1 and 2 (Grimm & Doil, 2006) & The SETK-2 (Grimm, Aktas & Frevert, 2000) Parental *assessment*	Language development score	No differences in language outcomes were found.
Schwarz et al. 2012	n=269	33 months old	WPPSI-III (Gordon, 2004) *Child assessment*	Verbal and general Language score	No improvements in language outcome observed.
Tomlinson et al. 2016	n=939	36 months old	PPVT - adapted for South Africa (Dunn, 1965) *Child assessment*	*PPVT score*	Yes, improvements in language outcomes. Children in the HVP neighbourhoods had significantly better language development than children in the control neighbourhoods.

Why did some Home Visiting Programmes significantly improve children's language outcomes and others did not?

Frequency of home visits

The frequency of home visits varied across each of the HVPs. Home visits ranged from weekly visits to biannual visits. Furthermore, the frequency of home visits varied within programmes, with three programmes decreasing the frequency of home visits as the child got older (Robling et al. 2016; Sierau et al. 2015 and Tomlinson et al. 2016). Nearly all the studies provided an average number of home visits over the course of the intervention. However, it was often unclear if the visits were evenly spaced out over time, or whether visits were, at times clustered at certain time points (such as when the mother was in need of more support). Furthermore, within some studies, the range in the number of visits varied considerably. For example, Olds et al. (2002) reported that home visits ranged from 0 to 78 visits during the infancy stage for home visiting paraprofessionals, with an average of 16 home visits. In addition, Olds et al. (2004b) reported a range in visits from 0 – 71 over the course of the first two years of the child's life, with an average of 26 home visits. This sizable range in the frequency of home visits makes it very difficult to draw conclusions as to way in which frequency of home visits may have an affect the child's language development.

Duration of home visits

Over half of the studies (n=6) did not report the average duration of a home visit within their HVPs (Olds et al. 2002, 2004a and 2014; Olds et al. 2004b; King et al. 2005 and Sierau et al. 2015). It is unclear whether this information was not measured as part of the program evaluation, or whether this data was not included in the study paper. Of those that did report the average duration of a home visit, the time spent in the home varied considerably, with 15minutes being the shortest average duration (Schwarz et al. 2012) and

79.14 minutes being the longest average home visit duration (Robling et al. 2016). There was also considerable variation within HVPs. For example, Robling et al. (2016) reported that the duration of home visits ranged from half an hour to three hours, with the duration depending on what the clients support requirements were at the time of the visit.

The fact that six studies did not report the average duration of a home visit makes it difficult to draw firm conclusions about the role that this factor may play in children's language development. However, it is of note that the two studies that reported the longest average duration of home visits (Arcena et al. 2009 and Robling et al. 2016) both found positive outcomes for children's language development, whilst the shortest average duration of home visits (Schwarz et al. 2012) did not find an improvement in children's language. However, given the variation in the duration of a home visit within each study and the fact that no study analysed the impact on programme outcomes that the length of the duration of a home visit has, this pattern should be noted with caution. There may be a number of reasons as to why the duration of home visits may play a role in children's language development. A longer home visit is likely to help in the development of the rapport between mother and home visitor. Given that the women targeted by these programmes are vulnerable, building up a level of trust and confidence in the home visitor may help to facilitate the mother accepting and following the support and advice offered by the home visitor around maternal skills and supporting child development. It is questionable as to whether all the necessary information and support could be offered within a 15-minute home visit (Schwarz et al. 2012) as opposed to a home visit lasting an hour (Robling et al. 2016). Mothers and their children who receive longer home visits would also allow for the home visitor to offer more support and guidance to the mother with regards to caring for their child and aiding the child's development.

Child age when language was assessed

There was some variation in the ages at which the children's language abilities were measured. The youngest age at which children's language ability was measures was between the ages of 12 and15 months (Arcena et al. 2009), whilst Olds et al. (2014) and Olds et al. (2004b) measured children's language ability at 72 months of age. These two studies are of interest as they suggest that if HVPs do impact upon children's language development, then these differences can be measured relatively early within the child's life and that language skills can continue to develop ahead of the control group for several years into the child's life. A comparison of the programmes that did and did not make a difference to child language development reveals overall similarities in the time points when the measures were taken. It therefore appears that if HVPs do help to develop children's language, evidence of this would be apparent and measurable from an early stage.

Prenatal / Postnatal commencement of visits

Seven of the nine MVP's within this review began home visits prenatally. The two programs to commence home visits after the birth of the child were Nair et al. (2003) and Schwarz et al. (2012). All of the HPV's that had a positive impact on children's language outcomes began their home visits during the mothers pregnancy. Overall, five of the seven studies that began home visits prenatally reported positive impacts upon children's language development. In contrast, both of the studies that commenced their home visits after the child was born did not report an impact upon children's language development. There may be several reasons as to why a prenatal start to home visits aids children's language development. All the HVPs that improved children's language development stipulated in the programmes aims that one of their objectives was to have a positive impact upon the pregnancy outcome, through promoting healthy prenatal behaviours and thus improving foetal health. A healthy change in maternal behaviour during pregnancy (e.g. smoking

cessation) would likely have a positive impact upon foetal development that could improve postnatal outcomes. Furthermore, prenatal support may help promote the mother's early attachment to her baby that results in a closer relationship postpartum that fosters children's subsequent language development.

Measures used to assess children's language development

Across the eleven studies, nine different language assessment tools were used. Some studies used more than one assessment tool, as language was assessed at different times during the visiting process. The majority of studies used specific measures to assess children's language (Olds et al. 2002; Olds et al. 2004a and Olds et al. 2014; Olds et al 2014b; Robling et al. 2016; King et al. 2005; Tomlinson et al 2016; Nair et al. 2003 and Sierau et al. 2015). Only two studies (Arcena et al. 2009 and Schwarz et al. 2012) used more general child development measures that incorporated an assessment of language ability. Three of the studies used or partly used parental reports on child language (Nair et al. 2003; Robling et al. 2016 and Sierau et al. 2015). The remaining studies (including Robling et al. 2016) used direct child assessments. Analysis of this did not differentiate between the studies that had a positive impact on language and those that did not.

Utilising a range of language assessment tools has resulted in a range of different ways to measure children's language. For example, based on their assessment scores, Aracena et al. (2009), Olds et al.(2002) and Olds et al. (2004a) categorised children's language ability on three levels – delayed language, normal language and superior language ability. Olds et al. (2014) measured overall language scores and receptive language scores. Receptive language scores were also reported for Olds et al. (2004b), Tomlinson et al. (2016) and Nair et al. (2003). Mean length of utterance was the measure of language for Sierau et al. (2015), though the MLU scores were not reported in the paper, whilst a general language score was reported for King et al. (2005) and Schwarz et al. (2012). Robling et al. (2016)

assessed language ability through a parental questionnaire and via a face-to-face plus parental assessment, both of which assessed whether the child was reaching specific language milestones.

An analysis and comparison of the language assessments used and the methods by which these assessments are administered did not reveal a difference in the language outcomes between the studies. The wide variation in measures used and the range of language skills assessed and reported makes a comparison of the two groups of studies difficult.

Discussion

Using the inclusion criteria to screen the studies that emerged from the database search resulted in 11 empirical papers for inclusion in this review, two studies of which were long term follow-up studies. Therefore, a total of nine individual HVPs were found to have followed an randomised control trial design and met the inclusion criteria for this systematic review. Given the fact that the HVP model has been set up in countries all over the world, this review firstly found that children's language assessment is not a widely assessed outcome measured by these intervention programmes. This is somewhat surprising as language development is a vitally important developmental step for children. However, the challenges that present when assessing children's language, including identifying an appropriate language assessment measure are known (Dockrell, 2015) and may be a reason this domain of development appears to be often overlooked as an outcome.

Five of the nine individual HVPs included in this review reported a significant difference in the language development of the children whose mother received the intervention in comparison to the control group. This therefore gives grounds to suggest that HVPs do have the potential to enhance the language development of the children they

support. However, this review also makes it clear that not all HVPs make a difference to children's language development.

The variation in language development outcomes within this systematic review are consistent with the finding of Peacock et al. (2013), who examined a wide range of HVP outcomes, including child language development.

Though it is difficult to draw firm conclusions, it appears that the earlier a HVP engages and supports the mother (ideally during her pregnancy), the more likely the programme will be to have an impact upon the child's language development. Though conclusions are again difficult to draw given the variation of the studies, the fact that all the studies that found positive outcomes for language development began prenatally, whilst both studies that began postnatal failed to report a positive impact on children's language gives grounds to suggest services looking to implement HVPs should commence their visiting prenatally, as this might give the intervention the best chance to make a positive difference to children's language development (and potentially other domains of development). Though this is a tentative conclusion, it is one supported by Peacock et al. (2013) who concluded that HVPs that approach mothers prenatally achieved the greatest effectiveness overall. This conclusion also makes sense in light of some of the theories as to how children acquire language. For example, the Interactionist Theory of language acquisition (Bruner, 1983) states that children's learning of language is dependent upon a desire to communicate with the world and the social interaction we are able to experience. It therefore follows that if HVPs are able to engage mothers from a very early stage and facilitate an improvement in the quality and frequency in which mothers interact with their children (i.e. straight from birth), the increase in social interaction and verbal communication between mother and child will likely lead to an enhancement in the speed and ability of a child developing their language skills.

In addition, the fact that half the studies did not report the duration of the home visits within their programme makes it challenging to compare the impact of visit duration on the HVPs outcomes and therefore does not help services to calculate the 'dose' of visits required to make a positive impact on children's language.

One challenge when assessing language development is the array of language domains that can be measured. For example, language assessments can look at phonology, pragmatics, syntax, semantics and morphology (Yoshinaga-Itano, 1997). As a result, a wide range of language assessment tools have been developed, each one measuring one or more aspects of an individual's language capabilities. It is therefore unsurprising that across the eleven studies, nine different language assessment tools were used, each reporting similar or (more often) different aspects to language development. As a result, a degree of caution is needed when making direct comparisons between study outcomes.

Though all the included studies set out the frequency of the home visits, several studies did not indicate the average duration of home visits. In addition, no study carried out a statistical investigation into whether the length of home visits was associated with better outcomes, including child language development. This makes it difficult to determine the intensity of the home visit needed in order to achieve positive results for the mother and child. It was also noted that no study reported how closely the home visitors followed the programme model. This again makes it difficult to determine whether it was the programme model that led to improvements in child language outcomes, or whether it was other factors that made the difference. Future studies should aim to assess not only how frequent home visits take place, but also whether the length of the home visits and how closely the home visitor follows the programme model has an impact on outcomes.

Overall, this review is constrained by the articles that were retrieved through the database search. Though a twenty-eight year publication period was used as part of the search criteria, it is possible that relevant studies had been published before 1990 and were therefore not included in this review. In addition, studies included in this review were limited to those published in the English Language, therefore excluding potentially relevant studies written in other languages. It is possible that additional studies have been published within electronic databases not searched as part of this systematic review. However, a hand search of the reference lists of relevant studies was conducted in order to minimise this risk as far as possible. The findings and conclusions of this review need to be considered in light of the potential for publication bias, selective reporting within studies and the methodological limitations of the included studies. However, a quality assessment of each included study was conducted in order to identify all risks of bias.

One limitation as a result of the studies that were available for inclusion was that most stopped following children's development at 24 months (n=4) and at by 36 months, n=6 of the studies had no follow up on language development. Only two studies followed up beyond 36 months (Olds et al. 2014; and Olds et al 2004b) assessed language at 6 years of age. In order to understand whether the language improvements are maintained in the long term by the children within these programs, researchers need to continue monitoring and reporting the outcomes as the children's development continues.

Given that most HVPs target similar populations (vulnerable / socially at-risk mothers), the results and conclusions of this review will be generalizable to many existing and future HVPs. The fact that the target populations are similar in several ways across HVPs is a key strength to the research and development of these programmes and current and future HVPs should consult with the evidence base and look to add to it through their practice, both in terms of children's language development and wider outcomes.

Future HVPs should give a lot of consideration to how they expect the length of the home visits and the dose / duration of each visit to impact the programs outcomes. Though it was difficult to draw a firm conclusion, the trend of this review, added to the conclusions of other reviews (Peacock et al. 2013) suggests that identifying the most appropriate dose of visit is a vital component of the HVP model, not just for improving children's language development, but for ensuring the support offered by the HVP is sufficient and meeting the needs of the mothers and their children. Visits that are too short are unlikely to allow the home visitors to impart their knowledge to the mothers and are therefore perhaps unlikely to see the best possible outcomes, both in terms of the child's development and mothers outcomes. This is supported by a meta-analysis of HVPs by Nievar, Van Egeren and Pollard (2010) who concluded that the effectiveness of HVPs is primarily dependent upon the intensity and frequency of the services provided to the family. Further support for longer visits having a better outcome is provided by Gomby et al. (1999) and Holzer, Higgins, Bromfield, Richardson and Higgins (2006). Future commissioned services need to ensure their home visits are supported by the research in order to deliver a 'goldilocks' dose of visiting; not too long, not too short, but just right, so as to give the supported families the best opportunity to thrive.

The time at which these programmes first meet with the mother also appears to have an influence on the final outcome with regards to children's language development, with programmes starting postnatally having the least impact. Service commissioners should strongly consider home visitors meeting with the mothers during pregnancy, as it is possible that lifestyle changes and imparted knowledge at this stage has a significant impact on the child's development.

In conclusion, this systematic review set out to address an existing gap in the research literature by exploring whether HVPs have an impact on the language development of the

children of mothers supported by the programme. Whilst this review of the studies published in this area has shown that HVPs do have the potential to have a positive impact upon children's language development, it also demonstrates that not all HVPs target or measure children's language and amongst those that do, not all HVPs obtain success in this area of child development.

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Supplementary Gesture-speech production and children's language development: Assessing the outcomes of a Home Visiting Programme

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(See Appendix A)

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Abstract

Introduction: Research exploring young children's gesture production has shown a close association between children's gesture production and their language development. Several gesture types indicate when a child will soon transition to the next developmental language stage. Supplementary gesture-speech production both predates and predicts when a child will begin to use two-word utterances in their verbal communication (Iverson & Goldin Meadow, 2005).

Aim: This study explores supplementary gesture-speech production as a means of analysing the language development of children who were involved in one of the UK Governments programmes offering support to young, vulnerable mothers and their children. The Family Nurse Partnership (FNP) involves nurse home visiting that commences during pregnancy, to two years postpartum.

Method: A large scale randomised control trial of the Family nurse Partnership (FNP) program in England (Robling et al., 2016) explored the outcomes of an FNP trial. Analysis showed that language development of the children supported by FNP was significantly more developed than the usual care group. This sub-study involves a sample of the mothers and their child who were video-recorded engaging in three-minutes of free play during the 24 months assessment (n = 483). Videos were coded for children's gestures, with a particular focus on children's supplementary gesture-speech production. A comparison of supplementary gesture-speech production was conducted between the two groups of children, followed by analysis to explore the gestures association with children's Mean Length of Utterance. Finally, potential predictor variables of supplementary gesture were explored.

Results: No significant difference in supplementary gesture-speech production was found between the two groups of children. However, a significant positive association was found between children's supplementary gesture-speech production and their mean length of utterance score, suggesting that the many of the children's language development had not reached the supplementary gesture milestone yet. Finally, mother's age was found to be a predictor of children's supplementary gesture-speech production.

Conclusion: The study was unable to support the finding by Robling et al. (2016) with regards to differences in language development. However, the close association between

children’s mean length of utterance and supplementary gesture supports the research that gesture production and social circumstances play an important role as children’s language develops. Mother’s age as a predictor of supplementary gesture-production also reinforces the need to support societies most vulnerable mothers and their children.

Key words: Gesture; Language; Children; Home Visiting Program (HVP), Family Nurse Partnership

Introduction

Most parents find the birth of a child to be a life changing experience. For many, the transition into parenthood also presents numerous challenges. When that new parent is in their teens, those challenges can be exacerbated. Teenage mothers, particularly those in a low socioeconomic status (SES), often face a wide range of biopsychosocial risk factors such as a lack of social support, low self-esteem and financial challenges (Beck, 2001), all of which can impact upon their own personal wellbeing and that of their child.

To support young mothers living in vulnerable circumstances, a number of home based intervention programmes have been developed across the world (Tomlinson et al., 2016; Schwarz et al., 2012; Aracena et al., 2009). 'Home visiting' refers to an evidence-based strategy in which a professional or paraprofessional renders a service in a community or private home setting (Duffee, Mendelsohn, Kuo, Legano and Earls, 2017). These programmes are often aimed at supporting mothers on low incomes, with evidence suggesting that the approach can assist the family in several ways, such as supporting the child's mental development and behaviour (Caldera, Burrell, Rodriguez, Crowne, Rohde & Duggan, 2007), reducing the rates of child abuse and neglect (DuMont et al., 2008), and improving the uptake of childhood immunisations (Johnson, Howell and Molloy, 1993). Despite the positive results of individual studies, a wider look at the evidence base shows that outcomes for home visiting programmes (HVPs) are often mixed, with non-statistically significant outcomes being much more common than significant findings (Peacock, Konrad, Watson, Nickel and Muhajarine, 2013).

The Nurse Family Partnership (NFP) is a Home Visiting Program that was initially developed in America. Following successful evaluations (Olds, Henderson, Tatelbaum and Chamberlin, 1986, Kitzman et al., 1997; Olds et al., 2002), the model has been set up and

evaluated across America and in countries such as the Netherlands (Mejboubi et al., 2015) and in Germany (Sierau et al., 2016), where modest to good outcomes have been reported. The model was introduced in England in 2007 under the name of the Family Nurse Partnership (FNP), with the aim of offering at-home support to improve the outcomes for socially disadvantaged, first-time young mothers and their children. Delivered by specially trained family nurses, the core feature of the FNP is to provide an intensive series of home visits that begin prenatally and continue over the course of the child's first two years of life. The programme aims to reduce known associations between the young family and poor outcomes including social exclusion, child abuse and neglect, and diminished economic self-sufficiency. FNP also aims to promote sensitive and competent care giving whilst educating the mother about child development, modelling sensitive parent-child interaction, and providing guidance on how the mother might access appropriate childcare (Robling et al., 2016).

Research by Robling et al., (2016) set out to analyse the outcomes of the FNP program in England. The focus of the study was on mother and child outcomes, with data collected during the intervention period and throughout the study, up until the child reached 24 months of age. In contrast to other reviews of the FNP model, Robling et al., (2016) found that nearly all the outcomes for the mothers and children supported by the FNP were not significantly different to the outcomes of the control group who had received care as usual through the local maternity service. The one outcome where a significant difference was found was children's language development. Each child was assessed at 24 months of age using the Early Language Milestone (ELM) scale (Coplan, Gleason, Ryan, Burke and Williams, 1982); a part assessment, part maternal report measure of language ability. Analysis of the results showed that children who had been supported by the FNP had significantly better language development than their peers within the control group.

This outcome is an important finding, given that studies have negatively associated long-term poverty and low socioeconomic status with a range of mental health, physical health and educational adverse outcomes (Engle and Black, 2008). One of the most consistent developmental processes found to be impacted by low socioeconomic status concerns children's language processing skills, including vocabulary, phonological awareness and syntax at many different stages of development (Hoff and Tian, 2005; Noble, McCandliss and Farah, 2007). Roy, Chiat and Dodd (2014) found that, in comparison to preschool children whose parents or carers were from a mid-range socio-economic status and employed, preschool children whose parents or carers were from a low socioeconomic status and underemployed scored significantly lower on standardised measures of core language processes. As a result of this and other research that has highlighted the significant 'word gap' in children's language between socio-economic classes, the UK government plans to spend millions of pounds on a scheme to offer support to parents and carers, in an attempt to improve the language, vocabulary and social skills of children across the UK social spectrum (Department for Education, 2017).

Children's advances in their language skills are an important developmental step as language skills often lay the groundwork for other cognitive and social tasks (Goldin-Meadow et al., 2014). A delay in this developmental process at a young age, has been found to be negatively associated with children's social development and can be a predictor of their future academic ability. For example, pre-schoolers who lack clear language skills experience trouble communicating their ideas in an effective manner and have more difficulty sustaining sessions of play with their peers (Gertner, Rice and Hadley, 1994). These children have also been found to be at increased risk of academic under-achievement (Anderson and Freebody, 1981). In addition, a child's ability at 30 months of age to use language for decontextualized talk (describing the "there and then", as opposed to the "here and now") has been found to

predict seventh-grade academic language proficiency at 12 years of age (Uccelli et al., 2018). Language skill opens up opportunities for the individual and the timing of this developmental process appears to have a significant impact upon other developmental processes within that child's life. The strong link between early language development and later-life outcomes has led to calls in the UK for early language skills to be prioritised as a child wellbeing indicator (Johnson and Kossykh, 2008; Field, 2010; Save the Children, 2012).

There are many different ways in which children's language development can be assessed. Formal measures can focus on a range of child language capabilities, such as the child's understanding and expression of language (Adams, Coke, Crutchley, Hesketh and Reeves, 2001), their syntactic structures (Armstrong and Ainley, 2007), their Mean Length of Utterance or MLU (Rice et al., 2010) and their word knowledge (Wiig and Second, 1991). A wealth of research has also explored how children's gestures develop in line with children's language ability (Nicoladis, Mayberry and Genesee, 1999; Özçalişkan and Goldin-Measow, 2009; Özçalişkan and Goldin-Meadow, 2010; Iverson and Braddock, 2011), with research demonstrating that changes in gesture not only predate, but also predict changes in language (Iverson and Goldin-Meadow, 2005).

Young children use gestures to communicate before they are able to use language (Acredolo and Goodwin, 1985; Özçalişkan and Goldin-Measow, 2005). Infants will typically produce their first gestures between 9 and 12 months of age, using pointing gestures to indicate objects and people within their immediate environment (Bates, 1976; Bates et al., 1979). At this early stage in development, these gestures are almost always produced without speech and are instead often accompanied by meaningless vocalisations (Özçalişkan and Goldin-Meadow, 2005). The production of these first gestures signal advances in children's cognitive processes, particularly in relation to their language production. For example, lexical

items for objects to which a child points are soon found in that child's verbal repertoire (Iverson et al., 2005).

At early stages of language learning (14-22 months), gesture is negatively related to speech, with gestures compensating for limitations in spoken language skills (Özçalışkan and Goldin-Meadow, 2009). As language develops, so does children's use of gesture, with children beginning to combine gesture and speech in their communication. Initially, children's gestures help to convey information that reinforces the information conveyed within their accompanying speech (for example, saying "dog" and pointing at a dog). This is a referred to as a complementary gesture-speech combination (Iverson et al., 2011). However, it is the child's production of supplementary gesture-speech combinations that researchers have found to be of particular interest when examining children's language development. Supplementary gesture-speech combinations (e.g. pointing at a hat, yet saying a word for a different object - "Daddy"; "Daddy's hat") has been found to predict the onset of a significant language developmental milestone; two-word utterances (Goldin-Meadow and Butcher, 2003). Between the ages of 14 – 34 months of age, children have been found to rely on gestures, including supplementary gesture in order to produce particular constructions (Özçalışkan and Goldin-Meadow, 2009). As children's linguistic ability develops, so does their use of gesture, with supplementary gesture being used in gesture-speech communication to convey two different units of construction, before being able to produce the construction entirely in speech. Supplementary gesture is the child's first demonstration of an emerging ability to convey sentence like information in a single communicative act. Once this construction is established in their repertoire, children begin using speech over gesture as their preferred means of communication.

The Current Study

This study sets out to explore children's use of supplementary gesture-speech combinations using a substantial sample of children who had formed part of Robling et al. (2016) study. Given that the Early Language Milestone (ELM) score partly relied upon maternal reports of their children's language ability, the evidence base around supplementary gesture supports its use as an objective, yet indirect gauge of children's language development. It is hypothesised that based on their advanced language scores (relative to the care as usual group) on the ELM scale, children who had been supported by the FNP would produce more supplementary gestures than the children who received usual care, thus indicating that they have reached an advanced language milestone. In addition, if children within the FNP intervention group have moved beyond the supplementary gesture stage and are increasingly using spoken language to communicate, a negative association between supplementary gesture production and the children's mean length of utterance (MLU) score (Brown, 1973) would be expected. Finally, given that specific gestures have been shown to be associated with children's language development (Özçalışkan & Goldin-Meadow, 2009), this study will explore known predictors of child language development in order to identify potential predictors of children's supplementary gesture production. The rationale for each of these predictors is as follows:

Mother's age: Children born to young mothers have been found to perform more poorly than their counterparts born to older mothers on assessments of expressive language and language comprehension (Keown, Woodward, & Field, 2001). This relationship between the mother's age and their child's language outcomes is accounted for by the level of maternal verbal stimulation. Sutcliffe et al., (2012), have also found children's language development scores to be associated with improvements with increasing maternal age.

Socio-economic status (including whether the mother is in education, employment or training at 24months, and deprivation score): There is a strong social link between the speech and language developmental abilities of children and the level of social disadvantage that the child grows up in (Dockrell, Lindsay, Law & Roulstone, 2015; Waldfogel & Washbrook, 2010).

Relationship status to child's father. Non-resident father involvement has been shown to be associated with better child outcomes in the preschool years (Jackson, Choi, & Franke, 2009).

Post Natal Depression (PND): Symptoms of maternal depression in the year following the child's birth have been shown to be associated with poorer child language at 36 months. However, maternal depressive symptomology at 36 months was not associated. This association was accounted for by mothers with PND providing a poorer level of child caregiving, which in turn was moderated by socioeconomic factors (Stein, Malmberg, Sylva, Barnes, & Leach, 2008).

Number of cigarettes in antenatal period: The effects of antenatal tobacco smoke exposure on the cognitive development of the child is well researched. Studies have drawn links between antenatal cigarette smoking and the negative impact it can have upon children's language development (Fried, Watkinson & Siegel, 1997; McCartney, Fried & Watkinson, 1994; Lewis et al., 2007).

Gestation at delivery and birthweight: Language ability has been found to be lower in children who were born very preterm and with a very low birth weight (very preterm, < 32 weeks gestational age; very low birth weight, <1500g). These delays have been found to extend into the preschool years (Barre, Morgan, Doyle, & Anderson, 2011).

Child Gender: Girls have been shown to demonstrate superior linguistic skills over boys during the early years of their development (Bauer, Goldfield & Reznick, 2002); Bouchard, Trudeau, Sutton, & Boudreault, 2009).

Method

Participants

The data used in this study was originally collected for research investigating the outcomes of the FNP home visiting program (Robling et al., 2016). Of the 1645 mothers who took part in the investigation, 808 were randomly allocated to the intervention arm and received home based visits from the FNP nurse during their pregnancy and during the two years following the child's birth. The 810 participants within the control arm received care as usual from the local NHS maternity services, in line with usual care practice. Women recruited to the study were nulliparous and aged 19 or under. All women within the study lived within the catchment area of a local Family Nurse Partnership team. Further details relating to the inclusion and exclusion criteria have been set out by Robling et al., (2016).

Of the mothers who took part in the original study, 483 consented to their family nurse video recording them engaging in free play with their child. Figure 1 shows the process of randomising study participants and the data collection time points. This group of mothers and their children will be referred to as the BABBLE subsample. In comparison to the mother-child dyads within the original (non-BABBLE) sample, those within the BABBLE sample who received input from the FNP were found to have had more home visits and more antenatal visits than those within the original sample. In addition, the BABBLE sample at baseline had fewer participants of a black background; had mothers with fewer qualifications

and included more families where only English was spoken within the home (see appendix D).

The BABBLE sample comprised of n=246 mother-child dyads who had received FNP support and n=237 mother child dyads who had received care as usual. As previously mentioned, Robling et al., (2016) reported that those children who received FNP support were found to have better language scores (as measured with the ELM) during the 24-month assessment, in comparison to the control group. Analysis of the ELM scores within the BABBLE sample showed similar trial arm differences to those found in the original study (Robling et al., 2016), adjusted difference in means (adjusted by minimisation variables and by site, linear regression) =4.01, 95% CI(-1.57 to 9.58), p=0.15, Cohen's d=0.16 (d=0.14 in full sample) . The findings in the BABBLE sample and that of Robling et al., (2016) are therefore representative.

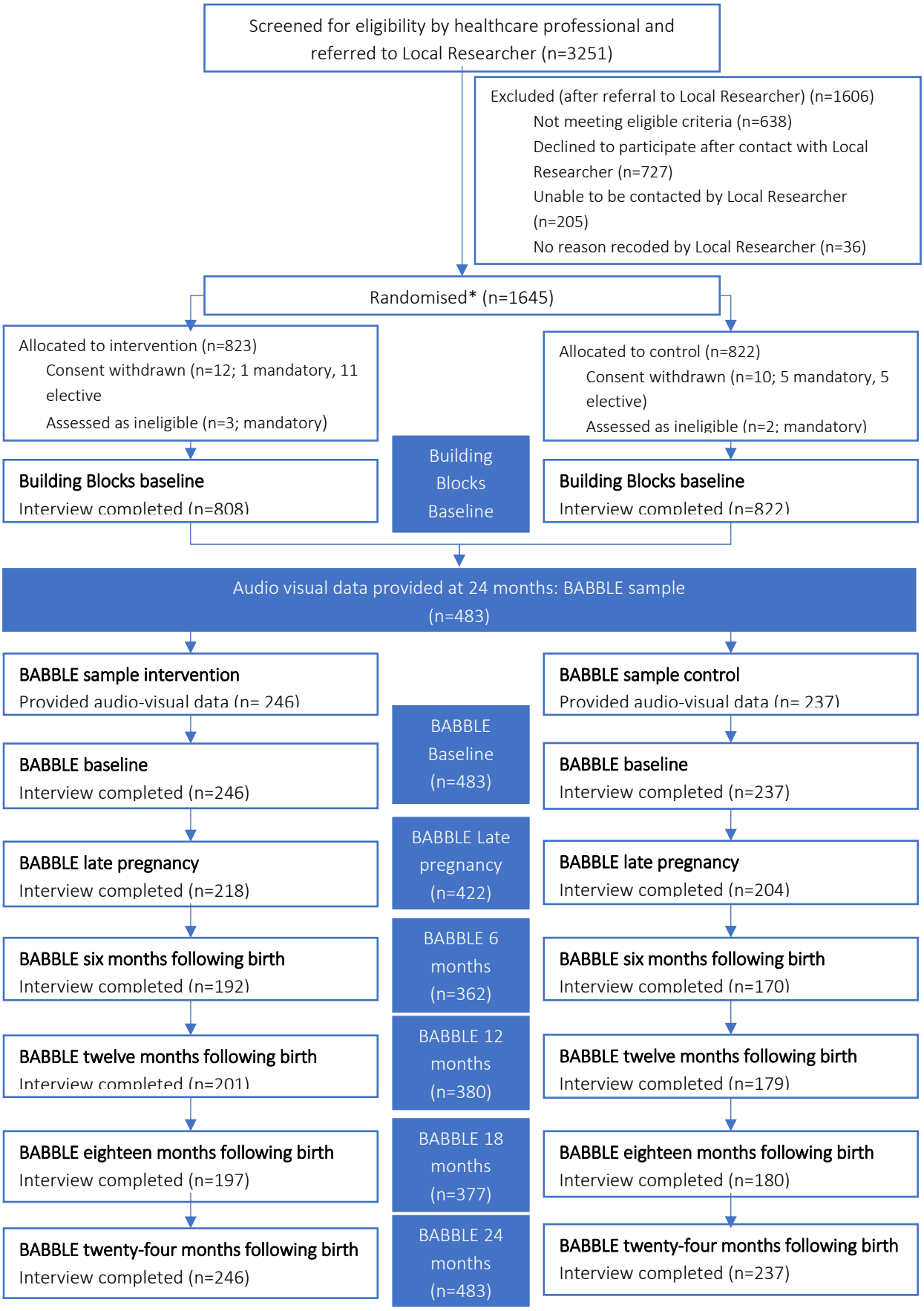

Figure 1. Building Blocks to BABBLE sample, with flow chart of available self-report data

Procedure

The data reported in this study came from the analysis of video recordings taken within the family home when the child was 24 months old. The video recordings were originally conducted in order to observe maternal sensitivity and all were three minutes in length. In each recording, the mother and the child engaged in free play, with the nurse providing the mother-child dyad a selection of toys to play with in order to record the pair's engagement. These toys included a book, building blocks, a soft toy and a wind-up toy car. The mother was asked to interact with their child as they typically would and to ignore the presence of the nurse holding the video camera. The mother-child dyad could play with the toys provided or they could play with the child's own toys if they wished.

Data transcription and coding

Child vocalisation transcription and coding – Using a bespoke transcription coding form, each child's meaningful speech was transcribed verbatim from the video recordings by trained research assistants who were blind to the trial arm. The coding form was divided into five-second segments, up to three minutes in length. Each child vocalisation was transcribed within the corresponding 5 second segment. All meaningful speech produced by the child was transcribed (e.g. "biscuit", "smile", "cow"). As in research of a similar nature, onomatopoeic sounds (e.g. "quack", "moo moo") and interjection words ("ooh", "shh") were also transcribed as meaningful words (Rowe, 2008; Sauer, Levine, and Goldin-Meadow, 2010). Child speech that was an imitation of their mother's speech was also coded. The child vocalisations were then copied to a similarly structured form in which to code the corresponding gestures made by each child during the corresponding recording.

Gesture coding – Coding the children's gesture was undertaken by a researcher who was blind to the trial arm the child in each video had been assigned. Each gesture was coded on a bespoke gesture coding form designed for this study (see appendix E).

Gestures were coded into one of three classifications in accordance to a gesture coding manual devised for the purpose of this research (see appendix F). The identifying features of each gesture followed those set out within previous studies (Nicoladis, Mayberry and Genesee,1999, Özçalışkan and Goldin-Meadow, 2005; Özçalışkan and Goldin-Meadow, 2009), thus assisting in a continuity within the area of research into child gesture. The coded gestures were 1) 'Deictic gestures' - gestures that direct attention towards physical objects, people or locations. For example, a child might point their finger at a flower in order to refer to the flower, or hold up and show their caregiver a teddy in order to make reference to the teddy. 2) 'Conventional gestures' - gestures where their form and their meaning were culturally recognisable (e.g., nodding the head to gesture "yes"; waving their hand to gesture hello). 3) 'Iconic gestures' - gestures whereby the child used their hands and / or body to depict the attributes, behaviour or the actions of an object. For example, a child could stretch out their arms to imitate an airplane, or curl all their fingers to pretend to be like a tiger's claw.

Potential gestures were not coded if the child's hand movements involved direct manipulation of an object (e.g. shaking a rattle). If the hand movement was part of a ritualised game (e.g. pat-a-cake), the hand movement was not coded as a gesture as it was difficult to determine whether the action was communicative. If, however a child was holding an object whilst they made a gesture (e.g. holding a teddy whilst pointing at the TV), the gesture itself was coded accordingly.

In addition to being coded as a gesture accompanying speech, deictic gestures were also used as a general indicator as to how prevalent gesture production was amongst the total sample of children, given the relatively brief three-minute window the video allowed into the child's life. Deictic gestures are the earliest and most basic form of gesture that children produce and are frequently used by children as they learn to communicate with the world

around them. It was therefore accepted by the research team that if it were found that this gesture was observed being made by a majority of children across the sample, this would demonstrate that the children were capable of producing gestures during the brief three minutes of observation.

Each observed gesture was further coded if it was accompanying intelligible words spoken by the child (e.g. the child points at a doll and say "baby"). These gesture-speech combinations were coded in relation to whether the act of communication satisfied the description of a supplementary gesture, as set out in the coding manual. A supplementary gesture was coded when the gesture added additional information to the message conveyed through the child's speech (e.g. the child points at a banana and says the word "hungry").

Reliability

Reliability was assessed on a subset of the recorded mother-child interactions by an independent coder. The reliability between coders for deictic gesture was κ =.93; n=75; for complementary gesture κ =.90; n=75; for iconic gesture κ =.89; n=75 and for supplementary gesture-speech production κ =.80; n=75.

Results

To begin, a general overview of the whole cohorts use of gesture will be analysed, including deictic gesture as an indicator of overall gesture production. Following this, children's use of supplementary gesture was analysed in several different. Firstly, to investigate the whether there was a difference in the production of this gesture between the two groups. Secondly, analysis compared how the gesture was associated with the children's MLU scores and other data variables. Finally, selected variables available to the researchers

with regard to the family demographics will be analysed to determine whether any of the chosen variables acts as a predictor for child supplementary gesture production.

Whole sample descriptive data for gesture production

As illustrated in Table 1, analysis of the children's production of deictic gesture showed that this gesture was produced by 59.2% (n=282, M=2.14, SD=3.56) of the children across the entire BABBLE sample during the course of the three-minute video. In contrast, conventional gestures were produced by 29.6% of the children (n=141, M =0.57, SD=1.24) and iconic gestures were produced by 4.2% of the children (n=20, M=0.08, SD=0.47). Supplementary gesture-speech combinations were observed for 18.3% of the children (n = 87, M = 0.38, SD = 1.14).

Table 1

Total frequency of gesture production by type

Gesture	Number of children producing gesture (%)	Range	Mean	SD
Deictic	275 (57.8%)	0-34	1.88	3.18
Iconic	18 (3.8%)	0-5	0.07	0.45
Conventional	131 (27.5%)	0-15	0.54	1.21
Supplementary	87 (18.3%)	0-11	0.38	1.14

NB: The descriptive data in the above table is based on raw scores

Supplementary gesture production between trial arms

Between trial arm production of supplementary gesture was analysed. Within the FNP group, 44/243 (18.1%) of the children produced a supplementary gesture. Within the usual care group, 43/233 (18.5%) produced a supplementary gesture. Given the low frequency

count for supplementary gesture, the production of this gesture was dichotomised to compare the difference in the number of children who produced this gesture between trial arms.

A logistic regression analysis was used with minimisation variables (gestation, smoking status at recruitment, and first / preferred language) entered into the first step, and the trial arm entered at the second step. The overall model was found not to be significant for supplementary gesture χ^2 (4) = 1.64, p = 0.80, Nagelkerke R square = 0.01, and trial arm did not represent a significant step in the model χ^2 (1) = 0.01, p = 0.92, see Table 2.

Table 2

Differences in supplementary gesture between trial arms

	Adjusted* OR	95% CI for OR	p-value
Usual care	Reference		
Intervention	0.97	0.61 to 1.55	0.92

Note. *Analysis adjusted for minimisation variables (gestational age and smoking status at recruitment, and first or preferred language).

Supplementary Gesture and language development

The association between supplementary gesture production and the children's MLU score was analysed in order to determine the relationship between supplementary gesture and the child's expressive language development. A significant positive association was found between production of supplementary gesture the children's and MLU score at 24 months of age (r = .244, p< .001). That is, across the whole sample of children, the higher the child's MLU score, the more likely they were to produce a supplementary gesture-speech combination. Conversely, the less the children spoke, the less likely they were to produce a supplementary gesture-speech combination.

Predictors of Supplementary Gesture: Univariable analysis

Robling et al., (2016) collected a wide range of variables on the mother participants. Relevant variables were analysed in order to determine whether any would be found to be predictors for the children's production of supplementary gesture. These can be seen in Table 3.

Table 3

Univariable analysis of predictor variables for supplementary gesture

Predictor Variable*	**OR**	**95% CI for OR**	**p-value**
Mother Age	1.23	1.01 to 1.50	0.04
In Education Employment Training at 24 months			
No	Reference		
Yes	1.53	0.95 to 2.45	0.08
Relationship status to child's father at 24 months			
Not in any relationship	Reference		
Married	0.72	0.15 to 3.39	0.68
Separated	0.89	0.28 to 2.83	0.84
Closely involved / boyfriend	1.08	0.61 to 1.89	0.80
Just friends	1.15	0.58 to 2.27	0.69
Deprivation score	0.99	0.98 to 1.01	0.28
Post Natal Depression at 6 months	1.03	0.98 to 1.08	0.32
Number of cigarettes in antenatal period	0.98	0.94 to 1.03	0.44
Recalculate the gestation delivery – weeks	1.09	0.95 to 1.26	0.23
Weight of the baby	1.00	1.00 to 1.00	0.10
Baby gender			
Male	Reference		
Female	0.76	0.48 to 1.22	0.25

Note * All predictor variables were entered into models on the univariable level in a single step.

Table 3 shows that mothers age (p<0.05) was found to be a predictor of children's production of supplementary gesture. No other variable was found to predict this gesture to a level of statistical significance.

Discussion

This study compared the production of supplementary gesture amongst a sample of n=483 children, n=246 of whom has received support from the FNP, whilst n=237 children had been allocated to receive care as usual. This study also explored the associations between supplementary gesture production and children's MLU score, based on the video transcripts. Finally, predictors of supplementary gesture production were analysed.

Gesture production

Analysis of the children's production of deictic gesture showed that 59.2% of the children made this gesture at least once during the video recording. The relatively high proportion of children producing a deictic gesture instilled a good degree of confidence that the children were producing gestures (at the basic level of gesture communication at the very least) within this short time period for observation. Deictic gestures are the first form of meaningful gestures to typically emerge amongst very young children. They precede spoken words and play an important role in word learning (Özçalişkan, Gentner and Goldin-Meadow, 2014), which is likely to be the reason behind this gesture type being the most frequently observed.

Supplementary gesture production across trial arms

When the production of supplementary gesture was compared across the trial arms, no significant difference was found between those children who received FNP support and those who received care as usual. As no significant difference was found between the two trial

arms, and therefore the groups appear very similar in terms of their gesture development, this study is unable to support the findings of Robling et al (2016).

A look at the data reveals that children across the entire sample did not routinely produce supplementary gestures during their recorded interaction with their mother. To help understand this outcome, research by Özçalışkan and Goldin-Meadow (2009) has shown that at around the age of 14 months old, children are typically using a variety of linguistic constructions that combine both gesture and speech, including the use of supplementary gesture. Children's use of supplementary gesture steadily increases over the coming months, peaking in use at around the age of 26 old. From this age, speech becomes children's preferred modality of communication, therefore leading to a decline in children's use of supplementary gesture. This preference of using speech over gesture + speech continues as children continue to develop their language skills. This research therefore suggests two potential explanations for the outcome of this study in relation to the children's language development: 1) Children across the sample had not yet reached the developmental stage of using supplementary gesture. 2) Children across the sample had developed their language skills beyond the stage of needing to use supplementary gesture in their communication and were therefore using speech as their preferred method of interaction. Both these explanations offer an understanding of the low frequency count of supplementary gesture observed across the sample, based on the research behind the use of this gesture. In order to identify which account might best explain the supplementary gesture outcome and therefore provide an understanding of the stage of language development across the whole of the sample, the association between supplementary gesture and the children's MLU score across the whole sample was analysed. This showed that there was a significant, positive correlation between children's supplementary gesture production and their MLU score. That is, the more a child communicated verbally, the more likely they were to produce a supplementary gesture-

speech combination. This outcome is perhaps better interpreted in the reverse. That is, the less a child used words in their communication, the less likely they were to produce a supplementary gesture. Had the children progressed beyond using supplementary gestures in their communication, we would have expected a negative association between supplementary gesture and MLU as the children would be using their words more than their supplementary gestures. However, this appears not to be the case. Therefore, this outcome suggests that the majority of children across this sample had not yet reached the supplementary stage of gesture language development.

To understand why the majority of children might not have yet reached this stage, it is important to consider the demographic of children within the study, all of whom were born to young mothers living in low socioeconomic communities. Research has shown that the language development of children born within these circumstances tends to be lower, compared to their peers (Arriaga, Fenson, Cronan and Pethick, 1998; Huttenlocher, Vasilyeva, Cymerman and Levine, 2002; Rescorla and Alley 2001). Therefore, although the children who received FNP support scored higher on the ELM assessment, their demographic circumstances may mean that their gesture development is not at the level as might be expected of more typical population. As a result, no difference between the two groups was observed.

A second possibility is that although the number of deictic gestures demonstrated that gestures were amply produced during the three-minute video, this time scale may not have been long enough to observe a large quantity of supplementary gestures. Studies such as Iverson et al. (2005) have recoded children gesture production at different time points, with each video recording being 30 minutes long. It is possible that longer recordings would have allowed for more supplementary gestures to be produced and coded.

A further possible explanation is that as the recordings were filmed in a naturalistic setting, with the children allowed to do as they wished. There was no control, task, test or influence over the children's actions. Though this methodological approach has many strengths, it does limit the researcher to only being able to code what they see spontaneously occur on screen. These are all considerations that future research should be mindful of with regards to future studies of a similar nature.

Predictors of supplementary gesture

A second significant finding of this study was that mothers age was a predictor of children's supplementary gesture production. This therefore suggests that the younger the mother, the less developed the child's language. This outcome supports the findings of other research that have concluded that children born to teenage mothers are at increased risk of language development delay. Additionally, this finding adds to the understanding that the children of the youngest mothers are at the biggest risk (Keown, Woodward and Field, 2001) and that supplementary gesture production / observation might be a useful tool for practitioners working within this field to be aware of. This outcome also reinforces the need for young mothers and their children to be given the support needed to ensure that the circumstances they find themselves has as little negative impact on both as possible and that the mother is given the support to be the best parent she can be to her child. Support could include teaching the mother how to recognise their child's gestures and respond in a mind-minded way so as to help the child's language develop and enhance the mother's maternal responsiveness.

Conclusion

In conclusion, the use of supplementary gesture as a means of exploring children's language development was unable to support the findings of Robling et al., (2016), who found a significant difference in the language abilities between the children who received

HVP support and the control group. Supplementary gesture analysis suggests that there was no difference between the two groups language ability and that the BABBLE sample as a whole had not yet reached the supplementary gesture developmental milestone, based on the gestures association with the children's MLU score. However, it is necessary to remember that supplementary gesture production is not a validated language assessment measure, so caution needs to be taken when interpreting these results. However, the study raises the potential as to how supplementary gesture, when associated with children's language score has the potential to be a useful tool when working in the field of children's language development. Finally, the research finding that children born to the young mothers are at an increased likelihood of experiencing language delay further raises the importance that both mother and child are given the support they need in order to overcome the challenges they face.

Recommendations

As this study was unable to support the language findings of Robling et al., (2016), further research on the long term influence the program may have had on the children's language development is needed. Current and future HVPs should consider targeting children's language development as an important developmental process.

This study recommends that developmental gesture awareness and recognition should form part of the training for professionals working in the field of child language. Studies should also seek to further explore the potential that supplementary gesture and other developmental gestures such as iconic, have in helping assess language development of preschool children.

Limitations

This study has several limitations which need to be taken into consideration when interpreting these results. As previously stated, the video recordings on which the gestures

were observed were originally recorded for the purpose of observing parent child interactions such as maternal sensitivity and child responsiveness (Robling et al., 2016), not gesture. As part of the recording, the children were given a number of toys to play with, which at times resulted in the child's hands being occupied with these items. This may therefore have had an impact upon the total number of gestures the children produced. However, children in both trial arms were given the same toys to interact with, so this limitation potentially impacted both trial arms. In addition, each video recording lasted for three minutes and though this short time period allowed for the observation of many communicative gestures, a longer time period would likely have produced more gestures for analysis.

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Critical Evaluation

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Introduction

The following commentary provides a contextual overview and critical evaluation of both the systematic review and empirical paper. The commentary will provide considered reflections on the processes and decisions made at each step of the research process, as well as implications for clinical practice, future research and plans for dissemination. The final stage of this report provides an overall reflection on the research process relating to both personal and professional development.

Do Home Visiting Programmes improve children's language development? A systematic review

The area of research

In the process of developing a question for my systematic review, my thoughts were guided by my empirical study. This presented three potential areas to focus on; Home Visiting Programs (HVPs), children's language development and gesture. A review of the literature across these topics showed that a large number of studies had been conducted exploring the effectiveness of HVPs across a wide range of areas. This was not surprising as the HVP model of family and child support has been around for several decades, has been implemented across several countries around the world and has received a significant amount of funding. As a result, I came across several systematic reviews that have looked at the outcomes of HVPs, from broad reviews (Peacock, Konrad, Watson, Nickel & Muhajarine, 2013), to systematic reviews of a more specific nature (Stamuli, Richardson, Duffy, Robling & Hood., 2015; Avellar & Supplee., 2013; Bilukha et al., 2005; Hadian, Mirghafourvand, Mohammad-Alizadeh Charandabi, Ghanbari, Nahaeii & Meedya., 2018). However, it was apparent that there was a gap in the literature where no systematic review had been conducted to look specifically at whether the HVP model supports children's language development.

This therefore became the focus of the systematic review and combined two of the three research topics I had outlined – HVPs and children's language development.

The rationale as to why HVPs might have a positive influence on child language development is as follows. Although HVPs often vary in several ways, their broad aim is to help support the mother to become the best parent she can be, to help the mother herself with difficulties she might be experiencing in her life and to help the child's development. If these programmes are able to help educate and develop the mothers parenting practices, help the mother become more aware of how they can support their child's development and potentially develop the attachment between the mother and child, then a consequence of this might be that the child's language skills and development are seen to improve as a result.

Systematic Review Guidelines

To support the write up of this systematic review, I followed the guidelines set out by Boland, Cherry & Dickson (2017). This guide, along with the PRISMA statement (Moher, Liberati, Tetzlaff, Altman & Prisma Group., 2009), were key to helping me follow a formulaic approach when carrying out the step by step process, whilst helping to structure my write up. In addition, using the PICO process helped to frame and answer my systematic review question.

Literature search

Four databases were searched in order to identify the articles relevant for this review. Following a review of systematic reviews that have focussed on HVPs and a consultation with a librarian, specialising in systematic review searches, the targeted databases were Embase, Medline, Psychinfo and Emcare. Furthermore, these databases were selected as they included journals with a focus on interventions led by nurses and other healthcare professionals, and were likely to result in published papers relevant to the systematic review topic.

The search terms for these databases were identified through an examination of several published systematic reviews that have focussed on HVPs. A consultation with the librarian then helped to adjust the search terms in order to comply with the search strategies for each database. This helped to identify the variance in the search term wording required to ensure the most effective search was conducted. The terms were chosen in order to identify children (child* OR exp/infant OR baby OR babies OR preschool), language (language OR speech OR word* OR vocab*), home visiting (home visit* OR house call OR home intervention OR home based), low socioeconomic status (low SES OR low socioeconomic OR poor fami* OR poverty OR disadvantaged) and women who were pregnant (pregnant OR post partum OR prenatal OR neonatal OR perinatal OR mother*). As the review was focussing on children's language outcome, the initial database search did not include variations on the word 'pregnancy'. However, having screened the database search results, this search criteria was then included and combined with the initial search terms, and the search re-run. This resulted in a more targeted database search for HVPs that work with pregnant women or mothers, thus making the results more applicable to answering the research question.

A Microsoft Excel database was created by myself to manage and sort through the database search results. Microsoft Excel was chosen over software programs such as Mendeley as I felt more confident in using Microsoft Excel to organise and separate out those papers I deemed relevant and not relevant to my research question. One difficulty that this presented however was that duplicate papers were not automatically removed, which meant that working through all the papers identified through the database search took a considerable amount of time.

Inclusion and exclusion Criteria

In order to ensure that the papers selected for my systematic review would help address my research question, several inclusion and exclusion criteria were established. These criteria played a vital role as a reference tool when sorting through the database search results. The inclusion criteria for my systematic review was as follows, along with the reasons for this parameter:

1) *The study involved an evaluation of a home visiting programme delivered by healthcare professionals or paraprofessionals:* Home visiting was the target intervention of this review and so ensuring studies focussed around this form of intervention was vital.

2) *The study used a randomised control trial design*: Randomised control trials (RCT) are seen as the gold standard in research. Therefore, ensuring that only studies that followed an RCT design provided an extra degree of confidence in the findings of the systematic review.

3) *The study population was pregnant women or women supported by a home visiting programme that began within the first three months of the birth of their child*: Home visiting programmes can begin at various stages of a child's early life. However, limiting the included studies to those that start either during pregnancy or very soon after the child is born, reduces the chances that differences in the children's language development is down to other factors in the child's life that might play a role as they get older.

4) The women involved were defined as living in social deprivation, were on a low income, or were defined as being socially at risk: The majority of HVPs target women of this demographic. This inclusion criteria ensures that the sample is homogenous in terms of their socio-economic circumstances. In addition, this was seen as important in relation to the development aspect of the systematic review as socio-economic circumstances have been shown to be correlated with children's language development, with children from lower

socio-economic status' having less developed language skills than their higher socio-economic peers (Law et al., 2011). By ensuring that all the HVPs targeted families of a similar socio-economic background, this removed this risk of bias from the study.

5) The study involved an assessment and reported the outcomes with regards to the child's language development following a period of home intervention support: As previously mentioned, many studies on HVPs have been conducted and have focussed on a range of outcomes. As this systematic review was focussed on the language development of children, it was therefore essential that the study involved an assessment of the children's language following the home visiting period.

6) Home visiting was the primary service delivery strategy. This inclusion criteria ensured that it was the HVP that was having the impact on the children's language development and not another intervention that the family had been offered alongside the home visits. This inclusion criteria excluded some models of support that included home visiting, but also involved community based support to the young family, such as the Flying Start programme in Wales.

Due to a lack of access to translation services, articles were excluded if they were not published in English. In addition, articles were excluded if they were published before 1990. This decision was taken as I wanted to include studies that were relatively recent, but also provided enough of a time period for a large enough sample of studies and potential follow up studies to meet the inclusion criteria. In a review of the literature, discussion with my research supervisors and consultation with the systematic review librarian, the cut-off date of 1990 was agreed.

Quality assessment

Choosing a quality assessment tool took longer than I had anticipated. The quality appraisal process is an important part of the systematic review process and there are many different tools to choose from. Several tools were considered, such as the Critical Skills Appraisal Program (CASP), though I decided to select the Cochrane Risk of Bias Tool (Higgins et al. 2011). This tool was selected as it was user friendly, has been widely used in systematic reviews that focus on randomised control trials and was accompanied by an informative guide for each category when judging the risk of bias. In addition, the Cochrance Risk of Bias tool has been used in a systematic review exploring home visiting programmes, providing a good assessment of each study involved (Hadian et al. 2018). One limitation of the tool was the time it took to complete, a limitation that has been addressed by Higgins et al., (2011). In addition, a review of the literature revealed that the reliability of the tool has not been extensively studied. Furthermore, the 'incomplete data' category was the most difficult to assess for bias in this review, as has been found by others who have used this quality assessment tool (Hartling, Ospina, Ling, Dryden, Hooton & Krebs, 2009). However, despite the tool relying on individual's judgements to rate the risk of bias, the guidelines proved very helpful when assessing the bias risk. In order to help make the risk of bias outcomes more visual for the reader of the review, a color-coded table was included in the review to illustrate the strengths and weaknesses of each study under each risk of bias category. This display table is commonly featured in other systematic reviews that have used the Cochrane Risk of Bias Tool and makes for quick and easy reading.

A consideration for the risk of bias process was how to score the category 'Blinding of participants and personnel'. This presented an issue in how to rate this risk of bias, as the nature of all the included studies meant that all mothers in both trial arms would have been aware of which trial arm they had been allocated, based on whether they received home visits

or not. It was decided that all studies would receive the same rating and for this to be 'unknown risk' as this was felt to be the fairest decision.

Quality Appraisal - Second assessor

A second assessor, independent of the research up to this point, quality assessed 4 of the final research papers included in this review. These papers were chosen by the second reviewer at random from the list of all the papers. This procedure was done in order to ensure that the judgements made with regards to the risk of bias for each study were fair and reliable. NICE (2012) suggests a minimum of 10% of the papers should be quality assessed by a second reviewer. However, as the final number of papers identified for review was reasonably limited, it was agreed that for added assurance, the second quality assessor would review four papers, taking the number of papers reviewed to 36%. The results of the quality assessment agreement between the coders was $\kappa=.69$; $n=24$, suggesting a good level of inter-rater reliability for the risk of bias judgements across the papers.

Data extraction

The data distraction process was based on an adapted version of the Cochrane Public Health Group Data Extraction Template. This template was chosen as it was comprehensive in its suggestions as to what data might be needed to be extracted. Additionally, it encouraged the user to modify the template to suit the needs of their review. Rather than extract the data from each study into the individual Microsoft Word templates that had been created, I used the template headings to create my own data extraction spreadsheet in Microsoft Excel. This allowed me to display each study side by side, allowing me to quickly and easily compare the data for each study alongside one another. On reflection, more data than necessary was collected for each study, though this decision was consciously made as it was felt that this would help to decide what data was important and available to be included in the final tables within the systematic review paper.

Overall, this approach proved to be very beneficial, as the adapted data extraction form identified key factors for inclusion within the systematic review, across all the studies. The side by side Excel template allowed for quick visual comparisons across all the studies and consequently made it easier to create the tables that featured throughout the paper.

Data Analysis

The criteria for a meta-analysis of the data was considered in detail. However, given the range of language assessment tools used and the variability of the reported outcomes, it was decided that the systematic review did not meet the requirements of a meta-analysis. Therefore, a narrative review was conducted on the data findings.

One significant challenge of any research conducted to measure language development is the number of domains to language skill that can be measured. These domains include receptive skills, expressive skills, word pronunciation, vocabulary size etc. Each domain measures a different, yet inter-connected area of language development and for each domain, numerous language assessment tools have been developed. It was therefore not surprising to find that of the eleven studies included within my systematic review, a total of nine different language assessments had been used. Some of the studies used language specific assessments (Robling et al. 2016; King, Rosenberg, Fuddy, McFarlane, Sia & Duggan, 2005), whist other studies used measures of language were a scored as part of a larger overall assessment of the child's development (Schwarz et al. 2012). In addition, the quality of the reporting of language outcomes varied, with some studies simply referring to 'language development' as an overall outcome (for example, Olds et al. 2004a), whilst other studies focussed more specifically on a particular language domain, such as receptive skills (Olds et al., 2004b).

It was apparent that across most of the included studies, language was one of many areas of development that studies set out to assess and include in their reports. In addition, it became clear that the HVPs often had a very broad range of family life that they aimed to target, with no studies specifically targeting one area for development, particularly children's language development. The consequence of this was that although the systematic review was comparing language outcomes across the studies, it was not possible to compare like for like language outcomes. The challenge of assessing language skills in preschool aged children has been highlighted by Dockrell (2001). The paper draws attention to the fact that accurate identification of children who are experiencing delays or disorders in language is problematic. Dockrell (2001) explains that language is multidimensional and therefore does not easily lend itself to single unitary measures. It is therefore argued that it would be necessary to profile a range of skills in order to achieve a valid picture of a child's language performance. In relation to the studies within my systematic review, some studies utilized measures that cover a number of language domains and produce an overall language score (King et al, 2005; Robling et al. 2016; Sierau, Dahne, Brand, Kurtz, Klitzing & Jungmann, 2015; Schwarz et al, 2012; and Tomlinson et al, 2016). Other studies have instead selected a language assessment that measures one domain of language (Nair, Schuler, Black, Ketringer & Harrington, 2003, Olds, Holmberg, Donelan-McCall, Luckey, Knudtson & Robinson, 2014, Olds et al, 2004b, Schwarz et al, 2012). This raises concerns when trying to determine whether HVPs impact upon language, as by only reporting one domain of language development, we are left not knowing whether the HVP had an impact on the other domains of language. In addition, reporting an overall language score for the child does not allow for reviewers to look at the breakdown of the domains assessed to see if HVP have a more significant impact on, for example receptive language as opposed to expressive language.

Implications for theory and practice

In relating this research to a theoretical understanding of language development, social-interactionist and usage-based theories such as Tomasello, (2003) locates the development of a child's early communication within their social environment and emphasises the importance of socially meaningful interactions between children and their caregiver. I believe that the basis of this theory of child language development would be one that most, if not all HVPs could use to teach to the mothers, fathers and caregivers as to how they can help develop their children's language skills. By imparting knowledge to the families, in layman's terms that are easily understood and implemented (such as responding contingently to their child's attempts at communication, talking frequently to their child, using a variety of words during communication), vulnerable families might feel more informed and in control of their child's linguistic development.

Peacock et al. (2013) suggests that from the analysis of their systematic review looking at a range of HVP outcomes, that programmes are most effective when a higher dose of the intervention is delivered over a longer period of time and mothers are approached prenatally. Though the results of this review are mixed, the thee appears to be support from this study to back up Peacock et al., 2013. In addition, this conclusion also makes logical sense, though the key is finding the right balance between time spent with the families and the finances and resources available to provide this level of intervention. However, I would argue that if many HVPs are not having the desired impact (as suggested by Peacock et al. 2013), then there is a lot of financial and resource investment that is not being utilized in the best possible way.

Targeted home interventions might also be an alternative to the blanket approach of many HVPs. This too makes sense, as an intervention that aims to address everything is likely to make small impacts spread over many areas. However, an evidence based home

intervention targeted at improving, for example a child's language development, and is aimed at children who have been identified as being at risk, might be more likely to produce positive outcomes in that domain.

Another implication for the application of this research to practice is in relation to a finding by Olds et al. 2002 & 2004a. They found that the biggest improvement in language ability was to children born to a mother with low psychological resources. These two studies were the only ones to identify this as a factor in their studies, though the findings suggest that this measure should be more routine. This again suggests that it is the children whose mothers are the most vulnerable who need the most support. However, it also gives hope as this also shows that these children are the ones who can make the biggest improvements. Services where finances and resources are restricted might therefore be required to target the most vulnerable in society, as these families may be the ones who respond best to the HVP model.

Future research

The literature on language development highlights how language is a vitally important developmental process of future development (Peterson et al. 2013) (Uccelli, Demir-Lira, Rowe, Levine & Goldin-Meadow, 2018). Therefore, current and future interventions that are aiming to support children's overall development (such as HVPs) should consider approaches that enhance each child's language ability as part of their intervention model.

In addition, an important avenue for future research is the use of more longitudinal methodologies in order to explore whether the positive impact on children's language development achieved by some HVPs is maintained as the child gets older. Most of the included articles stopped assessing children's language development at or below 24 months of age, with only two studies assessing the children's language development beyond the age of three years old. Studies should also look to use validated language assessments that cover a

range of language domains. If possible, choosing the best measure for language assessment should be done in consultation with a speech and language professional who has knowledge of children's language development. HVPs should also aim for consistency in the measures they use, particularly when those HVPs follow the same of similar model. Where possible, the published papers should also look to report the scores of each language domain measured. This would improve the transparency of the language measure and allow for a greater level of comparison of language domains, which would in turn allow reviewers to understand whether there is one domain of language which HVPs particularly improve over another.

Supplementary Gesture-speech production and children's language development: Assessing the outcomes of a Home Visiting Programme

Rationale for the research

The following provides a brief background that led to the empirical study being undertaken. The author of this research portfolio was not involved in the initial study by Robling et al. (2016).

This study was conducted following the findings of a large-scale research project undertaken by Robling et al. (2016). Robling et al., (2016) evaluated the outcomes of the Family Nurse Partnership (FNP) Home Visiting Program (HVP), a model of intervention that has been developed in America (Olds, Henderson, Tatelbaum & Chamberlin, 1986, Kitzman et al. 1997; Olds et al. 2002) and was established in England in 2007. Robling et al. (2016) set out to evaluate the FNP program and explore how effective the program is at improving the lives of both the mothers and their children (up to the age of 24 months). The evaluation of the FNP program involved 1618 mothers, but found that compared to the control group who received care as usual, there was very little difference in the outcomes between the two trial arms for both mother and child. However, the study did find that children who received input from the FNP had significantly better language scores than those in the care as usual

group, as measured with the ELM (Coplan, Gleason, Ryan, Burke & Williams, 1982). This measure is in part scored by maternal reports of child language, so it was felt that there was a chance of bias in this measure. This study was therefore devised in order to find a way of objectively assessing children's language development in order to see if the findings of the ELM can be supported.

Selecting an assessment of language

The aim of this research was to assess the language abilities of children who had formed part of the above study. Half the children, along with their mother, had received support from the Family Nurse Partnership program, whilst the other half formed the control group. As the study had been completed and the data collected, it was agreed that the only way to objectively assess the children's language capabilities was via 483, three-minute long video clips which had been recoded as part of the original study. The video recordings showed the child and their mother in a naturalistic setting (their own homes) being left to interact with each other as they normally would.

The decision to use the children's gesture as a means of assessing their language capabilities was one I arrived at after much deliberation. I was very aware at the early stages of this work that this was not an area of research or clinical practice that I was familiar with. Therefore, I set about conducting a detailed search of the literature, consulting with local speech and language therapists (both in clinical practice and within academic fields) and emailing lecturers in the area of children's language in order to gather their views on this challenge. I was grateful to receive a wide range of suggestions as to how I might go about this research, though many expressed their opinion that the task would be a challenge, given the nature of the data available. Suggestions I received included counting the children's Mean Length of Utterance (MLU) in morphemes and counting the number of different words the

children produced. Both these options were considered, but neither were felt to be offering something new to the research base that had not been done before. One idea that was arrived upon was to focus on children's gesture production. As I learnt, gesture has received a significant amount of research interest, with many studies focussing on children's gestures, how they develop, why they develop and how they link to language development (Nicoladis, Mayberry & Genesee, 1999; Özçalişkan & Goldin-Measow, 2009; Özçalişkan & Goldin-Meadow, 2010; Iverson & Braddock, 2011). This led me to email the leading expert in the field of children's gesture research (Susan Goldin-Meadow) who suggested that my research pays particular attention to whether the gestures made by the children are produced with speech.

Supplementary gesture and language development

Through reading the research in children's gesture production it became apparent that there are three main forms of gesture-speech combination – complementary, supplementary and disambiguating. Of the three, supplementary gesture-speech combinations have been shown to be the most interesting in relation to language, as researchers have found that supplementary gesture-speech combinations predate and predict when a child will soon begin putting two words together in their vocalisations. (Ozcaliskan et al., 2009).

Theory and evidence supporting this research

Research has shown there to be a trajectory of gesture and language production that most children follow. As outlined by (Ozcaliskan et al., 2009), children use gesture to communicate before they produce their first words. The first gestures to emerge are deictic and children use these gestures to identify items within their environment. These gestures emerge when the child is round 10 months old. At this stage, these gestures are nearly always produced unaccompanied by meaningful speech (Özçalışkan & Goldin-Meadow, 2005). It is not until the child reaches the age of around 14 – 22 months of age that they begin to

combine their gestures with spoken words. These early gesture-speech combinations are often defined as complementary, that is the child will point and name the item they are pointing at, for example, point at a car and say "car". Children will also being to use conventional gestures that communicate socially accepted gestures such as nodding the head to communicate "yes". As the children's skills in language develop, their use of language and gesture in single communications becomes increasingly complex. At this stage, gesture and speech can be seen to differ in relation to what the child is gesturing to and what they are saying, for example, pointing to a chair and saying "daddy". At this stage, the child is forming a sentence like communication, with their gesture supplementing what they cannot yet say in speech ("Daddy's chair"). Importantly for the present research, studies have found a close link between early supplementary gesture-speech combinations and later linguistic constructions that have underscored the robustness of supplementary gesture as a harbinger of children's linguistic development (Capirci, Iverson, Pizzuto, & Volterra, 1996; Iverson & Goldin-Meadow, 2005; Ozcaliskan & Goldin-Meadow, 2005). As gesture develops, children begin to use iconic gestures (e.g. flapping their arms like a bird to convey flying).

In very young children's communications, the age at which a child first produces a supplementary gesture-speech combination has been found to predict the age at which the child produces their first two-word utterance (Goldin-Meadow & Butcher, 2003; Iverson et al., 2005). That is, children who are first to produce communications in which gesture and speech are combined to convey different information (i.e. a supplementary gesture) are also the first to produce two-word combinations in their speech. Once the child has mastered this linguistic construct, they move on to increase their language production and reduce their gesture usage (Özçalişkan et al., 2009) It is therefore clear from the research that children's ability to produce sentence like communications through speech and gesture is a very good predictor of the child's increasing linguistic development in their emerging ability to convey

these meanings entirely within speech. By associating the child's supplementary gesture production with their speech production, it was hoped that this would give an indication as to the stage of gesture development the child has reached.

A review of the literature appeared to suggest that this approach had not been undertaken before. Most studies that have researched this developmental pattern in children have monitored a child's development at set time intervals, assessing for changes in gesture production at each time point (McGillion et al., 2017; Nicoladis et al., 1999; Özçalişkan et al., 2009; Özçalişkan et al., 2010; Iverson et al., 2011). That approach has the advantage of closely tracking the changes, whilst being able to have some element of control over the environment in which the child is in, in order to best assess for developments in gesture. Given the nature of the data collection process from Robling et al. (2016) - a three-minute window into each child's life, the traditional method of gesture analysis was clearly not possible. However, Robling et al. (2016) had collected a significant number of video recordings, therefore presenting a large sample size from which to work with. Therefore, I set out to explore whether observations of supplementary gesture at one, individual time point at 24 months of age – an age when children might be expected to start producing supplementary gesture as they begin to put two words together, would support the findings of Robling et al., (2016).

To further ensure that the theoretical underpinnings of this work were strong, I attended a talk by Professor Sotaro Kita, an expert in language development and gesture. After his talk, I was able to discuss my hypothesis with him. He agreed that the premise of the study was supported by the evidence and was interested to hear more about my findings.

Ethical considerations

Ethical approval for my research was granted under the same ethical agreement that the Robling et al. (2016) received, as my study was an example of further exploratory analysis that was being undertaken using the data from the original investigation. A confirmation email was received from the project director, thus allowing the research to be undertaken (see appendix G).

In the development of this study, several important ethical considerations were identified. To ensure those involved in the study were aware of their ethical responsibilities and the protocols around the data, each individual involved in the coding process was required to sign a confidentiality agreement. Amongst the ethical issues raised and guidelines set out, this agreement ensures that the videos were only to be watched within a private space within the university building and that no video recordings were to be removed from the University computer drives. A copy of the code of conduct agreement can be found in appendix H. Another important consideration was the use of unique identifying numbers for each video and corresponding coding form (as opposed to the use of the mother and child's names). This unique identifying number later allowed for the gestures to categorised by those who received the FNP input and those who were part of the control group.

Developing the coding form

In order to ensure that the coding process was reliable and that the data was collected and recorded in a clear and accurate way, I created a bespoke gesture coding form for this study. This form went through many drafts, pilots and consultations with my supervisors before the final version was agreed upon (see appendix E). To help with the development of this form (and the development of the gesture coding manual), an undergraduate psychology student was briefly recruited to the study, in order to help develop the gesture coding form and manual. The student proved to be very helpful, not only in developing both the manual

and the coding form, but also for reflecting ideas as to how the study could be further developed.

The coding form itself was divided into 5-second segments for the duration of three minutes. This allowed me to code each gesture the child produced at the corresponding time point, alongside the vocalisations that the child made at that same time (NB: the children's vocalisations and speech were transcribed by coders working on a second research project connected to the video recordings). A total of 3 different gestures were coded along with one gesture-speech combination (supplementary). The primary focus of the coded gestures was on whether the child produced the gesture with speech and met the manual guidelines to be classed as a supplementary gesture. When a supplementary gesture was observed, this was coded within the supplementary coding box, with a total automatically generated for each child within the form.

Developing the coding Manual

Despite the wide array of research into children's gesture, no standardised gesture coding manual was identified. A coding manual was therefore developed for the purposes of this study. The definitions of the gestures were obtained from studies published in this area, (Nicoladis, et al.,1999, Özçalışkan et al., 2005; Özçalışkan et al., 2009). Having used these definitions within the current study, this will assist with the continuity within the area of research into child gesture. The coding manual allowed the coder to ensure that their coding was following a set process and each coded gesture met a specific definition. The manual was piloted on a randomised 15% sample of the total videos, and a high level of reliability was achieved with a second coder, thus allowing the manual to be used to code the remaining videos. Developing the manual took time and underwent numerous changes. One challenge of trying to define a gesture was trying to interpret whether a hand movement was a communicative gesture or not. For example, if a child extended their index finger and

touched a material surface, was that child pointing or feeling? It was decided that the coder would make a note of any uncertain gestures and consult with a second researcher in order to reach a consensus. On reflection, this procedure provided reassurance that challenging decisions relating to gesture production could be discussed with a colleague with knowledge of the study, rather than the decision being taken by myself alone.

Participants

The participants in this research were mothers and their child who took part in Robling et al., (2016) study. Of the overall sample of 1645, 483 mothers consented to being filmed by their family nurse. This sample will be referred to as the BABBLE sample.

Preliminary analyses was conducted on the BABBLE sample to see how representative the sample was to the original data set. Comparison of the two data sets showed that the BABBLE sample was a very close representation of the original data set. Due to the fact that all mothers across the sample had the choice of opting in and allowing themselves and their child to be recorded, this relatively random process of filming the mothers had the potential to be problematic. For example, there could have been a large bias of mothers from one trial arm agreeing to be filmed, leaving few mothers in the other trial arm. It was therefore very fortunate that there was a very even split between those mother-child dyads who had received support from the FNP and those who received care as usual. As it was, the sample who consented to being recorded were very similar across trial arms and also very similar to the larger sample from which they were originally part. This therefore meant that the findings from analysis of the BABBLE sample were generalizable to the larger sample, and therefore generalisable to a wide demographic of the population.

Coding the videos for gesture production

Coding the gestures produced across the 483 videos took months to complete as each video had to be watched through carefully and often re-watched to ensure the gesture was being coded correctly. I was aware that this process was very tiring and could become mundane, so I structured my video coding into blocks, with regular breaks.

The naturalistic setting in which all the videos were filmed had both advantages and disadvantages. The biggest advantage was that the child was being observed as they would normally be; at home with their mother. Any gestures produced were natural and given that neither the mother, nor the nurse filming the video were aware that the recording might be used for gesture observation, there was no suggestion that the production of the children's gestures was biased or unduly influenced. However, the naturalistic setting also meant that children were free to do as they normally would, and at time this meant using their hands to play with toys around them. As a result, some children did not gesture and this may have been due to their hands being occupied during the video. Though I was not involved in the planning or filming of the videos, future research that involves observing children's gesture within a naturalistic environment should be mindful of the objects available to children to hold and the role these objects might play in the production of children's gestures.

One limitation of the gesture coding process was that I was responsible for coding all 483 videos. As a result, this had the potential to put pressure on me to ensure the gesture coding was completed by an agreed deadline, in order to allow time for the gesture analysis and paper write up. To ensure that the potential for time pressures did not have a negative impact upon the accuracy of my coding, the coding process was commenced as soon as was practically possible and mini-deadlines were set over the course of several months to ensure that ample time was given to the completion of this vital task. On reflection, having a second

coder to code half the recordings would have been a preferred option, but this issue was well managed.

Data Analysis

The statistical analyses of the gesture data was conducted by myself with the support of a statistician who helped guide the selection of statistical analytical tests.

The decision to include the descriptive results of the children's production of deictic gesture was taken, as I recalled myself questioning what the likelihood was of observing many gestures across the sample, given each video only lasted for three minutes. This was particularly the case with supplementary gesture as I had not come across any research which had coded gesture production amongst children of this age within such a brief time period. In order to challenge this assumption that readers of this paper may have had, I decided to use deictic gesture as a benchmark of sorts for what level of gesture could be observed across the sample in this time period. Deictic gesture was selected for this purpose as it is the most simple, basic and widely observed gesture amongst children of this age and would therefore be expected to feature frequently if the video's allowed. The results showed that deictic gesture was heavily featured amongst a majority of the sample, therefore demonstrating that the time frame, though brief, was enough for children to produce gesture. For reasons of consistency and transparency in my research, I decided to also include the descriptive statistics from the whole child sample production of iconic, conventional and supplementary gestures.

Given the low frequency counts for supplementary gesture, I decided to dichotomise the gesture for further analysis. A logistic regression was then conducted to explore whether there was a difference, not in the total number of supplementary gestures produced by one trial arm against another, but whether there was a difference in the number of children

between trial arms who produced a supplementary gesture. As the data analysis within the study by Robling et al. (2016) included minimisation variables (gestation, smoking status at recruitment, and first / preferred language), care was taken to ensure these minimisation variables were also included in my logistic regression analyses.

Discovering that there was no significant difference between the trial arms in terms of their supplementary gesture production was surprising at first. This led me to re-check with the literature with regards to the research around this gesture production. However, a second review of the literature around supplementary gesture confirmed to me that the theoretical underpinnings of this study were strong. However, seeing the strong positive correlation between supplementary gesture and children's MLU score provided a strong conclusion that, based on the trajectory of supplementary gesture, that the majority of children across the sample had not reached this milestone yet.

This approach to language assessment was a relatively novel and presented as a unique opportunity, given the sample size and video data. This result appears to be in contrast with that of Robling et al. (2016) and raises questions relating to the choice to use the ELM as the language assessment scale. The ELM scale that was used as the original measure of language development was an interesting choice of measure, as it is not a widely used language assessment tool. Through conversations I had with colleagues specialising in speech and language, it became clear that they were not familiar with it. Furthermore, the assessment tool was designed to assess for language delay in young children. In contrast, my research using supplementary gesture production was assessing for a development difference between the two trial arms, not necessarily looking for an advancement or delay in language. There are several language assessment tools that could have been considered instead of the ELM scale, which future studies into children's language development could consider; measures such as the Preschool Language Scale, fourth edition (PLS-5 UK) or the Bayley Scale for

Infant and Toddler Development (Albers & Grieve, 2007). Both assessments are widely used to assess the language abilities of this age group and have good validity and reliability scores. However, these language assessments, as with many other language assessments which provide a greater, more detailed insight into a child's language development are required to be administered by a trained professional, may come with additional costs and would be likely to take longer to complete than the ELM scale.

Predictor variables for supplementary gesture

Given the data available from Robling et al. (2016), I decided to use a selected range of variables in order to explore which, if any would be found to be a significant predictor of children's production of supplementary gesture. I was aware during this process that if too many variables were selected as potential predictors, then there was an increased chance of a seemingly random variable appearing as a significant predictor by chance. Therefore, predictors were chosen because there was an evidence base linking that variable to language, for example, Nicely, Tamis-LeMonda & Bornstein, (1999); Oades- Sese & Li (2011) for attachment's links to language development; Law, Bean & Rush (2011) for social deprivation links to language development). Multivariable analysis was planned to be conducted had two or more variables been identified as having statistical significance. However, the univariable analysis showed only one variable (mothers age) as a predictor with statistical significance.

Clinical Implications

The fact that supplementary gesture production was associated with children's MLU score raises the question as to the role that children's gesture production could play in assessing their language development. There is a wealth of research that has found that gesture is tightly linked to children's language development (Goldin-Meadow et al., 2003; Iverson et al., 2005; Ozcaliskan et al., (2009); Ozcaliskan et al., 2010). This includes not only supplementary gestures, but also iconic gestures (Nicoladis et al., 1999). The challenge for

assessors however, is that observing single gestures made by a child is far more challenging when it is done 'live' with an active child, as opposed to watching gestures that are on a computer screen. The advantage of conducting gesture observational research with video recordings is that the recordings could be paused, rewound and played back slowly in, order to determine whether a hand movement was a gesture or not, what type of gesture it was and whether the gesture was made with or without speech. To do all this without a recording would likely be impossible and unreliable and lead to many gestures being missed. However, anecdotal observations of children's gestures might be a useful tool for those working in the field of speech and language. To gain advice on the role that gesture plays in language assessment and development in a clinical setting, I spoke with a colleague who is an experienced speech and language therapist working with young children. Though speech and language therapists are aware of the role of gesture in helping children's language, gesture is often used to help teach the mother about engaging with a child. For example, when a child points at a cup, teaching the mother to label the item as a "cup" to help the child learn the word for the object. However, it was apparent that in my colleague's experience, less attention is paid to the children's production of developmental gestures. It would likely therefore be clinically useful for professionals working in this field to have an increased awareness of the developmental predictor gestures (supplementary gesture, iconic gestures), with research exploring how useful these spontaneously produced child gestures are in assisting these professionals to assess a child's language development. This is underlined by Abner, Cooperrider & Goldin-Meadow, 2015 who argue that "the study of language is incomplete without the study of its communicative partner, gesture".

That mothers age was found to be a predictor of children's supplementary gesture production highlights the need for support to be given to the mothers and children in these circumstances. Though the majority of the mother's in this sample were relatively young, this

study suggests that the language development of the children of the youngest mothers was not at the level of the children of older mothers. However, as supplementary gesture is not a validated measure of language, this outcome would need further investigating. Despite this important caveat, the finding is supported by research which has shown that children of younger mother's tend to have poorer developed language skills in comparison to those children born to older mothers (Keown, Woodward & Field, 2001). A recommendation might therefore be that services designed to support young mothers help them to recognise the gestures produced by their children. Studies have not only found that this can not only help the children's language to develop, but also improve maternal responsiveness to infant's nonverbal cues (Kirk, Howlett, Pine & Fletcher, 2013).

Future research

The study opens up many avenues for further research. One key piece of research is the need for long term follow up studies involving the children of Robling et al. 2016. Given that this study was unable to support the language findings of this study, long term assessments of the children's language development will help shed more light on this outcome. One option that was open to the researchers would have been to follow the development of the children at regular time intervals after the 24-month assessment, with researchers paying particular attention to the age at which the children in the trial arms began producing 'iconic' gestures (gestures or movements that imitate the actions of an object, e.g. rolling their index finger to convey a ball rolling down a hill). As previously mentioned, Nicoladis et al, (1999) has demonstrated that these gestures begin to emerge from 25 months of age and this is another gesture, more advanced again than supplementary gesture that is tightly related to development in language. Though the age of the children in Robling et al. (2016) now means this is no longer a meaningful assessment to undertake, it is a form of gesture observation that future research of a similar nature could look to utilise.

Research dissemination

Disseminating both the empirical research and systematic review to professionals and academics will be done so by submitting the papers for publication with the journal Child Development (impact factor of 4.195) and The Journal for Nursing Studies (impact factor of 3.755). To facilitate this process, both research papers have been written to the standard guidelines of the two journals. These two journals were identified as they both publish papers of a similar nature to the research within this portfolio and both have respectable impact factors.

Though both papers have missed the 2018 National Literacy Trust conference, this annual event has been identified as a conference where this research could be further disseminated. In addition, the NAPLIC conference, a conference that leads in developmental language disorder and speech, language and communication needs has also been identified as a relevant conference to present this work.

Self-reflection and competency development

The process of undertaking and completing this research has been lengthy, challenging but ultimately rewarding. This section offers a reflection on my experience undertaking this research and skills and competencies that have been developed through it.

From the start, the research required me to develop my understanding of children's language development, which led me to enhancing my knowledge with regards to children's gesture. Prior to this research, my experience of children's language development was that of being a father to two young girls. I was not aware of the different forms of gesture and did not realise there was an evidence based link between children's gesture and their language development. Over the course of this research, I have become acutely more aware of these

two elements of child development, as well as expanding my personal knowledge of this research base.

The systematic review process has developed my knowledge and my confidence in conducting such a piece of research. The process has also enabled me to develop my skills in data extraction and evaluating the strengths and weaknesses of published research. It has also further demonstrated to me the importance of gathering the evidence from a wide range of research papers before arriving at a conclusion as to whether an intervention works or not. As my systematic review demonstrated, simply looking at one or two studies into an interventions effectiveness would not provide the full picture. In addition, it has emphasised the important role that systematic reviews play in understanding what interventions work (or not) and why, as well as demonstrating the vital role that clinical psychologists play in conducting research.

The empirical paper allowed me to develop my role as a leader in a large piece of research, a core competency of a clinical psychologist. From the start, there were many big decisions to make and this work has given me the confidence to make those decisions and justify them with through the evidence base. Though the study did not find a significant difference between the trial arms, supplementary gestures strong association to child's MLU across the BABBLE sample demonstrated that the theory behind the study provided good grounds for investigation.

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Appendices

Appendix A

The Journal of Nursing Studies

Your Paper Your Way

We now differentiate between the requirements for new and revised submissions. You may choose to submit your manuscript as a single Word or PDF file to be used in the refereeing process. Only when your paper is at the revision stage, will you be requested to put your paper in to a 'correct format' for acceptance and provide the items required for the publication of your article.
To find out more, please visit the Preparation section below.

Introduction

The *International Journal of Nursing Studies* (IJNS) provides a forum for publication of scholarly papers that report research findings, research-based reviews, discussion papers and commentaries which are of interest to an international readership of practitioners, educators, administrators and researchers in all areas of nursing, midwifery and the caring sciences.

Papers should address issues of international interest and concern and present the study in the context of the existing international research base on the topic. Those which focus on a single country should identify how the material presented might be relevant to a wider audience and how it contributes to the international knowledge base. Selection of papers for publication is based on their scientific excellence, distinctive contribution to knowledge (including methodological development) and their importance to contemporary nursing, midwifery or related professions.

Submission to this journal proceeds totally online and you will be guided stepwise through the creation and uploading of your files. The system automatically converts your files to a single PDF file, which is used in the peer-review process.

Amongst the many submissions received we recognise that some will have been previously formatted for another journal. The Your Paper Your Way service (described later) means that authors can submit these papers to the IJNS without worrying about formatting the manuscript again to exacting specifications.

The IJNS also offers a rapid review service for newsworthy papers under our 4* submission service.

Types of papers

The IJNS publishes original research, reviews, and discussion papers. In addition we publish editorials and letters.Where a case is made we will also publish protocols of trials which meet our general criteria for interest and significance.

Editorials — 1,000–2,000 words
Authors who have ideas for editorials which address issues of substantive concern to the discipline, particularly those of a controversial nature or linked directly to current/forthcoming content in the journal, should contact the Editor in Chief (ijns@kcl.ac.uk).

Research Papers — 2,000–7,000 words

Full papers reporting original research can be a maximum of 7000 words in length, although shorter papers are preferred. Research papers should adhere to recognised standards for reporting (see guidance below and the Author Checklist).

Reviews and Discussion Papers — 2,000–7,000 words
• Reviews, including:
- systematic reviews, which address focused practice questions;
- literature reviews (scoping reviews, narrative reviews), which provide a thorough analysis of the literature on a broad topic;
- policy reviews, i.e. reviews of published literature and policy documents which inform nursing practice, the organisation of nursing services, or the education and preparation of nurses and/or midwives).
• Discussion Papers, i.e. scholarly articles of a debating or discursive nature.

Letters to the editor — up to 800 words and 10 references, from up to 5 authors
Designed to stimulate academic debate and discussion, the Editor invites readers to submit letters which should refer to and comment on recent content in the journal, introduce new comment and discussion of clear and direct relevance to the journal's aim and scope or briefly report data or research findings that may not warrant a full paper. Contributions that are of general interest, stimulating and meet the standards of scholarship associated with the Journal may be selected for publication. Contributions should be submitted as in the usual way.

Reporting guidelines

The editors require that manuscripts adhere to recognized reporting guidelines relevant to the research design used and require authors to submit a checklist verifying that essential elements have been reported for all primary research and systematic reviews.

Reporting guidelines endorsed by the journal are listed below:
•*Observational cohort, case control and cross sectional studies* - STROBE - Strengthening the Reporting of Observational Studies in Epidemiology, http://www.equator-network.org/reporting-guidelines/strobe/
• *Qualitative studies* - COREQ - Consolidated criteria for reporting qualitative research,http://www.equator-network.org/reporting-guidelines/coreq
• *Quasi-experimental/non-randomised evaluations* - TREND - Transparent Reporting of Evaluations with Non-randomized Designs, http://www.cdc.gov/trendstatement/
• *Randomised (and quasi-randomised) controlled trial* - CONSORT - Consolidated Standards of Reporting Trials, http://www.equator-network.org/reporting-guidelines/consort/
• *Study of Diagnostic accuracy/assessment scale* - STARD - Standards for the Reporting of Diagnostic Accuracy Studies, http://www.equator-network.org/reporting-guidelines/stard/
• *Systematic Review of Controlled Trials* - PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses, http://www.equator-network.org/reporting-guidelines/prisma/
• *Systematic Review of Observational Studies* - MOOSE - Meta-analysis of Observational Studies in Epidemiology, http://www.ncbi.nlm.nih.gov/pubmed/10789670

Where relevant, more specific extensions to the generic guide should be used, for example:
•**Cluster** Randomised Controlled Trials(where participants are randomised in groups, rather than as individuals)-*Consort 2010 statement: extension to cluster randomised trials*http://www.equator-network.org/reporting-guidelines/consort-cluster/
•*Observational studies using routine data*- RECORD - The Reporting of studies Conducted using Observational Routinely-collected health Data http://www.equator-network.org/reporting-guidelines/record/

You are required to adhere to these guidelines (or a suitable recognized alternative) and to submit a completed checklist from the reporting guideline to assist the editors and reviewers of your paper. You can search for the correct guideline for your study using the tools provided by the EQUATOR network: http://www.equator-network.org/ The guideline used must be indicated in the Author Checklist.

Studies reporting on the development of scales, measures or questionnaires

All research papers whose primary purpose is reporting the development or testing of scales / measures / questionnaires must include a copy of the full instrument as a supplementary file at submission stage so it can be published as an appendix online. *The IJNS does not accept instrument development papers which are not accompanied by a copy. We are unlikely to consider papers where there is no validation against a robust criterion, where findings indicate that the version published requires further development or where the underlying constructs are not well established.*

Authors are required to obtain written permission from the copyright owner of the instrument to reproduce it, and ensure that it is credited appropriately and the correct copyright line qualifying the permission to use/translate the instrument is supplied underneath the submitted scale. If authors want to retain copyright of their own scale they can do so and indicate that it is reproduced with their permission.

If the instrument is in a language other than English, then it must be accompanied by an English translation in addition to the original version. If the newly developed scale is a translation of an existing scale then the IJNS requires author(s) to obtain written permission from the copyright owner of the original scale to publish the translated version with full credit given also to the original scale (an English translation is still also required). *We are unlikely to publish instrument translations from one language to another unless the scale is useful for directly guiding clinical practice (e.g. diagnostic/ screening instruments) related to important and defined outcomes or there is some other clear contribution to the wider international literature from the publication.*

Where questionnaires or existing scales are used as measures to address a substantive question in the paper authors are strongly encouraged to submit the instrument for publication as an online appendix.

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List: References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication.
Examples:
Reference to a journal publication:

Van der Geer, J., Hanraads, J.A.J., Lupton, R.A., 2010. The art of writing a scientific article. J. Sci. Commun. 163, 51–59.

Reference to a book:

Strunk Jr., W., White, E.B., 2000. The Elements of Style, fourth ed. Longman, New York.

Reference to a chapter in an edited book:

Mettam, G.R., Adams, L.B., 2009. How to prepare an electronic version of your article, in: Jones, B.S., Smith , R.Z. (Eds.), Introduction to the Electronic Age. E-Publishing Inc., New York, pp. 281–304.

Reference to a website:

Cancer Research UK, 1975. Cancer statistics reports for the UK. http://www.cancerresearchuk.org/aboutcancer/statistics/cancerstatsreport/ (accessed 13 March 2003).

Reference to a dataset:

[dataset] Oguro, M., Imahiro, S., Saito, S., Nakashizuka, T., 2015. Mortality data for Japanese oak wilt disease and surrounding forest compositions. Mendeley Data, v1. http://sci-hub.tw/10.17632/xwj98nb39r.1.

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Appendix B

Example of database search

1	Postpartum.mp
2	Pregnan*.mp
3	Newborn.mp
4	Mother*.mp
5	Maternal.mp
6	Prenatal.mp
7	Neonatal.mp
8	Perinatal.mp
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	Language
11	Speech
12	Words.mp
13	Vocab*.mp
14	10 or 11 or 12 or 13
15	Home care services.mp
16	House calls/ or house call*.mp
17	Home visit*.mp
18	Home intervention.mp
19	Housing/
20	Home base*.mp
21	House call*.mp
22	Housing.mp
23	Early intervention.mp
24	15 or 16 or 17 or 18 or 19 20 or 21 or 22 or 23
25	Poverty/ or poverty.mp
26	Vulnerable population.mp
27	Disadvantaged.mp
28	Poor famil*.mp
29	Socioeconomic factors/ or socioeconomic.mp
30	Social welfare/
31	Low income.mp
32	Low ses or low socioecomic.mp
33	At risk.mp
34	Indigient?.mp
35	25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
36	exp infant/
37	Baby.mp
38	Babies.mp
39	Exp child/
40	Child*.mp
41	Toddler?.mp
42	Preschool.mp
43	36 or 37 or 38 or 39 or 40 or 41 or 42
44	9 and 14 and 24 and 35 and 43
	Limit 44 to (English language and yr=”1990-Current)

Appendix C

Quality Assessment – Risk of Bias assessment based on the Cochrance Risk of Bias Tool

Aracena et al. 2009

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Unclear Risk	The adolescents who met the criteria, and accepted to be part of the study were randomly assigned to the control and experimental groups, but the randomization process is not described
	Allocation Concealment	Unclear Risk	No specific information given with regards to allocation concealment
Performance Bias	Blinding of participants and Personnel	Unclear Risk	No specific information given with regards to blinding of personnel
Detection Bias	Blinding of assessment outcome	Unclear Risk	Evaluation of the child outcomes was done by "the medical team" but it is unclear who this medical team were and what involvement (if any) they had had with the mother and child up to the outcome assessment
Attrition Bias	Incomplete Outcome data	Low	Of the 14 missing cases, no significant differences were found with regards to those who finished the intervention
Reporting Bias	Selective Reporting	Low	Language outcome data has been reported
Other Bias			None

King et al. 2005

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Unclear Risk	Families were randomly assigned to intervention or control group, but the randomisation process is not detailed
	Allocation Concealment	Unclear Risk	No specific information given with regards to allocation concealment
Performance Bias	Blinding of participants and Personnel	Unclear Risk	No specific information given with regards to blinding of participants of personnel
Detection Bias	Blinding of assessment outcome	Unclear Risk	Research staff conducted the interviews with the parents. Home visitors conducted the screening assessments and identified children who were delayed.
Attrition Bias	Incomplete Outcome data	Low	n=643 families begin the study; n=270 control group; n=373 intervention group. 41 participants allocated to the "testing control group" not included as they were not assessed at the three year stage. 513 families completed assessments (n=209 control group, n=304 intervention group), with an attrition of 130 mothers (20.1% attrition).
Reporting Bias	Selective Reporting	Low	language outcomes are detailed
Other Bias			None

Nair et al. 2003

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Unclear Risk	Mothers were randomly assigned to intervention or control group, but the randomisation process is not detailed.
	Allocation Concealment	Unclear Risk	No specific information given with regards to allocation concealment
Performance Bias	Blinding of participants and Personnel	High	No specific information given with regards to blinding of participants of personnel
Detection Bias	Blinding of assessment outcome	Low	Research assistants who were unaware of the intervention status of the mothers and infants conducted all evaluation visits in a hospital clinic.
Attrition Bias	Incomplete Outcome data	High	38% attrition. Mothers who completed the 18-month visit were older at the entrance to the study than mothers whose children were with substitute caregivers or who had no follow-up at 18 months (27.6 years vs. 25.4 years, $p < .001$).
Reporting Bias	Selective Reporting	Low	Language scores are detailed and discussed
Other Bias			None

Olds et al 2002, 2004a and 2014

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	low	After completion of baseline interviews, identifying information on the participants was sent to the data operations office (located separately from interviewers' offices), where an individual who knew nothing about the participants entered their data into a computer program that randomized individual women to treatment conditions.25 The randomization was conducted within strata from a model with 3 classification factors: maternal race/ethnicity (Hispanic, white non-Hispanic, African American, American Indian, or Asian), maternal gestational age at enrolment (32 vs 32 weeks), and geographic region of residence (4 regions). Women assigned to 1 of the 2 home-visiting groups subsequently were assigned at random
	Allocation Concealment	low	A data operations officer blind to the participants entered the data into the computer program which randomized participants to either the intervention group or control group
Performance Bias	Blinding of participants and Personnel	Unknown Risk	No specific information given with regards to blinding of participants of personnel
Detection Bias	Blinding of assessment outcome	low	Data were gathered by staff members who were unaware of the women's treatment assignment, except for a few cases in which the participants inadvertently

			revealed their treatment status to the interviewers.
			2002 - 735 mothers were randomised (n=225 control, n=245 paraprofessional, n=235 nurse). N= 560 children completed the 24 month assessments, an attrition of 175 mothers (76.2% completing). (n=204 control, n=188 paraprofessional, n=168 nurse). Mother attrition at 24 months not detailed.
Attrition Bias	Incomplete Outcome data	Unknown Risk	**2004a** - Children completing 4 year assessment - n=211 control, n=198 paraprofessional, n=196 nurse. N=605, an increase of 45 children from 2002 study
			2014 - Children completing 6 year assessment - n=176 control, n=173 paraprofessional, n=169 nurse. N=518, an attrition of 42 children from 2002 study (92.5% completed)
Reporting Bias	Selective Reporting	low	language as an outcome is reported
Other Bias			None

Olds et al 2004b

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Low	Identifying information on the participants was sent to the University of Rochester, where it was entered into a computer program that randomized individual women to 4 treatment conditions. Women randomized to the home-visiting groups were assigned randomly to a nurse home visitor.
	Allocation Concealment	Low	No specific information given with regards to allocation concealment
Performance Bias	Blinding of participants and Personnel	Unclear Risk	No specific information given with regards to blinding of participants of personnel
Detection Bias	Blinding of assessment outcome	Unclear Risk	The language assessment used the Kaufman Assessment Battery for Children, but it is unclear who administered the test
Attrition Bias	Incomplete Outcome data	High	n=1139 mothers randomised to trial group (n=515 control group, n=228 intervention group). At 6 year follow up, n=615 children completed the assessments (n=425 control group, n= 190 intervention group). Mothers attrition at 6 year follow up was n=498 (56.3% completed)
Reporting Bias	Selective Reporting	low	Language outcomes are reported
Other Bias			None

Robling et al. 2016

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Low	Local researchers used a remote randomisation service (P73)

	Allocation Concealment	Low	Allocation was done by a remote randomization service
Performance Bias	Blinding of participants and Personnel	Unclear Risk	No specific information given with regards to blinding of participants of personnel
Detection Bias	Blinding of assessment outcome	Low	Self reported secondary outcomes of lare pregnancy, 6, 12, 18 months were measured using telephone interview by researchers blind to arm allocation. Secondary self-reported outcomes at 24mths were measured face to face during interview by researcher not blinded to arm allocation but independent of service delivery (intervention or control)
Attrition Bias	Incomplete Outcome data	Low	76.1% of families completed within the intervention group (
Reporting Bias	Selective Reporting	Low	Language assessment outcomes are outlined
Other Bias			None

Sierau et al. 2015

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Low	Women were randomly assigned either to the treatment or to the control group (using Efron's biased coin design)
	Allocation Concealment	Unknown Risk	No specific information given with regards to allocation concealment
Performance Bias	Blinding of participants and Personnel	Unknown Risk	No specific information given with regards to blinding of participants or personnel
Detection Bias	Blinding of assessment outcome	Low	Researchers who were blind to the treatment condition collected data via face-to-face interviews and developmental tests in families' homes.
Attrition Bias	Incomplete Outcome data	High	At 24 months, mothers attrition rate was 54.8% within the intervention group and 53.5% within the control group
Reporting Bias	Selective Reporting	Low	Language outcomes are reported for the child - measured by both mothers ratings and child assessment
Other Bias			None

Schwarz et al. 2012

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Low	Once mothers gave consent to participate in the study in the presence of a trained staff member, a sealed envelope containing a card stating "Intervention" or "Control" was selected. The randomization envelopes were generated by a blinded staff member and were grouped in blocks of 20, to allow for relatively even distribution over the course of the recruitment/randomization process.
	Allocation Concealment	Low	As above - sealed envelopes used that had been generated by a blinded staff member

Performance Bias	Blinding of participants and Personnel	Unknown Risk	No specific information given with regards to blinding of participants or personnel
Detection Bias	Blinding of assessment outcome	Low	Follow-up blinded assessments were scheduled for completion at a research office when the children reached a target age of 33 months;
Attrition Bias	Incomplete Outcome data	Low	n=302 mothers were randomized to a treatment group; n=150 control group, n=152 intervention group. N=269 children completed the assessments at 33 months. Mothers attrition was n=33 mothers, 10.1%
Reporting Bias	Selective Reporting	low	Language assessment is reported as an outcome as measured using the Wechsler Preschool and Primary Scale of Intelligence–Third Edition (WPPSI-III) at Age 33 Months
Other Bias			None

Tomlinson et al. 2016

Bias Domain	Bias	Authors Judgement	Supporting information
Selection Bias	Random Sequence generation	Unclear Risk	Neighbourhoods were randomized. UCLA randomized neighbourhoods in six blocked sets of four neighbourhoods each, for 12 PIP neighbourhoods (n = 644) and 12 SC neighbourhoods (n = 594). Randomization process not explained
	Allocation Concealment	Unclear Risk	As above - no further details given
Performance Bias	Blinding of participants and Personnel	Unclear Risk	No specific information given with regards to allocation concealment
Detection Bias	Blinding of assessment outcome	High	Townswomen were trained to deliver the intervention and conduct the assessments, entering responses onto mobile phones. Supervisors provided weekly data feedback.
Attrition Bias	Incomplete Outcome data	low	n=1238 mothers recruited to the study (n=594 control group, n=644 intervention group). N=958 mothers completed assessment at 36 months, an attrition rate of 280 mothers - 22.6% (n=456 control group, n=502 mothers intervention group)
Reporting Bias	Selective Reporting	Low	Language outcomes are reported for intervention and control group
Other Bias			None

Appendix D

Characteristics at BL between the intervention and trial arms in the BABBLE sample

	BABBLE sample (N= 483)	FNP intervention arm (N=246)	Usual care arm (N=237)
Number of antenatal check-ups (mean, *SD*)	10.86 *(3.25)* (N=464)	10.85 *(3.21)* (N=237)	10.87 *(3.29)* (N=227)
Age at recruitment (years)			
Mother age (mean*, SD)*	17.91 *(1.22)*	17.97 *(1.19)*	17.85 *(1.25)*
Mother less than 16 years N (%)	32 (6.6)	14 (5.7)	18 (7.6)
Father age categories N (%)			
Under 16		9 (3.7)	
Between 16 and 24	14 (2.9)	212 (86.2)	5 (2.1)
Between 25 and 34	408	23 (9.3)	196
Over 34	(84.5)	1 (0.4)	(82.7)
Missing	56	1 (0.4)	33
	(11.6)		(13.9)
	2 (0.4)		1 (0.4)
	3 (0.6)		2 (0.6)
Ethnicity N (%)			
White background	436	219 (89.0)	217
Mixed background	(90.3)	18 (7.3)	(91.6)
Asian background	29 (6.0)	4 (1.6)	11 (4.6)
Black background	8 (1.7)	2 (5.0)	4 (1.7)
	10 (2.1)		5 (2.1)
Religion N (%)			
None	257	128 (52.2)	129
Christian	(53.2)	111 (45.3)	(54.4)
Muslim	211	3 (1.2)	100
Sikh	(43.7)	1 (0.4)	(42.2)
Other	9 (1.9)	2 (0.8)	6 (2.5)
Missing	1 (0.2)	0 (0.0)	0 (0.0)
	4 (0.8)		2 (0.8)
	1 (0.1)		1 (0.1)
Language in the home N (%)			
English only	469	239 (97.2)	230
English and other language(s)	(97.1)	6 (2.4)	(97.0)
Other language(s) only	12 (2.5)	1 (0.4)	6 (2.5)
	2 (0.4)		1 (0.4)
Number of people living with mother N (%)	31 (6.4)	23 (9.3)	8 (3.4)
None	388	191 (77.6)	197
1 to 4	(80.3)	31 (12.6)	(83.1)
5+	62	1 (0.4)	31
Missing	(12.8)		(13.1)
	2 (0.4)		1 (0.4)
Participant living with at least one parent N (%)	306	156 (70.3)	150
Yes	(68.0)	66 (29.7)	(65.8)

No	144 (32.0)		78 (34.2)
Highest parental qualification N (%)			
Up to postgraduate	79 (16.4)	36 (14.7)	43 (18.1)
Up to A-Level	110 (22.8)	25 (10.2)	57 (24.1)
Oversea or other	50 (10.4)	94 (38.4)	25 (10.5)
None of these qualifications	63 (13.0)	0 (0.0)	26 (11.0)
Don't know	180 (37.3)		86 (36.3)
Missing	1 (0.2)		1 (0.4)
NEET status* N (%)			
Yes	190 (39.3)	93 (37.8)	97 (40.9)
No	231 (47.8)	123 (50.0)	108 (45.6)
Participant age > 16 at baseline interview	62 (12.8)	30 (12.2)	32 (13.5)
Index of Multiple Deprivation Score (IMD score) (mean, *SD)*[†]	38.73 *(18.01)*	39.06 *(18.46)*	38.39 *(17.57)*
Ever been homeless N (%)			
Yes	84 (17.4)	44 (17.9)	40 (16.9)
No	399 (82.6)	202 (82.1)	197 (83.1)
Live with father of baby N (%)			
Yes	115 (23.8)	57 (25.7)	58 (25.4)
No	335 (69.4)	165 (74.3)	170 (74.6)
Missing	33 (6.8)	24 (9.8)	9 (3.8)
Relationship status with baby's father N (%)			
	6 (1.2)	2 (0.8)	4 (1.7)
Married	41 (8.5)	21 (8.5)	20 (8.4)
Separated	372 (77.0)	189 (76.8)	183 (77.2)
Closely involved/boyfriend	64 (13.3)	34 (13.8)	30 (12.7)
Just friends			

*Definition of NEET status: Not in education employment or training (applicable only to those whose age at the end of previous academic year at time of baseline interview was > 16).

[†]Higher IMD score indicates more deprivation. Mean IMD score for England in 2010 is 21.67 (Wilkinson, Dawn, Louise, Falko, Sniehotta, & Michie, 2011).

Comparing BABBLE intervention and control arms

Summary

Linear, binary logistic and multinomial regressions were used to test differences according to the type of outcome (continuous, dichotomous and categorical, respectively). Results from continuous outcomes are presented as difference in unadjusted means (Intervention minus control). Nominal

outcomes are presented as adjusted odds ratios (ORs) comparing the odds of an event in the intervention trial arm versus the control arm.

The only differences detected in the trial arms in were age of father at the time of recruitment, where fathers in the intervention arm were significantly younger than those in the control arm.

Checking children's performance on the ELM at 24 months, children in the FNP scored higher than those in the control arm, however the difference only trended toward significance.

Number of antenatal check-ups

There were no differences in the number of antenatal visits between the intervention and control arms in the BABBLE sample, mean difference = -0.02, 95% *CI*(-0.61-0.57), $p = 0.95$.

Age at recruitment

The samples were balanced according to maternal age at recruitment. No significant differences were found between the intervention and control arms for number of mothers who were less than 16 at the time of recruitment, *OR* =.73, *95% CI*(0.36-1.51), p=0.40. In terms of continuous variables, there were no differences in maternal age at the time of recruitment, mean difference = 0.12, *95% CI*(-0.10-0.34), $p = 0.28$. This was not however, the case for fathers; fathers in the intervention arm were significantly younger than those in the usual care arm, mean difference = -0.76, *CI*(-1.47- -0.05), $p < .05$.

Ethnicity

Inspection of the percentages showed no differences between trial arms in terms of ethnicity, $\chi^2(3) = 1.55$, $p = 0.67$.

	OR	95% CI for OR	p-value
Ethnicity			
White background	Reference category		
Mixed background	1.62	0.75-3.51	0.22
Asian background	0.99	0.25-4.01	0.99
Black background	0.99	0.28-3.47	0.99

Religion

As one participant in the BABBLE sample was Sikh, for the purpose of comparing the trial arms, this case was included in 'other religion'. There were no differences in religion between the intervention and control arms. Overall model, $\chi^2(3) = 1.67$, $p = 0.65$.

	OR	95% CI for OR	p-value

Religion			
None	Reference		
Christian	category	0.78-1.61	0.55
Muslim	1.12	0.12-2.06	0.34
Other	0.50	0.25-9.20	0.65
	1.51		

Language in the home

No differences were detected between the intervention and control arms for language(s) spoken in the home $\chi^2(2) = 0.005$, $p < 1.00$.

	OR	95% CI for OR	p-value
Language			
English only	Reference		
English and other	category	0.31-	0.95
language(s)	0.96	3.03	0.96
Other language(s) only	0.96	0.06-	
		15.48	

Number of people living with the mother

Table shows the categorical data. To test whether there were any differences in the mean number of people living with participant in the intervention arm (mean = 2.56, SD = 1.63) and control arm (mean = 2.66, SD = 1.58). No significant differences here found between the samples mean difference = -0.10, 95% *CI*(-0.38-0.19), p = 0.52.

Living with at least one parent

The intervention and control arms were balanced in terms of whether the mother was living with at least one parent, *OR* = 1.92, 95% *CI*(0.83-1.83), p = 0.31.

Highest qualification

No differences were detected in highest qualification between intervention and trial arms, overall model, $\chi^2(4) = 2.92$, $p = 0.57$.

	OR	95% CI for OR	p-value
Highest qualification			
Up to postgraduate	Reference		
Up to A-Level	category	0.62-1.98	0.72
Oversea or other	1.11	0.59-2.43	0.62
None of these	1.19	0.87-3.32	0.12
qualifications	1.70	0.77-2.22	0.33
Don’t know	1.31		

NEET Status

The samples were balanced according to NEET status. Of those who were > 16 years old at interview and had data available for the intervention (N=216) and control (N=205) arms there was no significant difference between the groups for number who met NEET status, *OR* = 0.84, *CI*(0.57-1.24), *p* = 0.38.

Deprivation score

The trial arms were balanced according to IMD score. There were no significant differences between the two groups, mean difference = 0.67, 95% *CI*(-2.56-3.91), *p* = 0.68.

Ever been homeless

The trial arms were balanced according to whether the mother had ever been homeless, *OR* = 0.93, *95% CI*(0.58-1.49), *p* = 0.77.

Living with father of baby

No differences were found between the trial arms in the number of mothers who were residing with the father of the baby, *OR* = 1.01, 95% *CI*(0.66-1.55), p = 0.95.

Relationship status with father of baby

No differences were found between the BABBLE and non-BABBLE samples in mother's relationship status with the father of the baby, $\chi^2(3) = 0.88$, *p* = 0.83.

	OR	95% CI for OR	p-value
Relationship with father of baby	Reference		
Married	2.10	0.35-12.76	0.42
Separated	2.07	0.37-11.42	0.41
Closely involved/boyfriend	2.27	0.39-13.27	0.36
Just friends			

Checking ELM between intervention and trial arms in BABBLE sample

	BABBLE sample (N= 483)	FNP intervention arm (N=246)	Usual care arm (N=237)
Early language milestones percentile score (mean, *SD*)	60.77 *(31.85)*	63.32 *(31.48)*	58.11 *(32.10)*

The difference between the FNP and control arms for ELM percentile scores trended toward significance, mean difference = 5.21, 95% *CI*(-0.64-11.05), p = 0.08.

Appendix E

Video reference number -

Coder -

Time		Dyad speech	Child gesture					
Minutes	Seconds	Maternal speech in normal font. ***Child speech bold and italicised.*** Additional information in brackets.	Deictic	Cncentional	Iconic	Intelligible speech & Gesture	Supplementary Gesture	Description of segment
0	05.-10							
0	10.- 15							
0	15- 20							
0	20- 25							
0	25- 30							
0	30- 35							
0	35- 40							
0	40- 45							
0	45- 50							
0	50- 55							
0	55- 60							
1	00- 05							
1	05-Oct							
1	Oct-15							

Appendix F

GESTURE CODING SCHEME

General guidance

- Gestures should be coded when the child's hands are empty of objects, as objects in hands can make identifying gestures problematic. However, if the child is holding an item and is clearly seen to be pointing, this this can be coded as a gesture.
- Do not code for functional or symbolic play that involve the use of an object. For example, do not code as a gesture if the child is brushing imaginary hair with a brush or drinking pretend liquid from a real cup.
- If a child is judged to be manipulating an object, then this is not counted as a gesture. Examples of manipulating an object can include pushing a soap dispense, banging a real drum, stacking cups, throwing a ball.
- Hand gestures that are part of songs are not included. For example, e.g. "itsy bitsy spider", "Heads, shoulders, knees and toes". But make a note of it in the coding sheet if it does happen.
- If you are unsure how to code a gesture, make a note of the video reference and the time of the gesture and this gesture can be revisited. Do not guess at the gesture. If you feel you are guessing, make a note and come back to it. It is better to be conservative in your coding process.
- Gestures that appear 'stuttered' should be scored as being one single gesture. For example, a child who holds their hand up for a 'high-five', brings it down slightly and then brings it back up is scored as making one conventional gesture.
- In order to be coded, all gesture behaviour must be in view and must meet the criteria set out in the coding scheme.
- Coding on the coding sheet is done so using numbers that represent the number of unique occurrences in which the child was observed performing that gesture within that five second time frame. You will notice at the bottom of the coding form that the totals for each gesture will be automatically calculated.

For example:

- A child who makes one iconic gesture within the five second time period (e.g. uses their hand to demonstrate how big something was) would be coded with the number '1' in the iconic column.
- A child observed making two deictic gestures (e.g. pointing at a table and then at a toy) would be coded with the number '2' in the deictic column.
- A child who points three times in rapid succession at the same item would only be scored with one deictic gesture as this would not be seen as three unique and separate gestures.

Deictic gesture	Iconic gesture	Conventional gesture
Pointing		
Where the child indicates a referent in their immediate environment, such as a concrete object, person or location. This is most commonly done so with a 'point' of the child's index finger. Showing an item is also coded as a deictic gesture. Code deictic gesture when you observe an extension of the child's index finger (or other finger that is seen as being separate from the other fingers which are either partially or entirely curled back) towards a referent. A deictic gesture can be coded whether the child touches the referent or not. Count as one deictic gesture for each different object or item the child points to (i.e. if the child points at numerous, but different items or objects in quick succession, then count each point as a gesture. For example, a child may point at four different animals in a book in rapid succession. In this case, this will count as	Illustrative gestures that convey the attributes or actions of an associated object via hand or body movements. Iconic gestures should be coded based jointly on the form of the gesture and the communicative context in which it occurs. Iconic gestures may occur with or without speech. The context in which the gesture is made could be around what mum and / or the child are talking about (including onomatopoeic sounds), a play scenario or an activity they are engaging in. Examples of iconic gestures are: The mother points at a picture of a bird and the child flaps their arms in the motion of a bird to convey flying. Mum asks "*What's this?"* and points to a picture of an elephant / holds up a toy elephant and child responds by moving their arm to their nose and moving it in a trunk like manner. Child waves their hands above their head whilst saying "splash" to convey splashing in water. Holding their fist to the ear to mean telephone	Have a form and meaning that are culturally defined. These gestures would be widely and easily recognised by most people. ***E.g.*** - Nodding head for 'yes' High Five Clapping Waving 'hello / goodbye' Blowing a kiss

four individual coded deictic gestures). Multiple points to the same object area in rapid, quick succession count as one single point. Count as one point if the child drags their finger extension point across an object. Count as one finger point if, in the same finger extension, the child moves their pointed finger in an arch shape, before landing their point in the object's direction.		
Deictic - Show ing		
A showing gesture is coded as a deictic gesture when the child holds up an object into the line of sight of another individual, whilst clearly looking at the object and / or face of the interactional partner. A showing gesture can be coded, whether the interactional partner takes the object from the child or not.		
Exclusions	Exclusions	
The index finger is being used to manipulate an object (for example, playing the piano, feeling the	If the child is thought to be (e.g.) splashing their hands, but neither the child, nor their caregiver was heard to say the word splash,	

texture or an object, pressing a button). Do not count palm points or outstretched fingers as deictic gestures as it is very difficult to distinguish between offers or reaches etc. Do not count pointing with an object in hand if there is no clear extension of the index finger. Offering or passing an object to their interactional partners hand is not to be coded.	water, swim etc., or there was no play context or activity around swimming or water. The child is holding an object that is in the context of pretend play. For example, the child is holding a physical brush in their hand when brushing a baby's hair. If the child starts hopping around the room, but there is no context such as a related animal (e.g. a frog) having been spoken about or seen. If the child appears to be moving their hands or arms in an apparently random context.

<u>Gesture-Speech combination</u>

<u>Gesture alone</u>

Coded when the child is observed to make a gesture without any accompanying utterance or vocalisation.

<u>Intelligible speech and gesture</u>

Coded when the child is heard to speak understandable words and make a gesture at the same time.

Verbal elements to gesture:

Supplementary gesture

A gesture that provides a different, but related piece of information about the object or person that is the subject of the gesture. For example:

The child pointing to a picture of a bird while saying "*nap*" to indicate that the bird in the picture is sleeping.

Child says "*all gone*" or "mummy juice" and holds up an empty cup.

Child says "*open*" and points to a jar with its lid on.

A child nods their head and says "I want that" or shakes their head and says "I've already got one"

A child points at clearly separate items whilst counting.

A supplementary gesture is coded when there is a gesture and word made in combination.

Appendix G

Dear Tom

I am writing to confirm the justification for your use of data from Building Blocks:

This is one example of further exploratory analysis being undertaken using data from the Building Blocks trial. The proposed analysis (both for the PhD and other analysis being supported under the ISSF grant) involves coding existing data using different rating measures to that in the primary trial report and then further comparative analyses. This then offers the opportunity for a more precise, appropriate or complementary assessment within the outcome domains identified in the original trial and as described in the original participant materials.

I have further discussed this matter with the Centre Director, Professor Kerry Hood who has confirmed the appropriateness of the use of these data.

If you have any further queries do let me know.

Bw Mike

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Appendix H

School of Psychology, Cardiff University

BABBLE: Baby and Adult Building Blocks Language Evaluation

Guidelines for Working with Data

The Baby and Adult Building Blocks Language Evaluation (BABBLE) holds confidential and sensitive data about the participants in the study. This data must be handled sensitively and carefully in accordance with ethical guidelines.

S Drive and Data files

Undergraduates, members of staff and doctoral students have access to the S Drive which contains data files. All databases and file names are anonymised with a unique ID so that each participant's data cannot be linked to identifying data about the participant or their group membership within the Randomised Control Trial (RCT).

Those who are working on the data will not have access to any identifying information, such as names or birthdays. It is essential that this is maintained:

1) When writing transcripts or coding from video data, do not include any identifying information in any documents. In the case of names, an alternative could be: [child name] [caregiver name].

2) No personal or identifying data should be written down or printed out. Ideally, do not print out transcripts or coding. Ask permission from your supervisor if you do think this is necessary and ensure that they do not have any identifying information on them. Copies of transcripts or coding should be locked in cabinets in 9.04 at the end of the day.

Although data files are anonymised, they still contain confidential information and should be handled sensitively:

1) Do not copy any files onto personal memory sticks or other portable storage.

2) If you are working with a memory stick provided to you by the team, ensure this is locked away at the end of each day. If working with a memory stick without access to the S drive, it is your responsibility to ask a member of the BABBLE team to back up your work.

3) Do not email files to other members of the team.

4) Do not save files onto the D drive (the hard drive) of the computer you are working on, as this can be accessed by anyone who logs on to the computer.

5) Do not save files onto the desktop of a computer. Not only is this not secure, but desktop is unstable and your files may not be there next time you log in.

6) Do not save files onto your personal space on the network (H drive).

7) Never upload any files to the internet for any reason.

Paper Files

If working with paper copies of questionnaires, these must be kept locked in the secure location (filing cabinet or cupboard).

1) Always return all questionnaires to the secure location at the end of each working session. Do not store them in any desk drawers.

2) Do not change or mark any original files unless expressly told by your supervisor.

Handling Video and Audio Files

The S drive contains video and audio files of children and their parents. Only BABBLE team members with permission can access these files.

1) Video and audio files must not be accessed in any location where they might be seen by individuals who are not on the BABBLE team. All members of the project will have a secure space where they can view the videos, in the booths on the 2nd floor, offices on the 9th floor, or in the CUCHDS post doc room. If you need to be assigned a room for coding, contact your supervisor.

2) Information obtained whilst transcribing or coding data should never be disclosed to anyone, this means the content should not be discussed with a family member, friends, colleagues or anyone outside the research team.

3) If, when accessing the video or audio data, you come across anything that concerns you, report it to your supervisor immediately.

4) If, when coding, an individual who is not on the BABBLE team enters the room, minimise the video.

General

1) During coding sessions, if you need to leave a room (and you are the only team member there), please lock your work station and close the door behind you.

2) Remember to log off at the end of the day.

3) If, for any reason, your access card goes missing, report it to ANONYMOUS@cardiff.ac.uk for it to be deactivated, and they will supply you with a new one. Their office is at the end of the corridor on the 4th floor of the Tower Building, Park Place.

4) If you have any questions regarding working with data on the BABBLE study, please ask your supervisor on the team.

I, _____, confirm that I have read and understood the guidelines for working with data on the BABBLE study.

Signed _____

Date _____