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**INEQUALITIES IN IMMUNISATION AND
BREASTFEEDING IN AN ETHNICALLY DIVERSE
URBAN AREA: CROSS SECTIONAL STUDY IN
MANCHESTER, UK.**

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ABSTRACT

Objectives. To examine inequalities in immunisation and breastfeeding by ethnic group and their relation to relative deprivation.

Design. Cross –sectional study.

Setting. Manchester, UK

Participants. 20,203 children born in Manchester (2002-7), who had been coded as of White, Mixed, Indian, Pakistani, Bangladeshi and Black or Black British ethnicity in the Child Health System database.

Main Outcome Measures. Breastfeeding at 2 weeks postpartum; uptake of Triple Vaccine (Diphtheria, Pertussis and Tetanus) at 16 weeks postpartum; uptake of the Measles, Mumps and Rubella Vaccine (MMR) by the age of 2.

Results. Black or Black British infants had the highest rates of breastfeeding at 2 weeks postpartum (89%), and South Asian infants had highest Triple and MMR vaccination rates (Indian, 95%, 96%; Pakistani 95%, 95%; Bangladeshi 96.%, 95%) after controlling for area level of deprivation, parity, parenthood status and age. White infants were least likely to be breastfed at 2 weeks postpartum (36%), and to be vaccinated with Triple (92%) and MMR vaccines (88%). Within the White ethnic group lower percentages of immunisation and breastfeeding were significantly associated with living in a deprived area and with increasing parity. This was not found within Black or Black British and Pakistani ethnic groups.

Discussion Practices that are protective of child health were consistently less likely to be adopted by White mothers living in deprived areas. Methods of health education and service delivery that are designed for the general population are unlikely to be successful in this context and evidence of effective interventions needs to be established.

INTRODUCTION

The uptake and adoption of preventative interventions by mothers of young children is a key component of public health policy to reduce child health inequalities in the UK.[1, 2] Immunisation and breastfeeding provide children with a healthy start in life, not least by protecting against infectious diseases; [3, 4] increasing rates of breastfeeding in disadvantaged groups is identified as an important step in actions to reduce inequalities in infant mortality.[5] **Key social and demographic indicators of disadvantage that are associated with lower uptake of immunisation and/or breastfeeding include lower socioeconomic status, lower level of education, teenage motherhood, single parenthood and multi parity.[6-8]**

Delivering interventions that have an impact on inequalities in practices that are protective of child health is a particular challenge in inner city areas of the UK with ethnically diverse populations, since Black and Ethnic Minority (BME) groups tend to be clustered in the most deprived neighbourhoods.[9] The extent to which ethnic group determines inequalities over and above those associated with poverty is thus fundamental to the equitable provision of preventative services in infancy and early childhood.

Influential evidence on the determinants of inequalities in health by ethnic group in adulthood has, in general, shown that the relationship between poorer health and membership of a BME group is explained by relative deprivation, given the concentration of BME groups in deprived areas and thus the effects of poverty and social disadvantage on their health.[10,11] Infant mortality rates (IMR) are currently used as the headline indicator to measure child health inequality in the UK and these

suggest some degree of health disadvantage in infancy associated with BME status.[12] In 2005 IMRs in both Pakistani and Caribbean ethnic groups were twice that of the White British group. However the extent to which IMR constitutes a reliable marker of child health inequality **in this context is questionable for two reasons. Firstly evidence suggests that high rates of infant mortality for women of Pakistani origin are associated with congenital anomalies and those for Caribbean women with very preterm births. These conditions are unlikely to be related to deprivation.**[13]

Secondly there are a relatively small number of infant deaths in this country. The rate of infant deaths was 5.00 per 1000 population in England in 2002-4 [5] ranging from 1.6 per 1000 live births to 11.9 per 1000 live births in the 354 local authority areas. Measurement problems with using small numbers are compounded when breakdown of the figures by ethnicity are considered, since BME groups constitute a relatively small proportion of the UK population (8% according to the 2001 Census).

In this paper we examine the extent to which deprivation is the common factor that explains inequalities both between and within ethnic groups across three contrasting preventative practices in childhood, uptake of Measles, Mumps and Rubella (MMR) vaccine, uptake of the Triple vaccine (Diphtheria, Pertussis and Tetanus) and breast feeding. In this endeavour we are focusing not directly on health itself, but on maternal behaviours that are health promoting. The relation between deprivation and adoption of such behaviours is likely to be mediated by factors as various as access to health care, beliefs about the efficacy of an intervention, cultural /social group norms and support networks. Interestingly, recent studies that focus on only one of these

three preventative practices, demonstrate higher rates of immunisation and breastfeeding for South Asian when compared with White infants, even when the confounding effect of relative deprivation has been taken into account, although there is less consistency for Black or Black British infants; some studies have found lower rates of immunisation for this group, compared with South Asian and White infants, although these have not consistently controlled for relative deprivation.[7, 8, 14-18] The study presented here builds on this evidence by comparing immunisation and breast feeding practice *between* White, Mixed, South Asian and Black or Black British ethnic groups for infants born in the city of Manchester, the 4th most deprived local authority in the UK, where in some areas BME groups constitute over one third of the population. In addition we examine the socioeconomic and demographic factors that are associated with variations in these practices *within* the three largest ethnic groups in this area - Black or Black British, Pakistani and White. No previous research has undertaken such a comparative analysis for a community based population.

METHODOLOGY

Data were drawn from the Child Health System database for the city of Manchester UK. These data were collected from two sources: 1. The formal notification of birth which contains mandatory information collected by the midwife immediately after the birth of all babies and includes basic demographic details of mother and child, previous obstetric history and birth details. 2. A Personal Child Health Record that is issued on the birth of every child by all the Manchester Primary Care Trusts. This document is the main record of the child's health, growth and development and is used by everyone involved in the care of the child from birth to school entry and

contains information about feeding practice and child immunisations from 8 weeks to 3-5 years. Each section of the Child Health Record is produced in triplicate with the top copy remaining in the Child Health Record and on completion, one copy is retained by the Health Visitor and the third copy returned to The Child Health Department for entry onto the database.

This study covers the period from 1/4/2002 and 31/3/2007 during which a total of 31521 births were recorded. However, this analysis is limited to 20,203 children born during the study period coded as being of White, Mixed, Indian, Pakistani, Bangladeshi and Black or Black British ethnicity in the Child Health System database. Together, these ethnic groupings make up approximately 97% of the city of Manchester population. The following variables were extracted from this database:-

Maternal Characteristics

Self report of ethnicity has been collected on this database since 2002, using a categorisation based on the 2001 Census. **The following are the ethnic group categories that were used as the basis for analysis by ethnic group in this study:**

- **White: this category includes White British, White Irish and any other White background.**
- **Mixed: this category includes White and Black Caribbean, White and Black African, White and Asian and any other Mixed background (e.g. Black and Asian, Black and Chinese, Black and White, Chinese and White, Asian and Chinese).**
- **Asian and Asian British. Data for Indian, Pakistani and Bangladeshi (South Asian ethnic groups) have been included from this category.**

- **Black or Black British. This category includes Black Caribbean, Black African, and any other Black background.**

Other maternal characteristics that have been used in this analysis are age (<17, 17-18, 19-25, 26-29 30-34, 35+) parenthood status (one parent family or not) and parity (no previous births, 1 previous birth, 2 previous births, 3 or more previous births).

The measurement of breastfeeding and immunisation

Breastfeeding at two weeks postpartum is recorded as ‘fully breastfed’, ‘partially breastfed’ or ‘not breastfed’. For this analysis the first two categories have been combined to produce the dichotomous variable ‘breastfed : yes/no’, **since the intention of the analysis was to establish the uptake of breastfeeding as a health promoting behaviour and its variation by ethnic group.** The Triple Vaccine immunisation against Diphtheria, Pertussis and Tetanus is offered to children 8, 12 and 16 weeks after birth. The Child Health System database records information on the children who have received all three inoculations as a single variable and this has been used to measure uptake (‘yes/no’). The Measles, Mumps and Rubella vaccine (MMR) is offered to children at 13 months, but can be administered up to the age of 2; this was the cut-off point for measurement of uptake.

The measurement of deprivation

Area level of deprivation was measured using the Income Deprivation Affecting Children (IDAC) Index that is a sub-set of the Income Deprivation domain of the English Index of Multiple Deprivation 2004.[19] The calculation of the IDAC index is based on the percentage of children under 16 who are living in families in receipt of Income Support and Income-Based Job Seekers Allowance or in families in receipt of Workers Families Tax Credit or Disabled Persons Tax Credit whose equivalised income is below 60% of the median, before housing costs.

Using IDAC scores for the constituent Lower Super Output Areas, the mean level of area deprivation for each of the 32 wards in Manchester was calculated and divided into quartiles. The most affluent wards in Manchester had a range of IDAC scores between 0.12 and <0.37; the 2nd quartile between >0.37 and <0.47 the 3rd quartile between >0.47 and < 0.54 and the least affluent quartile between >0.54 and 0.73. In the statistical analysis the 2nd and 3rd quartiles have been merged.

Data were anonymised at source. The Local Ethnic Committee agreed that in this circumstance ethics approval was not required for the study.

ANALYSIS

We first calculated the distribution of our sample by maternal age, parity, parenthood status, ethnic group and **area** level of deprivation using descriptive statistics. Logistic regression models were then used to examine the independent association of ethnic group with MMR uptake by 2yrs, Triple vaccine uptake by 16 weeks postpartum and breastfeeding at 2 weeks postpartum. The final analysis examined predictors of immunisation and breastfeeding *within* the main ethnic groups in Manchester – White, Pakistani and Black or Black British ethnic groups. The independent variables entered into logistic regression models were maternal age, parenthood status, parity and **area** deprivation level. Each of these variables was controlled for the others in the logistic regression models.

RESULTS

Table 1 shows that just under half of the sample lived in the most deprived areas of Manchester (43%). In addition 13% of the population were single parents, 1% were aged under 17 and 5% were aged between 17 and 18 years at the time of birth. The largest ethnic minority groups were Pakistani (15%) and Black or Black British (15%), with Whites constituting 51% of the sample.

Socioeconomic and demographic characteristics were differentially distributed across ethnic groups. 43% of White mothers and 51% of mothers with Mixed ethnicity lived in areas of high deprivation. But those most likely to live in these areas were of Black or Black British ethnicity (68%). In contrast, members of South Asian ethnic groups were more likely to live in more affluent areas. For example only 19% of Pakistanis lived in deprived areas. Single parenthood and teenage motherhood were most commonly characteristic of mothers of White (17%, 9% respectively), Mixed (18%,9%) and Black or Black British ethnicity (14%,5%), but were uncommon in South Asian ethnic minority groups. In terms of parity, members of Black or Black British, Pakistani and Bangladeshi ethnic groups were more likely to have larger families with two or more previous births (38%, 35%, 41% respectively) compared to White mothers (25%).

Table 1: Maternal characteristics of the sample by ethnic group

	All Ethnic groups		White				Mixed				Black or Black British			
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Ethnicity	20203	100	11088	51	1461	7	3280	15	541	3	650	3	3183	15
Single Parent														
No	15997	87	8436	83	1093	82	2952	98	501	99	612	99	2403	86
Yes	2464	13	1746	17	248	18	61	2	3	1	6	1	400	14
Total	18461	100	10182	100	1341	100	3013	100	504	100	618	100	2803	100
Age														
<17	230	1	176	2	25	2	3	0	0	0	1	0	25	1
17-18	1045	5	764	7	97	7	52	2	0	0	5	1	127	4
19-25	6976	34	3936	36	521	36	1160	36	134	25	297	46	928	30
26-29	4322	22	2011	18	295	20	913	28	209	39	164	25	730	23
30-34	4486	23	2421	22	285	20	758	23	138	26	129	20	755	24
35+	2971	15	1728	16	229	16	354	11	51	10	50	8	559	18
Total	20030	100	11036	100	1452	100	3240	100	532	100	646	100	3124	100
Parity														
Primiparous	8027	42	4634	43	639	46	1094	35	278	54	191	30	1191	46
One previous birth	5865	30	3318	31	420	30	948	30	146	28	181	29	852	33
Two previous births	3009	15	1536	14	193	14	621	20	59	11	139	22	461	18
Three + previous births	2519	13	1226	11	148	11	482	15	36	7	117	19	510	20
Total	19420	100	10714	100	1400	100	3145	100	519	100	628	100	3014	117
Deprivation*														
Least deprived quartile	5505	27	3170	29	311	21	1367	42	171	32	205	32	281	9
2nd quartile	3747	19	1775	16	258	18	961	29	122	23	143	22	488	15
3rd quartile	2285	11	1355	12	153	10	338	10	71	13	113	17	255	8
Most deprived quartile	8666	43	4788	43	739	51	614	19	177	33	189	29	2159	68
Total	20203	100	11088	100	1461	100	3280	100	541	100	650	100	3183	100

*2nd and 3rd quartile scores have been merged for the purposes of statistical analysis into one interquartile' category

For health promoting behaviours, in the sample as a whole 90% of children had been MMR vaccinated, 93% had received all three courses of the Triple vaccine and 58% were breastfed at 2 weeks postpartum. Table 2 shows that there were distinct patterns of MMR/Triple uptake and breastfeeding for the largest ethnic groups. White babies were least likely to have had the MMR vaccine (88%) and infants from Indian, Pakistani and Bangladeshi ethnic groups were most likely to have been vaccinated (96%, 95%, 95%).

The lowest uptake rate for the Triple vaccine was observed for White (92%) and Mixed ethnicity (91%) and highest for Indian (94%), Pakistani (95%) and Bangladeshi (96%) ethnic groups.

Breastfeeding was most common amongst Black or Black British mothers (89%). Over two thirds of women in South Asian ethnic groups were breastfeeding at two weeks postpartum; the highest percentage was for Indians (85%). In contrast only 36% of White mothers were breastfeeding at this time, although this figure was higher for women of Mixed ethnicity (58%).

Table 2: Immunisation uptake and breastfeeding for White, Mixed, South Asian and Black/Black British ethnic groups

Ethnic Groups	Uptake			Odds Ratios			
	<i>N</i>	Total	(%)	Unadjusted Odds Ratio (95% CI)	P	Adjusted ** Odds Ratio (95% CI)	P
Uptake of MMR vaccine*							
All ethnic groups	10,106	11,261	(90)				
White	5,600	6,392	(88)	1		1	
Mixed	759	846	(90)	1.23 (0.98-1.56)	0.08	1.28 (0.99-1.64)	0.06
Pakistani	1,716	1,802	(95)	2.82 (2.24-3.55)	<.001	2.84 (2.20-3.65)	<.001
Indian	281	294	(96)	3.06 (1.74-5.36)	<.001	3.00 (1.58-5.67)	0.002
Bangladeshi	354	373	(95)	2.64 (1.65-4.21)	<.001	2.71 (1.67-4.40)	<.001
Black/Black British	1,396	1,554	(90)	1.25 (1.04-1.50)	0.02	1.52 (1.24-1.86)	<.001
Uptake of Triple Vaccine							
All ethnic groups	18,818	20,203	(93)				
White	10,236	11,088	(92)	1		1	
Mixed	1,330	1,461	(91)	0.85 (0.70-1.03)	0.09	0.80 (0.65-0.99)	0.04
Pakistani	3,121	3,280	(95)	1.63 (1.37-1.94)	<.001	1.78 (1.47-2.16)	<.001
Indian	511	541	(94)	1.42 (0.98-2.06)	0.07	1.22 (0.81-1.83)	0.35
Bangladeshi	626	650	(96)	2.17 (1.44-3.28)	<.001	2.60 (1.68-4.02)	<.001
Black/Black British	2,994	3,183	(94)	1.32 (1.12-1.55)	<.001	1.58 (1.31-1.91)	<.001
Breastfeeding at 2 weeks postpartum							
All ethnic groups	5,008	8,946	(58)				
White	1,700	4,677	(36)	1		1	
Mixed	363	631	(58)	2.37 (2.00-2.81)	<.001	3.00 (2.49-3.65)	<.001
Pakistani	1,097	1,528	(72)	4.46 (3.93-5.06)	<.001	4.53 (3.94-5.23)	<.001
Indian	211	248	(85)	9.99 (7.01-14.2)	<.001	8.40 (5.78-12.2)	<.001
Bangladeshi	247	294	(84)	9.20 (6.70-12.6)	<.001	10.51 (7.58-14.5)	<.001
Black/Black British	1,390	1,568	(89)	13.6 (11.6-16.2)	<.001	16.35 (13.5-19.7)	<.001

* Take up of MMR restricted to the number of children who were at least 2 years old at the time the database was compiled

** Adjusted for area level of deprivation, parity, parenthood status and age

Table 3 shows that for White mothers, living in a deprived area was significantly associated with lower uptake of the MMR and Triple vaccines and breastfeeding at two weeks postpartum. There were no significant relationships between these outcome measures and area level of deprivation for Pakistani mothers. Black or Black British mothers were significantly more likely to be breastfeeding at two weeks postpartum, if they lived in a deprived area (OR=2.41, 95% CIs= 1.51-3.86, $p<0.001$).

Multiparity was also a strong independent predictor of lower uptake across all three measures for White women only, with the likelihood of MMR and Triple vaccination and breastfeeding decreasing with increasing parity.

White women who were single parents were significantly less likely to breast feed than those with partners (OR=0.58, 95% CIs=0.46-0.74, $p<0.001$). The latter was also the case for Black or Black British mothers (OR=0.58, 95% CIs=0.35-0.89, $p<0.02$).

Younger White mothers, particularly those aged 25 or under, were significantly less likely to take up the Triple vaccine and to breastfeed at two weeks post partum when compared with older mothers (>35yrs). There was no similarly consistent relationship between age and uptake of vaccination for Pakistani and Black or Black British mothers.

Table 3: Independent predictors of immunisation and breastfeeding within White, Pakistani and Black or Black British Ethnic groups.

		White OR (95% CIs)	Pakistani OR (95% CIs)	Black/Black British OR (95% CIs)
MMR Uptake				
Single Parent	No	1	1	1
	Yes	0.93 (0.72-1.20)	0.61 (0.18-2.06)	0.70 (0.45-1.11)
Age	35+	1	1	1
	<17	0.62 (0.33-1.19)	-	0.94 (0.05-19.6)
	17-18	0.69 (0.46-1.04)	0.50 (0.08-2.83)	1.27 (0.23-6.98)
	19-25	0.78 (0.60-1.01)	1.01 (0.38-2.68)	1.37 (0.36-5.17)
	26-29	1.01 (0.77-1.34)	0.96 (0.37-2.51)	1.28 (0.35-4.72)
	30-34	1.14 (0.88-1.48)	0.69 (0.28-1.67)	1.46 (0.40-5.28)
Parity	primiparous	1	1	1
	one previous birth	0.60 (0.49-0.75)***	1.02 (0.56-1.87)	0.70 (0.37-1.32)
	two previous births	0.46 (0.36-0.59)***	1.34 (0.62-2.87)	0.78 (0.34-1.75)
	3+ previous births	0.26 (0.20-0.34)***	0.81 (0.37-1.72)	0.87 (0.31-2.41)
Deprivation	least deprived quartile	1	1	1
	interquartile	0.88 (0.69-1.11)	0.74 (0.44-1.26)	0.78 (0.26-2.31)
	most deprived quartile	0.69 (0.55-0.85)***	0.67 (0.36-1.28)	0.82 (0.30-2.22)
Triple Uptake				
Single Parent	No	1	1	1
	Yes	1.01 (0.82-1.23)	1.51 (0.36-6.24)	0.76 (0.49-1.22)
Age	35+	1	1	1
	<17	0.25 (0.14-0.47)***	-	0.41 (0.08-1.99)
	17-18	0.40 (0.27-0.60)***	1.15 (0.25-5.33)	0.93 (0.33-2.65)
	19-25	0.50 (0.39-0.64)***	1.42 (0.78-2.57)	0.75 (0.43-1.31)
	26-29	0.77 (0.59-0.99)*	1.49 (0.84-2.64)	0.85 (0.48-1.49)
	30-34	0.99 (0.81-1.56)	1.87 (1.05-3.31)*	0.85 (0.50-1.45)
Parity	primiparous	1	1	1
	one previous birth	0.45 (0.36-0.57)***	0.84 (0.53-1.33)	0.88 (0.57-1.37)
	two previous births	0.30 (0.23-0.39)***	0.87 (0.51-1.50)	0.72 (0.43-1.23)
	3+ previous births	0.14 (0.08-0.17)***	0.57 (0.32-1.02)	0.62 (0.37-1.08)
Deprivation	least deprived quartile	1	1	1
	interquartile	0.83 (0.65-1.04)	1.01 (0.69-1.48)	1.09 (0.58-2.01)
	most deprived quartile	0.73 (0.58-0.90)**	1.21 (0.73-2.02)	1.33 (0.75-2.34)
Breast feeding (2 weeks postpartum)				
Single Parent	No	1	1	1
	Yes	0.58 (0.46-0.74)***	2.02 (0.68-5.99)	0.58 (0.35-0.89)*
Age	35+	1	1	1
	<17	0.07 (0.03-0.18)***	-	0.70 (0.13-3.79)
	17-18	0.07 (0.04-0.11)***	0.48 (0.17-1.30)	1.08 (0.40-2.96)
	19-25	0.19 (0.15-0.23)***	0.85 (0.55-1.29)	0.73 (0.43-1.24)
	26-29	0.49 (0.39-0.61)***	1.03 (0.68-1.56)	1.47 (0.82-2.66)
	30-34	0.75 (0.60-0.92)**	1.30 (0.86-1.97)	1.10 (0.64-1.88)
Parity	primiparous	1	1	1
	one previous birth	0.59 (0.50-0.69)***	0.85 (0.63-1.56)	1.33 (0.87-2.03)
	two previous births	0.44 (0.36-0.55)***	0.89 (0.63-1.26)	0.95 (0.57-1.59)
	3+ previous births	0.20 (0.15-0.26)***	0.69 (0.46-1.03)	1.23 (0.69-2.19)
Deprivation	least deprived quartile	1	1	1
	interquartile	0.56 (0.47-0.67)***	1.25 (0.97-1.63)	1.62 (0.97-2.71)
	most deprived quartile	0.43 (0.36-0.51)***	1.32 (0.95-1.83)	2.41 (1.51-3.86)***

* p<0.05; ** p<0.01; *** p<0.001

DISCUSSION

Principal Findings

The health disadvantage of White infants living in deprived areas

This research **shows** that ethnicity is **associated with important variations** in the practice of health promoting behaviours in infancy and that differences between ethnic groups remain after area level of deprivation has been taken into account. In this study Black or Black British infants were most likely to be breastfed and Pakistani and Bangladeshi infants most likely to be vaccinated with both MMR and Triple vaccines. Immunisation and breastfeeding were lowest for White infants.

This study exposes the unique disadvantage of children born to White mothers living in deprived areas. These mothers were more likely to be single parents or teenage mothers – both of which are indicators of social exclusion – but infants were also less likely to be breastfed and to be vaccinated. Typically uptake of immunisation and breastfeeding initiation became less likely with each new child that was born into a family. The health impact of socioeconomic disadvantage is thus compounded for White infants by lower adherence to practices conferring a health advantage. Most notably, this is not the case for Black or Black British infants whose chance of being brought up in a deprived area was even greater than that of the White infants in this sample. Within this ethnic group there were no significant associations between lower rates of breastfeeding and immunisation and **area** level of deprivation; this was also the case for Pakistanis, although these mothers were less likely to live in deprived areas.

Strengths and Weaknesses of Study Design

One of the main strengths of the study is its location in an inner city area with an ethnically diverse population. This enabled a breakdown of the BME sample into subgroups with substantial numbers that allowed for the analysis of inequalities within – as well as between ethnic groups. **In order to maximise numbers for within group analyses, Black or Black British ethnicity was not disaggregated into its constituent ethnic groups. In this sample the majority of people in this category were Black African (64%), 19% were Black Caribbean and the remaining 17% were from ‘any other Black background’. There were no significant differences in immunisation uptake between these groups although Black African women were significantly more likely to breastfeed (92% breastfeeding at two weeks postpartum) compared with Black Caribbean women (79% breastfeeding at two weeks postpartum).**

The location also enabled a test for the confounding effect of deprivation in an area which is the 4th most deprived local authority in England.

Access to routinely collected statistics on immunisation and breastfeeding enabled a comparison of patterns of uptake by ethnic group across three outcome measures. Previous studies have focused on single outcomes only.

The poor coding of ethnic group in routinely collected data sources is a common problem for research in the UK.[20,16,15] In the time period covered by this study (2002 – 2007) almost a third of entries on the Child Health System database were incomplete for ethnicity (9846/31521). Analyses of possible bias indicated that a large proportion of the missing values emanated from an area of Manchester with a predominantly White population and with no significant movement of BME groups

into the area between the 1991 and 2001 Census. When the investigators compared the distribution of the sample by ethnicity with 2001 Census data for Manchester for children aged 0-4 it was clear that the missing values led to an under estimation of White ethnicity as a percentage of the total population and an overestimation of BME groups, particularly Black or Black British infants (Supplementary Table 1), **although it is also a possibility that the sample in the Child Health System database is indicative of a trend towards the decline of the White population in ethnically diverse inner city areas and the increase of ethnic minority populations.[21]** Following the assumption that the missing values were predominantly of White ethnicity did not significantly alter the demographic profile of the sample White population in terms of gender, age or parity (Supplementary Table 2). However it did indicate that those with missing ethnicity codes were less likely to be deprived and more likely to breastfeed than the White study sample. Including these values as 'White' would decrease the % living in deprived areas from 43% to 39% and increase those breastfeeding by 5%.

Entry of breastfeeding data onto the Child Health System database was also poor, with only 8946/20203 records for breastfeeding at 2 weeks postpartum. However the reliability of the findings are enhanced by replicating the results at another time point, for breastfeeding at initiation (Supplementary Table 3). Tests for representativeness revealed that there were no significant differences by ethnic group or by area of deprivation between the characteristics of the whole sample and the missing values sample for breastfeeding at two weeks postpartum. **It is therefore unlikely that missing values were a source of bias in the study. Moreover the numbers available for analyses of breastfeeding by ethnic group are more substantial than those of**

comparable studies based on the UK populations, in which breastfeeding data are based on retrospective self report.[8, 22]

A further limitation of this study is that deprivation was measured at the area level rather than using individual level measures of socio economic or educational statuses, which were not available on the Child Health System database. Some proxies of social disadvantage at the individual level such as teenage motherhood and single parenthood were however available and these display similar trends to findings based on area level of deprivation.

Interpretation of results

Socioeconomic and cultural context of health promoting behaviours in infancy

The fact that patterns of association between immunisation and breastfeeding and relative deprivation within the White ethnic group do not generalise to Black or Black British and Pakistani ethnic groups suggests that the role of relative deprivation as a determinant of such behaviours is dependent on the extent to which other possible explanatory factors such as access to health care, beliefs about the efficacy of immunisation and breastfeeding, cultural/social norms and support networks vary according to socioeconomic status. For example a qualitative study that explored decisions about infant feeding method for mothers living in deprived areas in the UK found a characteristic set of norms and values associated with breastfeeding that were embedded in support networks.[23] Mothers were prepared to give breastfeeding a ‘go’, but there was a strong expectation of difficulties and even failure. Expertise and confidence with bottle feeding was more widespread amongst support networks of family and friends and women relied strongly on this advice in the transition from

hospital to home. A recent cross - cultural study of breastfeeding initiation comparing ethnic groups in the UK and the USA also concluded that the relationship between socioeconomic status and infant feeding practice is strongly influenced by the cultural/social context. Kelly et al [22] found that the advantage shared by black and other ethnic minority groups in the UK with regard to breastfeeding was not observed in the US, where the lowest rate of breastfeeding was found amongst disadvantaged non-Hispanic Black mothers.

Similar conclusions can be drawn from the higher immunisation rates for South Asian infants.[16,24] For example the higher uptake of MMR vaccine for mothers of South Asian ethnicity has been attributed to trust in the judgment of health professionals, a tradition of belief within communities in the protective effect of child immunisation and language barriers leading to a lack of awareness of the debate about the safety of MMR.[16] **The health advantage for infants from South Asian ethnic groups could also relate to the selective migration of healthier women of childbearing age whose positive attitudes towards child protection are drawn from practices in their country of origin.[13] South Asian communities in Manchester increased by half from the 1991-2001 Censuses, with the largest increase in the Pakistani ethnic group.[21]**

Policy Implications

The advent of the NHS was marked by improvements in maternal and child health that were the consequence of preventative services that reached the poorest people in the UK population. The problem identified in this study is that, particularly for White infants living in deprived inner city areas in the UK, the health effects of

socioeconomic disadvantage are compounded by less than optimum adherence to practices that are protective of child health. Reliance on methods of health education and service delivery that are designed for the general population are unlikely to be successful in this context, but the evidence base of interventions developed specifically for disadvantaged populations is sparse and characterised by small scale studies.[25] In general the evidence that does exist suggests that methods of service delivery that take into account the social and cultural context of mothers living in deprived areas are more effective in increasing preventative practice. For example peer support in the community has been found to increase breastfeeding for low income women and adolescent mothers and non – professional voluntary support to improve immunization uptake in deprived communities.[26-28],[25, 29-32]

This study identified ethnic inequalities in uptake of immunisation and breastfeeding initiation that favoured BME groups and that were independent of relative deprivation; this has implications for the targets set by the Department of Health for monitoring change in child health inequalities. The findings of our study suggest that figures for breastfeeding initiation and immunisation are likely to be inflated in deprived areas by the presence of South Asian and Black or Black British ethnic minority groups and changes over time could reflect the mobility of these populations rather than the impact of policy interventions. A similar picture would emerge for rates of immunisation. Coding for ethnic group membership is not as yet common practice in routinely collected Child Health data and the poor quality of record completion has been noted elsewhere.[16] And yet these data are essential for monitoring inequalities in uptake of preventative interventions in infancy and early childhood.

In the UK change in child health inequalities is currently monitored using the headline indicator of 'a reduction of at least 10% in the gap in infant mortality between manual groups and the population as a whole by 2010'.^[5] The extent to which this constitutes a marker of child health advantage and disadvantage that is useful for locality based policies is questionable, particularly in deprived inner city areas with ethnically diverse populations.

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WHAT THIS PAPER ADDS

What is already known on the subject

- There is acceptance that inequalities in health by ethnic group are, in general, explained by relative deprivation.
- A review of the evidence focusing on interventions that are protective of health in early childhood suggests the independent effect of ethnicity as a source of inequality.

What this study adds

- This study compares three interventions - uptake of MMR, Triple Vaccine and breastfeeding - across ethnic groups taking into account the potential confounding effect of relative deprivation.
- It demonstrates that only for the White ethnic group is lower uptake of immunisation and breastfeeding consistently associated with deprivation and that for this group the likelihood of uptake of all three interventions decreases with increasing parity.
- Equitable provision of preventative services in early childhood needs to take account of both ethnicity and deprivation as sources of inequality.