Bradford District Infant Mortality Commission

Summary Report

Contents

Foreword 3

Summary of Conclusions 5

Summary of Recommendations 7

Understanding Infant Mortality in Bradford District 20

Population of Bradford District 22

Exploring the Evidence
- Infant Mortality and Deprivation 26
- Other factors 30
- Causes of Death 35

Appendix 1
- Checklist for Woman Centred Approach 38

Appendix 2
- List of Commission Members 40

Appendix 3
- Summary Table of Statistics 41

The full work of the Commission and evidence presented is available on the Bradford Infant Mortality website: **www.bdimc.bradford.nhs.uk**

Cover photography supplied courtesy of:

NATIONAL ELECTRONIC LIBRARY FOR HEALTH; PUNCHSTOCK; and MARK THOMAS / HELEN MCARDLE / SCIENCE PHOTO LIBRARY.

Summary Report published December 2006.

Foreword

Ninety-nine per cent of the babies born each year in Bradford District survive and live beyond their first year. This report focuses on the remaining one per cent (60-70 babies), who are born alive each year but who die before their first birthday. Each of these infants represents a personal tragedy to the families concerned and the Commission has been mindful of this as it undertook its work.

For nearly two years, the independent Commission, chaired by a lawyer and made up of bereaved mothers, politicians, members of voluntary organisations, health and other public service professionals took evidence, commissioned an extensive analysis of local data and sifted through reams of information. Their aim was to address these questions:

- **Why do proportionately more babies die in their first year of life in Bradford District than the average for England?**
- **What action are we already taking and what more needs to be done?**
- **What recommendations should the Commission make to individuals, communities, organisations and services so that we can reduce even further the number of such deaths in Bradford?**

Concern about the level of infant deaths in Bradford is not new. A number of reports have been produced, the first in 1915 and then a series from 1960 through to this present report. That we are still trying to solve this distressing problem, almost a century after the first report was published, powerfully underlines just what a complex issue infant mortality remains. Nonetheless, as figure 1 on page 20 shows, gigantic strides have been made over the last century.

In 2001, the Government introduced its National Strategy Action Plan for Neighbourhood Renewal. This action plan aims to narrow the gap between the most deprived neighbourhoods and the rest over a ten year period. A series of 'floor targets' have been set in relation to health, crime, education, worklessness, housing and environment. These targets are meant to be the minimum standard below which no neighbourhood should fall. One of the floor targets is concerned with infant mortality:

- By 2010 to reduce inequalities in health outcomes by 10 per cent as measured by infant mortality and life expectancy at birth
- Starting with local authorities, by 2010 to reduce by at least 10 per cent the gap between the fifth of areas with the lowest life expectancy at birth and the population as a whole

Bradford Vision, the Local Strategic Partnership for the District, has responsibility for ensuring that we achieve these floor targets. Despite a great deal of hard work, recent progress towards preventing babies' deaths has been slow and nobody is sure exactly why this is. It was for this reason that the Commission was established in 2004.

Foreword

The work of the Commission confirms that if we are going to make significant improvements in the current health of the infants born in Bradford District, then it is a task for everyone. The mental and physical health of the mother; the quality of the housing to which the new-born baby is taken from hospital; the income of the new family; and the support provided to them by their families, communities and public services are just some of the factors that are vital if babies are to survive and thrive.

Factors such as these illustrate well why this is a task for all the partners and partnerships of Bradford Vision. The number of births each year is rising, currently it is 8,000 per year, and the prediction is that the infant mortality rate will at least remain at its current level if no further action is taken. This is not an option.

Preventing infant mortality is not a task for health professionals alone, hence this summary. It has been written to help people understand the issues so that they can decide what action they can take - as individuals, as families and communities, through the services provided across all sectors - to help reduce the numbers of untimely deaths.

The Commission's work has been challenging. At times it seemed that every time a question was asked, the answers simply threw up another set of questions! The Commission is grateful therefore for the specialist expertise of the following organisations and individuals who gave generously of their personal as well as professional time: Sadie Binns, Helen Brown and the Bradford Health Informatics Team, Dr Ann Hobbiss, Dr Liz Kernohan, Dr Jenny Kurinczuk, Dr Sam Oddie, Julia O'Hara, Professor Alison MacFarlane, Dr Nadira Mirza, and Jan Smithies.

Thanks also to Fiona Clark, Eleanor Green, and Dr Dee Kyle who gave invaluable support, and the four former Bradford Primary Care Trusts that, along with Bradford Vision, provided funding for the Commission.

Elaine Appelbee

Elaine Appelbee

Chief Executive, Bradford Vision.
December 2006

Summary of Conclusions

The report of the 2004-06 Commission is the latest in a line of studies that have been carried out over the years into Bradford District's higher than average infant mortality rates. The first was produced in 1915 and the majority of the others from the 1960s to the present day.

As the number of women of Pakistani-origin grew in the 1960s it has been possible since then to study two populations, as the Commission has done in this report i.e. the white population and the Pakistani-origin population. The numbers of women from other ethnic minority communities are too small to study at whole population level (see page 25).

A constant pattern of findings has emerged through all the studies:

- Bradford (now Bradford District) has had a consistently higher than average infant mortality rate throughout its history whatever the population mix
- Socio-economic status is strongly associated with that rate for all mothers
- Babies born to Pakistani-origin mothers are twice as likely to die in their first year of life compared with babies born to white mothers as a whole

This pattern is confirmed again by the work of the 2004-06 Commission.

The Commission concluded that:

- Poverty and disadvantage remain strongly associated with infant mortality for both populations. If all babies born into the most deprived fifth of neighbourhoods did as well as those born into the least deprived fifth, infant mortality in Bradford District would drop by 78%
- 88% of Pakistani-origin babies and 41% of white babies are born into the most deprived two fifths of neighbourhoods
- Babies born to all mothers living in the most deprived fifth of neighbourhoods are five times more likely to die in their first year of life compared to babies born to mothers in the least deprived fifth
- In order to lower the number of infant deaths, deprivation has to be tackled across all the seven factors which are accepted by central government as playing a part in multiple deprivation **(Recommendations 1-5)**
- The infant mortality rate for babies born in Bradford within the nationally derived most deprived quintile of deprivation, is significantly higher compared to babies born into the same level of deprivation in England and Wales.
  Therefore deprivation alone does not provide the whole explanation for Bradford District's high rates of infant mortality **(Recommendations 6-8)**
- For both populations, a reduction in the number of very low birthweight babies would significantly reduce the number of babies who die in their first year of life **(Recommendations 1-5)**

Summary of Conclusions

For particular populations:

- Pre-term birth, younger teenage motherhood, smoking, alcohol and non-prescription drug use are greater risk factors for the white population, than for the Pakistani-origin population **(Recommendations 1, 3, 4, 5, 6, 8)**
- Babies born to Pakistani-origin mothers are still twice as likely to die in the first year of life compared with babies born to white mothers as a whole. This may be explained by their over-representation in the most deprived fifth of neighbourhoods and the additional associated risks of low birthweight and congenital anomalies
- Congenital anomalies, particularly autosomal recessive disorders, are significantly more likely to be the cause of death for Pakistani-origin infants than for white infants. The risk of being affected by an autosomal recessive disorder is still relatively small, but if affected the outcome can be fatal **(Recommendation 7)**
- Early, good quality ante-natal care is important for all pregnant women, but particularlly important for some groups which include pregnant women who are diabetic or at risk of developing diabetes in pregnancy; and pregnant women living in the most deprived two fifths of neighbourhoods

To note:

- More of Bradford District's older babies (post neonatal) die of infections than the average for England and Wales **(Recommendations 3b and 4)**
- The deaths from 'other conditions' and 'congenital anomalies' need more investigation and would benefit from more accurate recording of the cause of death **(Recommendations 9 and 10)**

Summary of Recommendations: Ten Priority Areas for Action

Detailed below are ten priority areas for action identified from the analysis of evidence presented to the Commission. In the view of the Commission, these are areas for action necessary to reduce the incidence of infant mortality in Bradford District. The list includes areas for action to tackle the social conditions that adversely affect infant health.

In order for the recommendations to be implemented, the help of individuals, communities, public and voluntary organisations and the private sector will be necessary.

The Commission wishes to acknowledge the huge amount of work already taking place across the District to improve the quality of life for people, especially for those living in the most deprived communities. Glimpses of this work are given through the examples alongside the recommendations. For details about the wider work that is being undertaken to tackle deprivation, the Commission refers readers to Bradford Metropolitan District Council and Bradford Vision, both of which gather information and data about this work.

Nonetheless more still needs to be done, especially in terms of targeting mothers and infants most at risk. In responding to these recommendations we are asking partners and partnerships to:

- Assess the effectiveness of current work
- Identify any gaps that still require action
- Decide how they can work separately or together to address them

The recommendations are in two parts:

- The first group of recommendations is set out below within this Summary Report and provides broad objectives for improvements in ten of the wider influences on infant health and survival
- The second group of recommendations are more specialised, aimed at specific partners or organisations and can be found in the Technical Report on the website

The ten priority areas for action in summary:

In relation to the impact of deprivation on infant mortality:

1. Reducing poverty and unemployment
2. Improving housing and the social environment of Bradford District's residents
3. Improving the nutrition of mothers and babies (including breastfeeding)
4. Ensuring access to appropriate health care
5. Ensuring appropriate social and emotional support for parents

In relation to factors that contribute to infant mortality for specific groups of our population:

6. Reducing the number of women who smoke or have high levels of use of alcohol and/or non-prescribed drugs in pregnancy
7. Developing a better understanding of the impact of genetics and strategies for empowering families to deal with genetic risk
8. Ensuring these recommendations are shared widely and understood by communities across the Bradford District

In relation to the actual causes of death:

9. Developing further the data collection and monitoring procedures in Bradford District
10. Continuing the research to understand the links between the underlying and immediate causes of death

Summary of Recommendations: Ten Priority Areas for Action

Recommendation 1: To reduce poverty and unemployment in families in Bradford District

The Commission has been made aware of the high proportion of babies born in Bradford District who live in the most deprived areas as measured by the Index of Multiple Deprivation for England and Wales [1].

The Commission is also aware of the association between this multiple deprivation and infant mortality in Bradford District as shown in the data analysis report and as observed in England and Wales as a whole [2].

In line with Bradford District's Community Strategy, higher levels of educational achievement and meaningful employment are considered key to reducing levels of deprivation, teenage pregnancy and poor maternal health in Bradford District.

The Commission endorses the work currently being undertaken by the strategic partnerships of Bradford Vision to narrow the gap between the most deprived neighbourhoods and the rest.

It recommends that:

- This work is reviewed by the partnerships to ensure that the actions being taken are accelerating progress
- Particular attention is paid to increasing levels of educational attainment and increasing opportunities for meaningful employment

1 www.bdimc.bradford.nhs.uk
Analysis and Interpretation of infant mortality data: prepared on behalf of the IMC by the Bradford Health Informatics Service

2 www.bdimc.bradford.nhs.uk
Trends and variations in births and infant mortality in England and Wales: prepared on behalf of the IMC by Professor Alison Macfarlane

Case Study

Bradford has been chosen as one of only three cities in the country to pilot Fair Cities, an employer-led initiative aimed at increasing employment rates in the most disadvantaged areas. Fair Cities is an initiative from the National Employment Panel, an independent advisory group to the Government.

Disadvantaged groups face a range of barriers to labour market participation. Some are generic (e.g. awareness of opportunities/support, lack of basic skills / qualifications etc), but others are specifically related to ethnicity (employer discrimination/ language skills etc).

The key difference between Fair Cities and other initiatives aimed at reducing the levels of economic inactivity is that it is employer led. Local director, James Murgatroyd, and his team report to a board consisting of the chief executives and managing directors of many of Bradford District's largest organisations. This board provides strategic direction and, importantly, access to a large number of job vacancies at all levels of skill and salaries.

Iain Cornish, Chief Executive of the Bradford-based Yorkshire Building Society says: "I believe that Fair Cities has the potential to make a lasting change to the most deprived communities of Bradford. Employers are taking an active lead in creating opportunities for people to gain valuable and rewarding careers not just through a sense of Corporate Social Responsibility, but in recognition of it being good business to broaden our recruitment pool."

Fair Cities Initiative

Recommendation 2: To improve the availability of good quality and affordable housing for families

The Commission was made aware of the state of housing in Bradford District. The Commission recognised that through the Housing Strategy, Bradford District is expected to meet its floor target of ensuring that all social housing reaches the Decent Homes Standard by 2010.

However there will still be a prevalence of 'unfit' housing within the private rented sector [3]. Poor housing conditions contribute to the association between infant mortality and multiple deprivation. Therefore the Commission recommends that:

- Due consideration is given to funding a Housing for a Healthier Baby programme to support pregnant women and their families with housing improvements, heating advice, welfare benefits advice and general health advice, using the lessons learned from the previous Housing for a Healthier Heart initiative

Case Study

Home safety is fundamental to ensuring the health, safety and welfare of the District's babies and children. The planning and preparation for this needs to begin where possible pre-conception or during pregnancy and must also reflect the different stages of infancy. A baby of 0-8 months for example will be learning to roll; so safety advice to families will include keeping hot drinks away from where the baby may roll or bang into. A baby of 8-12 months will be learning to stand; they will be pulling and tugging at long loose clothing, fire guards, and furniture - anything that can be used to pull themselves up.

In Sure Start areas and some area based regeneration schemes, for example Bradford Trident, there is a Home Safety initiative project managed by the Family Services Unit. This is a voluntary organisation working closely with Social Services and other statutory partners.

The Family Services Unit visit new families within the first two months of the baby's life to raise awareness and educate new families about risks in the home to babies as they grow. The unit will also provide stair gates, fireguards and smoke alarms at no cost all contributing to making the home a safe and secure environment for the developing child.

Programme Manager, Bradford Trident

3 www.bdimc.bradford.nhs.uk
Bradford District Housing Strategy 2003-2010.

Summary of Recommendations: Ten Priority Areas for Action

Recommendation 3a: To improve the health and nutrition of pregnant women, babies and women planning pregnancy

The Commission was made aware of the importance of women being well nourished in order to have a healthy pregnancy and the 'at risk' groups of women who are vulnerable because of poor nutrition [4, 5]. In view of the evidence received, the Commission recommends that:

- Full partnership support is given to the Healthy Start programme including appropriate uptake of vitamin D supplements in the community
- Those charged with implementing the recommendations contained within the Bradford District Obesity Review are aware of the negative effect of obesity on maternal and infant health
- Adequate nutrition and dietetic services are provided for newborn babies and infants who are at risk of feeding difficulties and/or nutritional inadequacy, for example, babies with complex health needs, malabsorption or those born with errors of metabolism
- Adequate dietetic support is provided for women with diabetes
- All Bradford District's Children's Centres and other children's services are actively promoting nutritional health
- Nutritional indicators of health are incorporated into routine data collection to inform future monitoring and service development for maternal health

Case Study

Poor diet hits maternal and infant health hard and in so many different ways. Its effects can reach beyond infancy and even into the health of the next generation. Yet we know that many mums and babies in Bradford still don't benefit from a nutritionally adequate diet, particularly in the most disadvantaged groups. The reasons for this are complex so there is no one simple solution - it is something that needs to be tackled in a consistent way by all those working with girls, mums and babies, and those who influence what they eat.

Community Nutrition and Dietetics Services Manager, Bradford Hospitals NHS Foundation Trust

4 www.bdimc.bradford.nhs.uk
Presentation to the IMC from the Bradford Nutrition and Dietetic Services, St Luke's Hospital.

5 www.bdimc.bradford.nhs.uk
Background literature report prepared on behalf of the IMC by University of Bradford School of Health Studies.

Recommendation 3b: To increase the numbers of women who start breastfeeding

The Commission is also aware of the low rates of breastfeeding in Bradford District [6] and that nationally, women from poorer social economic groups are less likely to choose to breastfeed than affluent women. The Commission is aware that breastfeeding protects against the incidence and severity of many infections in infancy, and that infections are a major cause of death for infants in the post neo-natal age in Bradford District [7]. In view of this evidence, and in line with the Local Area Agreement, the Commission recommends that:

- Full support is given by all partners to implement Bradford District's Breastfeeding strategy and Baby Friendly Initiative
- Breastfeeding is promoted through the Healthy Schools Standard initiative

Case Study

I first thought about breastfeeding when I went out for lunch with some friends and one of my friends needed to feed the baby. We said she should go ahead, and I saw how she could breastfeed in public and I was like 'wow', I couldn't see anything. Nobody at the restaurant noticed and I couldn't believe how convenient it was. When I was having Niamh, I decided I wanted to breastfeed because I thought it was healthier for the baby, and for fighting infections, and would give her the best start in life. I became a breastfeeding peer supporter; I went to the baby club at the Holybrook Centre every week. The Health Visitor saw me feeding Niamh there and said they needed people like me to show other mums what it can be like.

A lot of mums don't know about the benefits of breastfeeding. I try to be encouraging - suggesting things they could try. I talk a lot about being baby led. There's so much to learn about breastfeeding, it's really amazing.

Mother and baby, Greengates

6 www.bdimc.bradford.nhs.uk
Bradford District Breastfeeding strategy.

7 www.bdimc.org.uk Analysis and Interpretation of infant mortality data: prepared on behalf of the IMC by the Bradford Health Informatics Service.

Recommendation 4: To ensure equal access to all aspects of pre-conceptional, maternal and infant health care

The Commission was made aware from the background literature that equal access to technological advances in neonatal special care help to reduce social class inequalities in neonatal deaths. The Commission was not informed of any serious problem with access to special care for infants at either of the two NHS hospitals in the District.

The Commission was made aware that there may be unequal take up of pre-conceptional advice, early antenatal care and of some of the antenatal tests offered [8].

The Commission was also made aware that all women with diabetes have an increased need for pre-conceptional and ante-natal care [9].

The number of deaths from severe infections, meningitis and septicaemia is 21 over the 8-year study period, 3 a year. Breastfeeding, early management of infections and immunising babies could substantially reduce these deaths.

In view of these observations, the Commission recommends that:

- There is a woman and family centred approach for all care and services around sexual health, termination of pregnancy and pre-conceptional, antenatal and postnatal care in Bradford District (see Appendix 1)
- There is adequate, appropriate means of communication available within maternal care services. This includes communication in community languages (particularly audio-visual), braille, signing and meeting the needs of people with differing levels of literacy
- Bradford District NHS gives due consideration to further developing a systematic service for detecting and managing diabetes within maternity services and that all services supporting women with diabetes are made aware of the Confidential Enquiry into Maternal and Child Health (CEMACH) advice for pre-conceptional and ante-natal care
- Work is intensified to ensure take up of the immunisation programme for babies and infants especially in the most deprived areas of the District. This includes the new pneumococcal vaccine for babies from 2 months
- A review be undertaken of the means by which women are referred between services from pre-conceptional care through to post-natal care

Case Study

Antenatal care gives expectant parents choices; access to consultants, midwives and GP's gives them greater control of the service they receive. Airedale Hospital has recently benchmarked where its services are in line with the National Service Framework for Maternity Services; as a result we are looking to redesign some of the services we offer to meet the framework standard. We are hoping to develop a clinical network with Bradford, to look at how we can work across Bradford and Airedale rather than separately.

We have seven teams of Community Midwives actually running the clinics in GP's surgeries or in Health Centres. At these clinics women are encouraged to make choices; by developing their own birth plans they can document their preferences throughout their care. Women can opt to have a home birth with a Community Midwife present or alternatively we have a labour ward offering a flexible safe environment providing 24 hour care.

Advice is an important element of our service; information is available to all expectant parents who can have a tour round the unit. Also there is 24 hour advice from midwives and doctors on delivery suites, we have antenatal outpatient provision, and all women have a named Community Midwife.

Airedale Hospital Maternity Services

8 www.bdimc.bradford.nhs.uk
Presentation to the IMC from Professor Gardosi of the West Midlands Perinatal research unit.

9 www.cemach.org.uk
Important information for General Practitioners and the Primary Care Team: recommendations for women with type I and II diabetes. Confidential Enquiry into Maternal and Child Health. 2006.

Recommendation 5: To improve social and emotional support for parents, especially those living in areas of social disadvantage

The Commission received evidence about mental health issues for young mothers and the association between maternal mental ill health and infant health [10].

The Commission recognised the wide range of support at community level that exists across the District from informal parent and toddler groups through to Sure Start programmes and in particular the newly developing provision of Children's Centres.

In recognition of the importance of social and emotional support, the Commission recommends that:

- There is further development of the role and capacity of midwives, health visitors, and others involved with pregnant women and young families, to provide social and emotional support to their clients by working in close partnership with Children's Centres
- Health and other professionals working with families have knowledge of informal and formal community provision in the areas that they serve, to which they can direct families
- The role of Bradford District's Children's Centres are promoted as offering social and emotional support to parents and the take up and effectiveness of Children's Centre service is monitored in their local populations
- Health partners strengthen referral mechanisms and support for women with mental health problems

Case Study

Social and emotional support to parents ranges from universal play, recreational and childminding facilities for families, to services for parents who need extra help. This support is delivered in a range of ways including drop in centres; parents support programmes; provision of home safety equipment; support to young carers and parents of children with a disability. Specific projects running throughout the District include: a postnatal depression support group, a walking group, breastfeeding drop-in classes and beginners English classes.

Providers of these services range from statutory organisations to small community groups, brought together where appropriate, for example, within Children's Centres. Successful joint ventures include the Lowfield Family Centre who, working with Keighley Domestic Violence Services, run a group called 'Em'n'Em' offering an emotional empowerment approach to young mothers. The Lowfield Centre also works with the Youth Service to provide support for teenage parents.

Bradford District has a 'Working with Parents Network' and Government guidance issued in October 2006 provides the District with a checklist by which it can rate its parenting provision.

Strategy Co-ordinator, Children and Young People's Partnership

10 www.bdimc.bradford.nhs.uk
Presentation to the IMC from the Child and Adolescent Mental Health Services of the Bradford District NHS Care Trust.

Recommendation 6a: To reduce the numbers of men and women smoking

The Commission is aware of the evidence that maternal smoking is associated with low birthweights and Sudden Infant Death Syndrome (SIDS). Work from the USA indicates that where 30% or more of pregnant women smoke, then approximately 10% of stillbirths and infant death are likely to be caused by this [11].

The Commission noted that there is no routinely collected information about local smoking rates during pregnancy that can be used within data analysis. The Stop Smoking Services in Bradford District provided evidence that smoking is more prevalent in younger men and women of lower educational achievement and from poor social economic groups [12].

The Commission recommends that more support is given to work to:

- Implement smoke free environments and legislation
- Target work at preventing young people from taking up smoking
- Assist those planning pregnancies, or already pregnant, and other members of their household, to quit smoking
- Collect smoking rates during pregnancy and monitor outcomes consistently

Case Study

Bradford District Health Development Partnership's Stop Smoking Service has recently developed a protocol and policy (implemented October 1st 2006) for the non-medical prescribing of Nicotine Replacement Therapy (NRT) for pregnant smokers. Both documents have been approved by lead Obstetricians and Pharmaceutical Advisors for the Bradford and Airedale tPCT.

Women are assessed individually and holistically, and first line treatment is behavioural and psychological support alone. If the woman cannot stop smoking without the use of NRT then a prescription will have previously been obtained from the clients GP.

There are certain challenges associated with providing smoking cessation support for pregnant women, including: getting women to access the service in the first place; maintaining contact with those that do and helping women successfully quit. To meet these challenges and to enable the team to provide a seamless service, the two senior Stop Smoking Specialists supporting pregnant smokers across the Bradford District, are qualified nurse prescribers.

The aim of the service is to provide and ensure that an equitable and evidence-based assessment and treatment programme is accessible to all pregnant smokers.

Bradford District Health Development Partnership's Stop Smoking Service

11 www.bdimc.bradford.nhs.uk
Background literature prepared on behalf of the IMC by the University of Bradford School of Health Studies.

12 www.bdimc.bradford.nhs.uk
Presentation to the IMC from the Bradford District Stop Smoking Service.

Recommendation 6b: To reduce the numbers of women with high levels of use of alcohol and/or non-prescribed drugs in pregnancy

The Commission heard from the specialist midwifery services for women trying to reduce harm to their babies from their alcohol and drug misuse [13]. The Commission recognises that alcohol and drug misuse pose a high risk to infant health for a small proportion of Bradford District's mothers and recommends:

- Pre-conceptional advice to both men and women
- Target work at preventing women from misusing non-prescribed drugs and alcohol
- Further specialist support is given by Children's Centres and midwifery services for those women trying to quit during pregnancy

Case Study

The One Stop Drug Dependency Team was formed in response to the gradual increase in the number of babies born each year to drug and alcohol dependent women in Bradford. The team provide a multi-disciplinary, multi-agency approach to deliver non-judgmental care for the woman and her family.

Making this service easily accessible to women and their families is extremely important. The more hurdles, the less likely women are to come, so the service doesn't have the usual referral routes. Women can self refer / refer their friends; they can be referred by treatment agencies or they can just walk in off the street.

The service's attendance rates are strong, with approximately 70% attendance. The exit status for each woman is recorded after six weeks. We have 'unknowns', the woman may have moved away or delivered at another hospital; 'fully detoxed' having stopped the use of all street and prescribed drugs and 'partial detoxed' which is the biggest group and includes women who have made a significant difference in the amount of drugs that they were using and the amount of the prescribed medication that they are on.

What is fair to say is that a significant number of women, seen by the Drug Dependency Team, do make a huge change to their lives.

One Stop Drug Dependency Team, Bradford Royal Infirmary

13 www.bdimc.bradford.nhs.uk
Presentation to the IMC from the community midwifery services of the Bradford NHS Hospitals Foundation Trust.

Recommendation 7: To increase community understanding of the role of genetic inheritance in causing infant death

The Commission was made aware that congenital anomalies, including autosomal recessive disorders which are genetically inherited, are one of the major causes of excess infant deaths in Bradford District [14]. The Commission was not able to establish fully the impact on infant mortality of genetically inherited disorders due to possible misclassifications of cause of death within the death recording procedures [15]. A 'best-estimate' is that 3-5 of the excess deaths observed each year in Bradford District are from genetically inherited conditions.

In view of this, the Commission recommends that:

- All partners work to raise awareness and knowledge amongst the populations in Bradford District about the nature of congenital anomalies, including genetic conditions, and their impact on infant deaths
- In conjunction with other health organisations across Yorkshire and the Humber, a congenital anomalies register is established. This should be developed in conjunction with a clear protocol for post-mortems following an infant death to ensure that congenital anomalies are identified and data are collected in as many cases as possible
- A 'training for trainers' programme is developed with the Yorkshire Genetics Service to inform a wide range of health professionals about the genetic contribution to infant health and to publicise its genetic counselling services
- A programme of initiatives is developed in conjunction with local community and statutory organisations dealing with infant mortality and disability, to promote community understanding and general public awareness of genetic risk, autosomal recessive disorders and links with consanguinous marriage

Case Study

Yorkshire Regional Genetics Service provides Bradford's Genetic Services and is comprised of consultant clinical geneticists and genetic counsellors. Clinics are regularly held at St Luke's in Bradford for children and adults. Pregnant patients or patients contemplating pregnancy, wishing to see a fetal medicine specialist, are seen at twice weekly clinics in Leeds; the service hopes to offer this in Bradford soon.

Referral of children to the service is usually by General Practitioners or hospital Doctors who feel that the child may have a condition that could be genetic. The consultant geneticist will take a family tree and examine the child to see if they can suggest a diagnosis or further tests. They also talk about risks to subsequent children and risks to the wider family.

Adults seen at clinics either have a problem that is genetic or are contemplating pregnancy and are concerned about risks of a familial condition affecting the baby. Geneticists work closely with the genetic counsellors who often meet with patients prior to the clinic to take the family tree.

The service has 14 counsellors of which 5 have appropriate language and cultural expertise specifically for the South Asian community, two of which are based in Bradford.

Yorkshire Genetics Service

14 www.bdimc.bradford.nhs.uk
Analysis and Interpretation of infant mortality data: prepared on behalf of the IMC by the Bradford Health Informatics Service.

15 www.bdimc.bradford.nhs.uk
Paper prepared from research carried out on behalf of the IMC by Dr Sam Oddie of the Bradford NHS Hospitals Foundation Trust.

Recommendation 8: To ensure these recommendations are shared widely and understood by communities across the Bradford District

The Commission recognises the importance of ensuring different communities in Bradford District understand the reasons for the suggested recommendations and consulted with community groups on how to implement the findings [16]. In view of this it recommends that:

- There is dialogue with all communities on the findings and recommendations of the Commission at the time of publication
- A strategy on health education and promotion messages around pre-conception, pregnancy and infant health is developed in a way that is inclusive for men and women from the most vulnerable groups
- Community outreach work is undertaken specifically with the white community in the most deprived areas about the role of low birthweight in infant and child health. This is intended to support communities to respond to some of the information contained within this report
- Community outreach work is undertaken specifically to raise awareness and discussion among South Asian communities about the probable role of consanguinity in infant and child health. This is intended to support communities to respond to some of the information contained within this report
- Workshops are offered for relevant workers in the voluntary and public sectors

Case Study

The Bradford District Infant Mortality Commission met with a group of representatives from the South Asian community to hold an initial discussion about how best to inform the wider community about the story of, and the findings from, the Commission's work. They sought views and perspectives on how they might best communicate and plan for resources to get behind the implementation of recommendations, and further action to tackle infant mortality.

The meeting was well attended. In addition to specialists such as the genetic counsellors and paediatricians; community workers, Sure Start workers, educationalists, researchers and counsellors were present, all of whom have lots of contacts with families and communities. It was suggested that a very tangible way forward would be to provide very basic, but informed training to a range of front line workers, and people such as Imams, on basic genetics, access to counselling, testing and support. Parents also need 'training' and support in how to talk about their own situations, and the potential implications for other siblings, and for their own children.

Notes from the consultation held with members of the South Asian Community

16 www.bdimc.bradford.nhs.uk
Report on the consultation with community groups in Bradford District.

Recommendation 9: To develop further the data collection and monitoring procedures in Bradford District

The Commission acknowledges the extensive additional work by the Bradford District Health Informatics Services in providing evidence for its enquiry [17]. It also recognises that use of routinely collected data provides limited insight into the state of maternal and infant health outcomes. In view of this, it recommends that:

- Partners give due consideration to the detailed recommendations from the Bradford District Health Informatics Services to provide a fuller picture of maternal and infant health than currently exists [18]
- More comprehensive collection and analysis of local data is established, facilitated in part by an electronic maternity system at Bradford Teaching Hospitals NHS Foundation Trust, to include vital information on smoking, maternal health, and consanguinity
- There is further and continued monitoring of infant health and mortality, linking closely with the Born in Bradford cohort study and providing further investigation into post neonatal mortality rates, stillbirths and sex ratios of infant deaths in Bradford District
- A multi-variate analysis be undertaken to more accurately define specific risks to support targeted action
- Further study of national data is made to identify particular risks that may exist for babies born to women of other minority ethnic communities

Case Study

Born in Bradford is a unique project that will follow the lives of 10,000 babies born in the city between 2006 and 2008 as they grow up into children and eventually adults. The project will tell us how all those people whose actions help make Bradford lives healthier and happier can work more closely together.

It will help to show how local parents and children, working with professionals and community leaders can improve the health of those who are born and grow up in Bradford.

It will find out what makes some of the children and babies born in Bradford ill and target what can be done to put things right. These might involve advice on keeping healthy and helping people to look after themselves. It might involve the sorts of health care they should have access to and the way our neighbourhoods and city are organised.

As the children grow up the study will keep in touch with them, and through monitoring their progress, the project will help find the causes of ill-health. When we have that information, that will help to better plan how to make our lives healthier and happier.

Born in Bradford Project

17 www.bdimc.bradford.nhs.uk
Analysis, Methodology and Data issues: Bradford Health Informatics Services.

18 www.bdimc.bradford.nhs.uk
Technical recommendations of the IMC.

Recommendation 10: Future research to understand both the underlying and immediate causes of death

The enquiry raised as many questions as it answered and has indicated future areas of research [19]. It will be important also to understand the impact that the recommendations have on future infant health. The Commission recommends that:

- There is continued research into 'what works' in Bradford District to tackle its inequalities in infant mortality
- Further study of national data is needed to identify any particular risks to babies born to mothers from other ethnic minority communities living in the District
- There is continued research to clarify understanding of the immediate links between deprivation, ethnicity and infant health
- Further study is conducted in conjunction with the congenital anomalies register to determine the association between consanguinity, late fetal loss, infant mortality and disability
- All partners endorse and support the principles and aims of the Born In Bradford study

19 www.bdimc.bradford.nhs.uk
Executive Summary of the Data Analysis report prepared on behalf of the IMC by the Bradford District Informatics Service.

Understanding Infant Mortality in Bradford District

What is meant by Infant Mortality? Infant Mortality is defined as a death of a live born baby which occurs in the first year of life.

Stillbirth - is the term used to define babies born after 24 or more weeks gestation in the womb who did not show any signs of life (beating heart, breathing, voluntary movements). These stillbirths statistics are not included in the infant mortality statistics. The stillbirth rate is the number of stillbirths per 1,000 live and stillbirths.

Neonatal Deaths - In the first month of life babies are at particular risk. If a baby dies within 28 days of being born alive then the deaths are called neonatal deaths to distinguish them from the deaths of older babies. These deaths are included in the infant mortality total. The neonatal mortality rate is the number of deaths under 28 days per 1,000 live births.

Postneonatal Deaths - This term is given to deaths of babies aged between 28 days to one year. The postneonatal mortality rate is the number of deaths at 28 days and over but under one year, per 1,000 live births.

The Infant Mortality Rate is expressed as the number of live born babies who die in the first year of life per thousand babies born alive. For example, if 6,000 babies are born and there are 60 deaths then the IMR is 10 per thousand.

The infant mortality rate has long been used as a proxy measure of the health of babies and enables comparisons to be made between different populations. Populations with high infant mortality rates are more likely to have poorer health than those with lower rates.

Within the small number of deaths encountered today, Bradford District still has a higher rate than England and Wales. This inequality is of concern to the Commission. Table 1 shows that Bradford District has a relatively higher infant mortality rate compared to other Districts in the Yorkshire and the Humber Region and compared to England and Wales.

Figure 1 shows that the infant mortality rate for England and Wales decreased from over 160 in 1900 to 9 in the year 2000.

Figure 1 - Infant Mortality, England and Wales

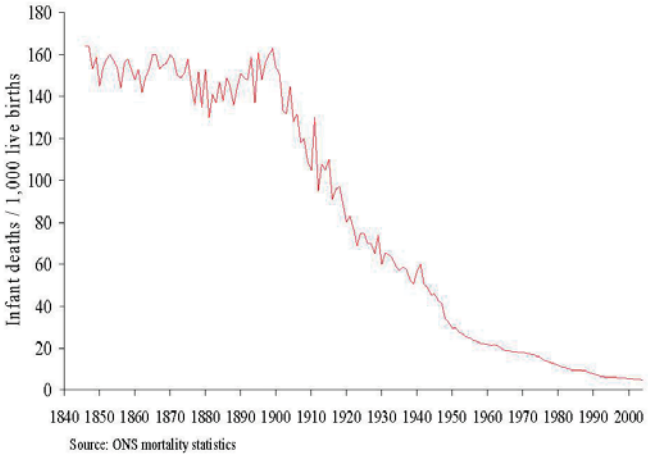


Table 1 - Infant mortality rate for districts in Yorkshire and the Humber compared to England and Wales as a whole in 2003

Infant Mortality Rate per 1000 live births, 2003

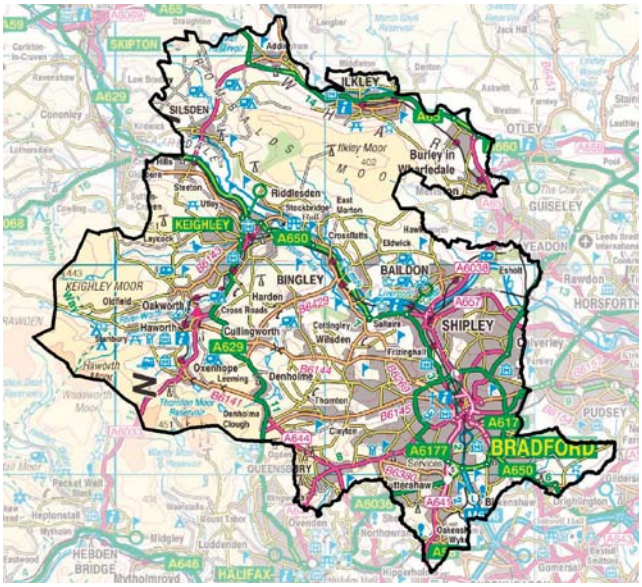
	Infant Mortality Rate 2003
England & Wales	**5.3**
Yorkshire and Humberside	**5.8**
West Yorkshire	**7.1**
Local Authority Areas within the Region	
Bradford District	**9.1**
Kirklees	8.0
Rotherham	7.0
Calderdale	6.8
Leeds	5.9
Kingston upon Hull	5.7
Barnsley	5.4
Doncaster	5.2
North East Lincolnshire	4.6
East Riding	4.5
Wakefield	4.5
North Lincolnshire	4.3
Harrogate	3.9
York	2.7
Craven	2.3
Hambleton	2.3
Scarborough	1.9
Richmondshire	1.8
Selby	1.3
Ryedale	0.0

Source: Prepared by Bradford District Health Informatics Services from ONS Regional datasets

The Population of Bradford District as compared with England and Wales

The Bradford Metropolitan District is outlined in the map below. It includes the city of Bradford and the towns of Bingley, Ilkley, Keighley and Shipley.

Figure 2 - The Population of Bradford District as compared with England and Wales

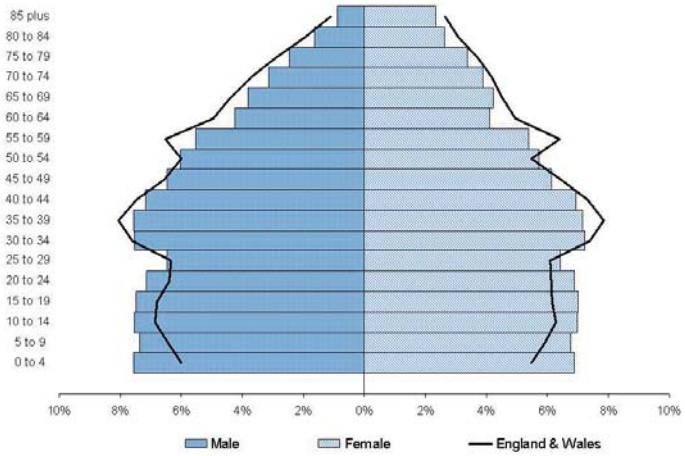


Source: Bradford District Health Informatics Service.
© Crown Copyright 2005. Ordnance Survey Licence Number 100015079.

The following section describes the population in terms of age, ethnicity and levels of deprivation. With regard to infant mortality, overall there are four features about the population of the District that are important:

- The population is younger than the national average. 22% of the population is under 15 compared with 18% in England and Wales (see Figure 3 over page)
- The fertility rate is higher than average for England and Wales: 73.4 live births per 1000 women of child-bearing age in Bradford District compared with the national average of 56.8 per 1000
- Bradford District has a diverse, cosmopolitan population. 78% is from white ethnic groups; 15% is made up of people of Pakistani-origin; 3% of Indian origin; 1% Bangladeshi; and 1% African / African-Caribbean
- The age structure of the South Asian origin populations is younger than that of the white community. For example 39% of the white female population is between 15 and 44 years of age compared with 51% in the Pakistani-origin community

Figure 3 - Population pyramid for the Bradford District, 2003



Source: Bradford District HIS from ONS mid year population estimates

Population by Deprivation

The Bradford District contains some of the most deprived neighbourhoods in the country. In 2003, 43% of the population of the Bradford District lived in the most deprived 20% of neighbourhoods in England[20]. Bradford District also includes some of the least deprived neighbourhoods in the country. This means that there is considerable variation in the level of deprivation experienced across Bradford District.

Box 1 - Index of Multiple Deprivation 2004

The Index of Multiple Deprivation is a composite index derived from seven domains of data available at local area level. These seven domains are used to build an overall index for each local area:

- Income
- Crime
- Employment
- Education
- Health
- Barriers to housing and services
- The living environment

Local areas are then ranked according to the multiple deprivation score and divided into five groups of equal size referred to as 'quintiles of multiple deprivation'.

This report has used the index of multiple deprivation in two ways:

1: To rank localities within Bradford District to analyse for inequalities within the District.

2: To identify the localities in Bradford District within the national quintiles to enable comparison with other areas of similar levels of deprivation.

20 Noble, M., Wright, G., Dibben, C. et al (2004) Indices of Deprivation 2004: Report to the Office of the Deputy Prime Minister. London: Neighbourhood renewal Unit.

The Population of Bradford District as compared with England and Wales

Table 2 - Population of Bradford District by ethnic group, 2001

	All		Female population aged 15 to 44 years	
	Number	*% of total population*	*Number*	*% of total female population*
White British	355,684	76.1	72,525	72.2
Other White	10,357	2.2	1,965	2.0
Asian or British Asian: Bangladeshi	4,968	1.1	1196	1.2
Asian or British Asian: Pakistani	67,994	14.5	17,387	17.3
Asian or British Asian: Indian	12,504	2.7	3365	3.3
Other ethnic groups	16,160	3.5	4042	4.0
Total	**467,667**	**100**	**100,480**	**100**

Source: 2001 Census

A summary of key features of births and infant deaths in Bradford District

Births

- During the years studied approximately 7,000 babies were born alive each year in Bradford District and 60-70 of these died in the first year of life
- The number of infant deaths each year is 20-30 above the national average for England and Wales
- The average number of births is increasing: 7191 (1999-01); 7238 (2000-02) and 7388 (2001-03)
- In line with the age profile of the populations studied the number of births to women of South Asian origin have increased by 23% (1996-2003) whilst for the same period, the number of births to women in the rest of the population has declined by 7%

Infant deaths

- Between 1996 and 2003 the numbers and rate of infant deaths in the most deprived quintile of the population increased whilst the number and rate of deaths in the least deprived decreased
- On the whole, babies who die in Bradford District were older than across England and Wales. The difference in the postneonatal mortality rate between Bradford District and England and Wales was wider than that observed for the neonatal mortality rates
- When infant mortality is combined with stillbirths the proportion of male to female deaths in Bradford District is similar to that in England and Wales
- In common with a small number of other local authorities, Bradford District has proportionally fewer male infant deaths and proportionally more female infant deaths compared to England and Wales. There are proportionally more male stillbirths and fewer female stillbirths in Bradford District compared to England and Wales

Specific populations studied in this report

Having a diverse population means that it may be possible to detect similarities and differences in infant mortality rates between different communities. This is important if we are to target actions to prevent more babies' deaths. However great care needs to be taken when such comparisons are attempted. The rates of infant mortality in Bradford District are high compared with the England and Wales but the actual numbers are still very small. Losing a baby in the first year of life is a rare event even in Bradford District.

Over a number of years babies from all communities will be represented in the figures. However, if the population is small compared to the whole, for example the Bangladeshi community, then the number of babies who die will be so few that statistically no conclusions can be drawn about that population.

The Commission has been concerned to identify the actions that will save the lives of more babies across all the communities of the District. To identify whether there are any heightened risks for the babies of those minority communities with small populations in the District, there is still a need to look at the evidence from the national picture for England and Wales to ensure that there is a large enough population for accurate data analysis and comparison.

There are two communities in Bradford District that are large enough to compare statistically, the white population and the Pakistani-origin population. It is for this reason alone that the report focuses on these two populations. Although the statistics compare the outcomes for mothers of Pakistani-origin with those for white mothers as a whole, many factors in the two populations could account for any observed differences, for example, age differences of mothers or their number of previous birth events. Importantly, 88% of babies born to mothers of Pakistani-origin live in the most deprived two-fifths of neighbourhoods in the District, compared to 41% of white mothers. In order to make a fairer comparison it is necessary to compare birth outcomes for mothers of Pakistani-origin with white mothers living in those same most deprived neighbourhoods.

Exploring the evidence - Infant Mortality and Deprivation

As the Commission explored the possible causes of the additional infant deaths, (the extra number of deaths in Bradford District above what we would expect if our mortality rates were the same as in England and Wales as a whole), evidence emerged that allowed the issue to be understood from three angles:

- **The association between deprivation and the increased number of deaths**
- **Other factors that might affect the populations studied and therefore might help us to understand why the extra deaths occur**
- **The causes of death of infants as recorded on Death Certificates**

Deprivation and infant mortality within Bradford District

The Commission was told that if the infant mortality rate across the whole of Bradford District had been the same as in the least deprived areas there would have been 78% fewer infant deaths.

Within the Bradford District there was a strong association between local area deprivation scores and infant mortality rates over the years 1993 to 2003. Between 1993 and 2003 Bradford Moor, City, Toller and Manningham wards had the highest infant mortality rates. Craven, Ilkley, Wharfedale, Baildon, Bingley and Worth Valley wards had the lowest infant mortality rates.

The effect that multiple deprivation has on the risk of death for infants of different ages is shown in Table 3.

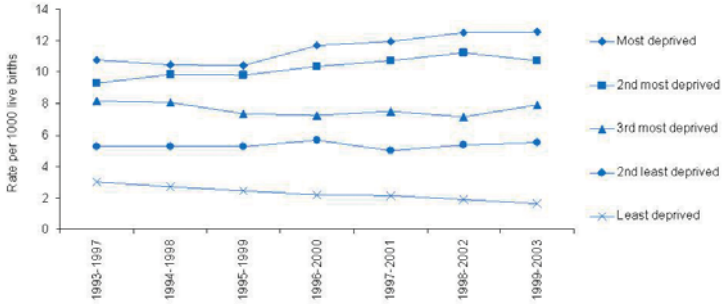
Overall infant mortality was consistently highest in the most deprived quintile and lowest in the least deprived quintile in the Bradford District. During the period 1993 to 2003 as a whole, a baby living in the most deprived quintile of areas in the Bradford District was almost five times more likely to die in their first year compared to those living in the least deprived quintile ($p<0.0005$).

Table 3 - Infant mortality rates by quintile of deprivation in Bradford District 2001 -2003

	Most deprived quintile 1	2	3	4	Least deprived quintile 5
IMR	11.7	10.2	7.9	5.4	2.4
Neonatal	6.3	5.7	4.7	3.6	1.3
Post neonatal	5.4	4.5	3.2	2.0	1.1

Source: Prepared by Bradford Health Informatics Service from ONS data

Figure 4 - Trends in infant mortality within five levels of deprivation in Bradford District 1993 - 2003.



Source: Bradford Health Informatics Service linked dataset

Figures 5-6 - Infant Mortality: Investigating the Trend Differences in Rates between Most Deprived and Least Deprived Quintiles of Deprivation.

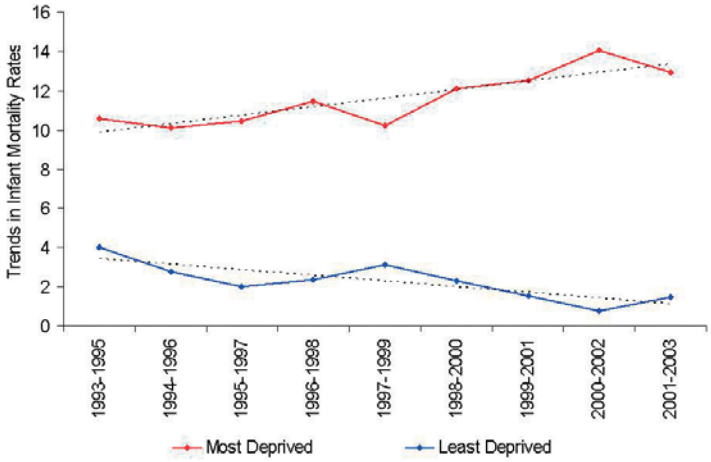


Figure 5 above shows a plot of mortality rates over time for the most deprived quintile and the least deprived quintile.

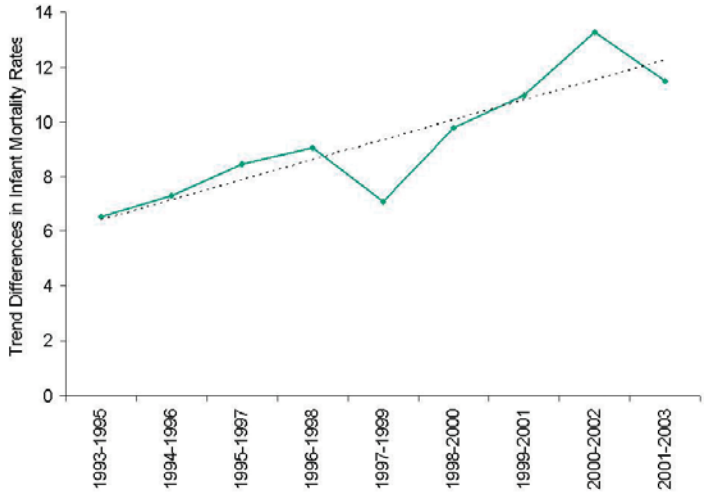


Figure 6 above is a plot of the difference between mortality rates for the two groups (most deprived and least deprived).

Source: Bradford Health Informatics Service linked dataset

The figures opposite illustrate:

- That the gap in infant mortality between the most and least deprived areas of the Bradford District widened from 1993 to 1997 and 1999 to 2003
- In the two most deprived quintiles infant mortality rates rose, whilst in the least deprived quintile they fell
- The ratio of the infant mortality rate for the most and least deprived quintile rose from 3.6 in the five year period 1993 to 1997 to 7.7 in 1999 to 2003 i.e. by 2003, infants were 7.7 times more likely to die in the most deprived quintile, compared to that in the least deprived quintile

In making these comparisons, the Commission is aware that some of the differences will be accounted for by differences in the distribution of other known risk factors for infant mortality. These include the age of mother, her ethnicity and how many children she has had already.

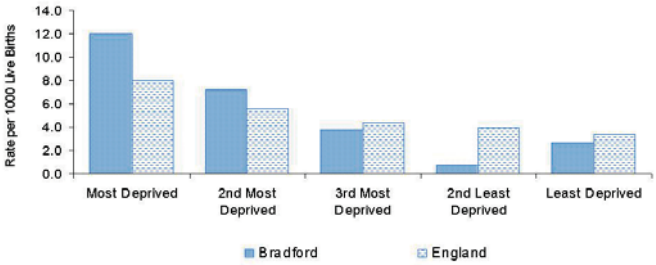
Comparison of the pattern of deprivation in the Bradford District with England as a whole

To understand how Bradford District differs from the rest of England as a whole, the Commission compared both the number of births and the infant mortality rates for those Bradford District babies that are born to residents in the nationally derived quintiles of deprivation, with that of the same quintiles in England as a whole.

- 60% of Bradford District's births were to women who live within the most deprived quintile of the national Index of Multiple Deprivation, whereas in England as a whole, 24% of births were to women living in the same quintile of deprivation
- The Infant Mortality Rate for women living in the most deprived quintile in Bradford District was higher than that of women in the same quintile of deprivation across England as a whole. In Bradford District the IMR in this quintile was 11.37 compared to 6.9 nationally
- Almost 80% of Bradford District's deaths occurred to babies of residents within the most deprived quintile of the national Index of Multiple Deprivation

The following graph suggests that there was a higher than expected mortality rate in the most deprived quintiles and slightly lower than expected in the least deprived areas in Bradford District when compared to the whole of England.

Figure 7 - Infant mortality rates in Bradford District compared to England by quintile of deprivation



Source: Bradford Health Informatics Service from the linked dataset

Infant mortality and ethnicity

Over the period 1996 - 2003, babies of mothers of Pakistani-origin were noted to be almost twice as likely to die in their first year of life compared to babies of white mothers as a whole.

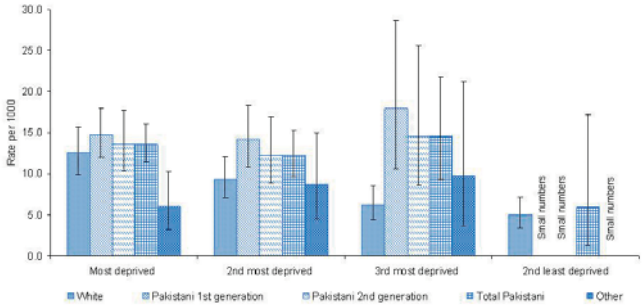
Bearing in mind that the majority of the Pakistani-origin population live in the most deprived two quintiles of Bradford District, it is clear that any comparisons need to take into account the disproportionate impact of deprivation on the Pakistani-origin community in Bradford District. When Pakistani-origin mothers are compared with white mothers living in the same deprived quintile areas there is little difference in the rates. Figure 8, over the page, shows that for the two quintiles, the infant mortality rates are similar between white and Pakistani-origin women. The number of births to Pakistani-origin women was too small in the affluent areas to be certain that infant mortality decreases as deprivation reduces in this ethnic group.

Table 4 - Infant mortality rates for the white and Pakistani-origin population of Bradford District District 1996 - 2003

	White	Pakistani origin total	Pakistani origin 1st generation	Pakistani origin 2nd and subsequent generation
Infant mortality rate	7.1	12.9	14.6	10.0
Neonatal mortality rate	3.8	7.7	8.6	6.1
postneonatal mortality rate	3.3	5.3	6.0	4.0
Stillbirth rate	3.3	9.6	10.8	7.6

Source: Prepared by Bradford Health Informatics Service from the linked dataset

Figure 8 - Infant Mortality by Ethnicity and Deprivation, 1996-2003



Note: Data for babies born to 1st and 2nd generation Pakistani-origin women and women of other ethnic groups living in the 2nd least deprived areas and all babies living in the least deprived areas have not been included due to small numbers.

Source: Prepared by Bradford Health Informatics Service from data in the linked dataset

Table 5 - Infant mortality rates and unadjusted Relative Risk of infant mortality within two most deprived quintiles of deprivation for white and Pakistani-origin ethnicity infants in Bradford District 1996-2003

	Bradford IMD quintiles 4 and 5	Whole of Bradford
% of total Pakistani origin live births	88	100
% of total white live births	41	100
Pakistani-origin IMR	13.1	12.9
White IMR	11.0	7.1
Unadjusted Relative Risk of Pakistani:White	1.2 p=0.103	1.8 p=0.0005

Stillbirth and infant mortality rates for babies of first and second generation Pakistani-origin mothers

In time, when people migrate from one country to another, the new migrants often take on the health characteristics of the new country. With infant mortality we would expect to see an improvement in rates through the second and following generations of women from Pakistan. The first signs of this decrease are being seen in Bradford District (see Table 4, page 28). The Commission was shown that there is a statistically significant difference in the stillbirth and perinatal mortality rates between first and second generation mothers [21]. Overall infant mortality appears lower for the second generation mothers, although this is not yet statistically significant. The higher stillbirth and perinatal mortality rates for first generation Pakistani-origin mothers highlights the importance of ensuring that they have access to care at the earliest stage of pregnancy.

Conclusions from the evidence about deprivation

- 60% of Bradford District's babies were born into the first quintile of deprivation for the whole of England. Deprivation is a major factor associated with the high infant mortality rate in Bradford District
- In order to lower the number of infant deaths, poverty and disadvantage has to be tackled across all the seven domains within the Index of Multiple Deprivation (see Box 1) **(Recommendations 1-5)**
- There is a statistically significant higher incidence of infant mortality for babies born in Bradford District's most deprived quintiles compared to those born into the same quintile in England as a whole. Deprivation alone does not provide the whole explanation for this higher incidence. This suggests other factors also play a part **(Recommendations 6-8)**

21 www.bdimc.bradford.nhs.uk
Presentation to the IMC from the Clinical Epidemiology Research Unit by Dr Ann Hobbiss.

Exploring the evidence - Other factors

Other factors within the two populations which are associated with infant mortality

The Commission is aware that much is already known about the factors that affect infant health. We therefore need to know which are most important in relation to Bradford District's population. The social factors that affect the life chances of infants include the following:

Box 2 - Social factors associated with multiple deprivation

Household environment	Maternal and paternal characteristics	Access to and quality of maternal care
Poverty and its consequential living standards	Young, under the age of 18 years and older mothers over 35 years	Access to pre-conceptional health education
Overcrowded housing conditions	First baby	Access to antenatal care
Smoky environment	Mental and physical health of mother	Access to maternity care
Inadequate or imbalanced diet	Maternal smoking, misuse of drugs and or alcohol	Access to post-neonatal care
Family relationships	Inherited conditions	

- Within the white population babies born to parents living in deprived socio-economic conditions are more likely to be of low birthweight
- Smoking, alcohol and illegal drugs can harm the developing fetus and young babies may be particularly vulnerable to the effects of living in a smoky environment, but any association with infant mortality has not been quantified in this country
- Very young mothers, mothers at the upper end of the age range, mothers having their first baby and those who have already had many babies can be at higher risk of losing their baby. The association between these factors is complex as they could also relate to social factors
- The quality of maternity care available to a woman can be an important factor, particularly for women who have pre-existing health problems, or who develop them during pregnancy, such as women with diabetes

Understanding 'risk' in relation to the Infant Mortality Rate

High risk for a small number of babies - Some factors associated with high infant mortality rates increase the risk of an individual infant death by a large amount, but only a few babies experience this risk factor. This means that this risk factor does not contribute a large amount to the overall infant mortality rate in the Bradford District. An example of this is the higher relative risk of an infant death for mothers using non-prescribed drugs.

Small additional risk for individual babies but affecting a large proportion - Factors associated with slightly raised rates of infant mortality but applied to a large proportion of babies make a larger contribution to overall infant mortality in the District. Examples of this are age of mother and smoking during pregnancy.

Identifying important factors that are associated with infant mortality within the population of Bradford that take account of the size of risk and the size of the population affected

To estimate which are the important factors that are associated with Bradford's infant mortality rates, a Population Attributable Risk Fraction (PARF) analysis on individual factors was carried out by the Bradford District Health Informatics Service. This analysis takes into account both the size of the risk of each factor and its prevalence in a population and enabled the Commission to describe more accurately the differing needs within the two populations studied.

For this analysis we have used white and Pakistani-origin populations and asked of each risk factor: what proportion of deaths in that population in Bradford District could be prevented if the death rate from

this factor was equal to that of the most favourable outcome? For example we know that the least deaths occur if gestational length when the baby is born is 40-41 weeks; or the birth-weight is between 3500-3999g; or the mother lives in the least deprived fifth of the population. Interpretation of our data requires care: the proportion of deaths would only be reduced if all the other 'confounding' characteristics associated with, for example pre-term birth and age of mother, also change to that of the reference group.

Note: Our analysis was limited to those factors for which data or information are routinely collected and made available to the Health Informatics Service. Only 'unadjusted' results are used.

Table 6 - Variables included in the Univariate Population attributable risk analyses

Included in the PARF analysis	Excluded because data not available
Gestational length	Smoking rates
Birthweight	Maternal health indicators
Deprivation quintile based on post code of mother	Date of booking in to ante-natal care
Mother's age	
Parity (number of previous birth events)	

The following tables start to highlight some crucial differences between the two major communities in Bradford District.

Table 7 - PARF analyses for the white population

Risk factors	Potential proportion of all white infant deaths that would have been prevented had the mortality rates from these factors equalled the reference group	Reference group with the least risk of mortality
Pre-term birth (gestational length less than 27 weeks)	27%	40-41 weeks
Extremely low birthweight <1000g	39%	3500g-3999g
Younger age of mothers under 20 years of age 20-24 years of age	 18% 15%	30-34 years
Deprivation quintile 1 (most deprived) 2 (2nd most deprived)	 32% 23%	5 (least deprived)

The percentages will not add to 100 as many babies will be counted in more than one category: the pre-term babies are likely to also be those that weigh less than 1000g.

Table 8 - PARF analysis for the Pakistani population

Risk factors	Potential proportion of Pakistani infant deaths that would have been prevented had the mortality rates from these factors equalled the reference group	Reference group with the least risk of mortality
Extremely low birthweight <1000g	27%	3500 - 3999g
Deprivation quintile 1 (most deprived) 2 (2nd most deprived)	 57% 32%	4 (4th least deprived)

Younger motherhood and pre-term birth appear to have a greater impact on infant mortality for the white population than for the Pakistani population. For the Pakistani population, the high proportion of births and hence deaths occurring within deprivation quintiles one and two dominate the analysis and mask other underlying causes other than extremely low birthweight.

Pre-term birth and birthweight

Bradford District has a higher proportion of low birthweight babies than in England and Wales as a whole. Babies with low birthweight have a higher risk of death, but other research suggests the association is not the same in white and South Asian populations [22].

There is some evidence that the threshold for risk attached to low birthweight may be different between different populations. Currently, only one threshold is used globally. This may be giving an inaccurate picture of the association between low birthweight and infant mortality. However this is still a matter of significant debate amongst practitioners and epidemiologists.

Babies are a low birthweight for two overall reasons:

i. Their growth is restricted but they are born at full term (this is referred to as 'Intra-uterine growth restriction' or IUGR

22 www.bdimc.org.uk
Background literature prepared on behalf of the IMC by the University of Bradford School of Health Studies.

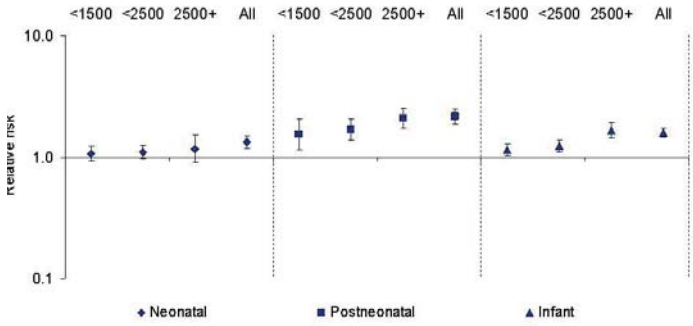
Exploring the evidence - Other factors

ii. They are born pre-term before they have matured to their full size

The PARF analysis described in the charts above suggests that for the white population the likely major cause of extremely low birth-weight (below 1000g) is being born before 27 weeks gestation.

However, when compared to England and Wales, the risk of a very low birth-weight baby (<1500g) dying in the first month of life is not significantly different to that which is observed nationally. This suggests that the neonatal care in Bradford District is of equitable standard to elsewhere.

Figure 9 - Relative Risk (RR) of Infant Mortality by birthweight in the Bradford District compared to England and Wales, 1996-2003

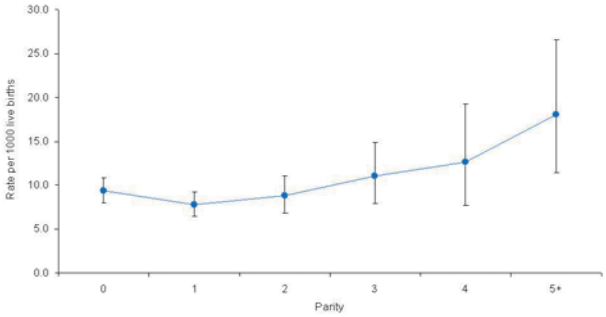


Source: Bradford Health Informatics Service from ONS data

Parity

Parity refers to the number of previous births and stillbirths born to a mother. Although this factor does not appear within the results of the PARF analysis as a major contributor of excess infant mortality in Bradford District, it is very often confounded by the age of the mother. Figure 10 indicates that in Bradford District, as in England and Wales, a woman's second baby had the lowest infant mortality rate, and increased with each subsequent baby. The higher rate of death of later babies can be partly due to the older age of the mother.

Figure 10 - Infant Mortality Rate by Parity for the Bradford District, 1996-2003



Source: Bradford Health Informatics Service from ONS data

Other factors not included in the PARF that are important to the population studied

For both white and Pakistani-origin babies, reducing the level of deprivation in their areas of residence would reduce their infant mortality rates. To understand better the causes of death for these populations, the Commission was keen to look at other aspects of maternal and infant health not included in the PARF.

Smoking

Smoking is associated with low birthweight babies and with death in infancy. Studies in the USA and in Denmark estimate that between 5% and 20% of infant deaths could be prevented in their population if no women smoked during pregnancy (these calculations take account of other factors that are associated with infant mortality). In noting these studies, the Commission understood that studies from other countries do not always transfer and apply accurately to this country.

- In England and Wales, 23% of women as a whole described themselves as regular smokers during 2004 [23]
- Within the SEC classification 'manual and routine occupations', this rose to 30%

23 Lader D and Goddard E Smoking-related behaviour and attitudes 2004. Office of National Statistics TSO : 2005.

- About 4% of all Pakistani-origin women in England are reported to smoke

Support for smoking cessation in pregnancy will positively impact most on the infant health of the white population.

Maternal health and diabetes

Diabetes is more common in Bradford District than nationally. Within the South Asian origin population, 6% are diabetic compared to 2% in the non-South Asian origin population.

There are 3 types of diabetes:

i. Gestational: This is not present before pregnancy; it occurs during pregnancy due to the additional stresses on the body. Recent evidence indicates that between 2 and 9% of all pregnancies have gestational diabetes

ii. Type I diabetes: Typically starts in childhood and requires daily insulin treatment

iii. Type II diabetes: Typically starts later than Type 1; it is associated with obesity and can require treatment by diet, tablets or insulin

Estimates from the Bradford Royal Infirmary (BRI) maternity services on the impact of Type I and II diabetes on birth outcomes in Bradford is calculated at 3 stillbirths and infant deaths combined [24]. 1 of the 3 deaths is likely to be a stillbirth and 2 of the 3 infant deaths.

Further estimates from the maternity services at the BRI suggest that detecting unknown diabetes and managing gestational diabetes is likely to improve birth outcomes by preventing 7 serious adverse outcomes a year. This could be brought about by screening, detecting and treating undiagnosed and gestational diabetes.

Other aspects of maternal health that affect infant health

Other aspects of maternal health known to be important are:

- The mother's mental health
- Her dependency on illegal drugs
- Her nutritional status including obesity
- Any genetically inherited condition that either she or her partner might carry

The Commission relied on evidence from service providers to draw its recommendations to improve these aspects of the health of women in Bradford District. The genetic inheritance factor is explored further in the cause of death analysis for the Commission.

Summary of conclusions from evidence about factors that impact on the particular populations studied

- Pre-term birth, younger, teenage motherhood, smoking, alcohol and non-prescription drug use are greater risk factors for the white population, than for the Pakistani-origin population **(Recommendations 1, 3, 4, 5, 6, 8)**
- For both populations, a reduction in the number of extreme and very low birth weight babies and reducing the level of deprivation would significantly reduce the number of babies that die in their first year of life **(Recommendations 1-5)**
- Early, good quality ante-natal care is important for some specific groups, for example those with or at risk from diabetes **(Recommendation 4)**

24 Verheijen CJ et al BJOG 2005; 112: 1500-1503

Exploring the evidence
- Other factors

Analysis of the recorded cause of death of Bradford District's infants

Understanding what is recorded on Death Certificates

This analysis relied on nationally collated data from the Office of National Statistics (ONS). The Commission quickly became aware that the recorded cause of death does not always tell the whole story.

This happens where the immediate cause of death is an illness that is a consequence of another underlying condition. For example, an infant with a severe neural tube defect may actually die from a pneumonia type infection. Pneumonia may then be recorded as the immediate cause of death. There may be no reference on the death certificate to an underlying condition (in this imaginary example, neural tube defect) which precipitated the death (from pneumonia, in our example).

This leads to a difficulty in estimating the numbers of babies that die from a specific condition. There will be some further discrepancies in the coding of specific causes of death into the broader categories by the ONS. A more detailed discussion of these aspects of data collection is given in the paper on methodology [25] and Cause of Death paper [26].

In the light of the lack of confidence in the estimates of the different causes of death in Bradford District by medical specialists on the Commission, further work was undertaken to estimate the full extent of congenital anomalies as a cause of death. This is reported later in this document.

Analysis of the actual information from Death Certificates

The ONS causes of infant deaths in the Bradford District have been compared to infant deaths across England and Wales and are shown in Table 9. The cause specific mortality rates have been compared which compare the chances of a baby that is born alive, dying from that cause in their first year.

25 www.bdimc.bradford.nhs.uk
Analysis, Methodology and Data issues : Bradford Health Informatics Services

26 www.bdimc.bradford.nhs.uk
Paper prepared from research carried out on behalf of the IMC by Dr Sam Oddie of the Bradford NHS Hospitals Foundation Trust.

Exploring the evidence - Causes of Death

Table 9 - Cause of Infant Deaths in the Bradford District and England and Wales, 1996-2003

	Numbers		Rate per 1000 Live Births	
	Bradford District	England & Wales	Bradford District	England & Wales
Congenital anomalies	132	7,221	2.3	1.5 (p<.0005)
Ante partum infections	6	320	0.1	0.1
Immaturity related conditions	143	10,694	2.5	2.2
Asphyxia, anoxia or trauma	22	2,175	0.4	0.4
External conditions	13	540	0.2	0.1
Infections conditions	59	2,105	1.0	0.4
Other specific	24	483	0.4	0.1
Sudden infant deaths	28	2,053	0.5	0.4
Other conditions	80	1,960	1.4	0.4
All causes	507	27,551	8.8	5.5

Source: ONS Annual District Births and Deaths files

This table shows us that:

- Babies in Bradford District are more likely to die from congenital anomalies than in England and Wales as a whole
- The risk of dying from an infection in Bradford District is higher than that of England and Wales. Further analysis on infections showed that this is particularly high in the post neonatal period, by which time the baby is usually living at home

Calculating the causes of excess deaths in Bradford District

The following analysis uses the national rates and categories of death and applies them to the numbers of babies that were born in Bradford District over an average of one year. The Bradford District data was analysed to show how many deaths a year from all ONS categories we would expect if our rates of death were the same as that for England and Wales.

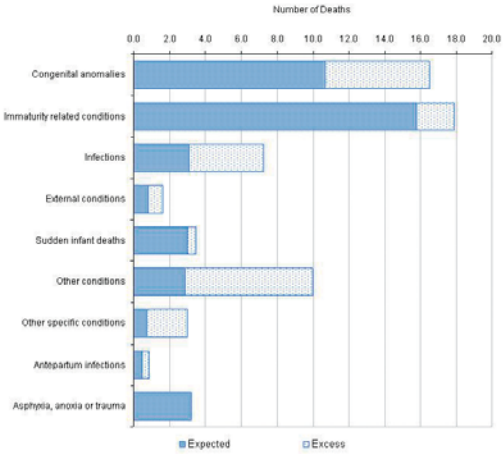
- Between 1996 and 2003, Bradford District recorded an average of 64 infant deaths in any one year
- If Bradford District had had the same mortality rates as England and Wales from the different causes shown, we would expect to have had an average of 41 deaths
- The average excess is therefore 23 a year (see Figure 11)

Of the excess deaths, the following causes were recorded on death certificates:

- 7 were due to 'unspecified conditions'
- 6 were due to 'congenital anomalies'
- 4 were due to 'infections'
- 2 were due to 'other specific conditions'
- 2 were due to 'immaturity related conditions'
- 1 was due to 'Sudden Infant Death in Infancy'
- 1 was from external causes
- There were no significant excess deaths from 'ante partum infections' nor 'asphyxia, anoxia and trauma' at birth

Exploring the evidence - Causes of Death

Figure 11 - Estimated number of expected and excess deaths by cause of death in Bradford District for 1996 - 2003



Source: Bradford Health Informatics Service from ONS data

Congenital Anomalies

In Bradford District approximately 6 of the 23 extra deaths (over and above the expected 41) are due to congenital anomalies, according to the death certificates. Some of these deaths fall into the category of 'autosomal recessive disorders'.

The work of Dr Sam Oddie, Commission member and paediatrician, shows that the causes of death recorded on 10% of infant death certificates were inaccurate. He estimated that at least a further 2 deaths per year are also caused by autosomal recessive disorders but that the deaths are mistakenly attributed to other causes [27]. If this estimation proves to be correct then this would put the number of extra deaths caused by autosomal recessive disorders at 3-5 per year. In order to be certain about this, further work needs to be undertaken at national level with regard to the recording of causes of death. This is a recommendation in the Technical Report which can be found on the website.

Why this is important

Autosomal recessive disorders are more likely to occur where the parents are closely related, so-called consanguineous relationships or marriages (literally meaning 'sharing the same blood'). In such relationships there is a higher chance of both parents sharing the same genes, increasing the risk that a baby will inherit these and suffer autosomal recessive disorders. These disorders can cause early death or serious disability.

Examples of marriages and partnerships between closely related people are to be found in many communities. They are a particular feature in Pakistan and in the Pakistani-origin community in Bradford District; 70% of marriages within that community meet the definition of 'consanguineous' [28].

Genetic counselling in West Yorkshire is helping families to identify their risk of carrying and passing on inherited disorders.

'Other Conditions'

This category of death includes all causes of death not identified elsewhere. The majority of these are non-specific terms that do not identify a clear disease as the cause of death nor describe symptoms. The Commission is not sure why there should be an excess of these deaths and would like attention to be given to clarifying these causes of death within the implementation of the recommendations on future monitoring.

27 www.bdimc.bradford.nhs.uk
Paper prepared from research carried out on behalf of the IMC by Dr Sam Oddie of the Bradford NHS Hospitals Foundation Trust.

28 www.bdimc.bradford.nhs.uk
Background literature prepared on behalf of the IMC by the University of Bradford School of Health Studies.

Comparisons of infant deaths excluding multiple births and deaths from congenital anomalies

It is common practice to remove babies with congenital anomalies and multiple births from analyses of infant deaths. This is because babies born as a result of multiple maternity have a greater risk of infant death. Given that the number of deaths from identified congenital anomalies in Bradford District is higher than might be expected, analyses excluding these babies will highlight any differences in infant mortality that can not be attributed to this factor.

Overall, for all causes of death, babies born to white mothers as a whole had an infant mortality rate of 7.1 per 1000 compared to 12.9 per 1000 for babies born to Pakistani-origin mothers. Excluding deaths from identified congenital anomalies and multiple births, the infant mortality rate for babies born to white mothers as a whole is 5.5 per 1000 compared to 8.1 per 1000 for babies born to Pakistani-origin mothers. This equates to a reduction of 55% in the additional risk of infant death among babies born to Pakistani-origin women compared to those born to white women.

Summary of Conclusions from evidence about the Causes of Death

- Autosomal recessive disorders are significantly more likely to be the cause of death for Pakistani-origin babies than for white babies born into the same quintile of deprivation. The risk of being affected by an autosomal recessive disorders is still relatively small even for this population, but if affected the outcome can be fatal **(Recommendation 7)**
- More of Bradford District's deaths are attributable to post neonatal infections than the average for England and Wales **(Recommendation 3b and 4)**
- The deaths from 'other conditions' and 'congenital anomalies' need more investigation and would benefit from more accurate recording of the cause of death **(Recommendation 9 and 10)**
- The Office of National Statistics need to use final, not initial cause of death, in their analyses

In Conclusion

The full Report of the Commission can be found on the website: **www.bdimc.bradford.nhs.uk**

This consists of material covering: Introduction and policy context for the work; Infant Mortality in England and Wales; Data studied and analysis; Analysis of Causes of Death and a Background Literature Review.

Appendix 1 of this summary outlines a Checklist for a 'Women-centred' approach to a healthy pregnancy and birth outcome

Appendix 2 gives a full list of members of the Commission

Appendix 3 provides a summary table of statistics used to prepare this report

The Commission approved the recommendations, the summary report and the report at its final meeting on the 1st November 2006 under the chairmanship of Julia O'Hara.

APPENDIX 1 - Checklist for a 'Women-centred' approach to a healthy pregnancy and birth outcome

This section was written on the basis of several Commission discussions and relevant literature. In particular, the NICE guidance on post natal care, published in July 2006, is very helpful, and is available on www.nice.org

For a woman to experience optimal maternal health she depends on a mixture of social and medical influences on her and her infant's life. Prior to and during pregnancy these include:

Her social circumstances

She is able to afford to eat well, heat her house and to be free from anxiety regarding poverty

She receives formal education to full secondary level

She lives in a decent standard of housing

She lives in a clean environment

Her own physical health

The pregnancy is planned

Prior to pregnancy, she has taken 400ug Folic Acid supplement and continues for twelve weeks into pregnancy

To have abstained from drinking alcohol at the time of conception

To be a non-smoker

Her BMI is 20-25 and she has general good nutritional status

During pregnancy

She is aged 25 - 30 years

She eats a healthy diet before and during pregnancy

No diabetes, no high blood pressure, no family history of pre-eclampsia or gestational diabetes

Does not smoke or take any un-prescribed drugs

Remains free from injury and illness during pregnancy

She is able to attain sufficient rest and recuperation during the last trimester as required

Her own emotional health

She has a positive attitude to her pregnancy and weight gain, i.e. a wanted pregnancy

Is free from depression and in good mental health

Her domestic circumstances

There is a supportive household, preferably with a car and telephone for access to assistance in emergency

No violence in the household

Her mother was well-nourished at the time of her own conception

She has access to good quality health services

Her health is monitored during pregnancy

She attends antenatal care at least four times and develops a good relationship with an expert midwife

She has access to a service that accurately identifies IUGR and its cause, and is able to respond with technologies to support adverse fetal developments

During the first year of her child's life, the following circumstances support a healthy outcome

Their social circumstances

Mother and child live in decent housing and are able to afford to resource the baby's material needs

She is able to share care of her baby with a partner

They have access to good social support and 'lay' experience in mothering

They live in a household free from domestic violence

The baby is not on the At Risk register or considered At Risk by health and social care professionals

Maternal physical health

She successfully initiates and maintains breast-feeding for six months

She has access to a healthy diet for breast-feeding

She remains in good physical health

Maternal emotional health

She remains free from post-natal depression and is generally able to cope

Access to health care services

They receive a seamless transfer of service from midwives to health visitors

They have access to mother and baby clinic for monitoring and support in infant health/care

The baby receives appropriate vaccinations, vitamin drops and development checks

APPENDIX 2 - Commission Members as at January 2005

Ms Nurjahan AliArobi - Walking for Health Co-ordinator

Mr Mohammed Ajeeb - Joint Chair, Strategic Health Improvement Partnership

Ms Elaine Appelbee - Chief Executive Bradford Vision

Ms Helen Brown - Assistant Head, Bradford Health Informatics Service

Cllr Elaine Byrom - Chair of Health Improvement Committee

Mr Mark Carriline - Chair of Children & Young People's Partnership

Dr Liz Kernohan - Director of Public Health

Professor Alison Macfarlane - Professor of Perinatal Health

Ms Heather Martin - Operations Director for Women's and Children's Services

Ms Rukhsana Mahmood - Community Development Worker

Dr Nadira Mirza - University of Bradford

Ms Cheryl Moorhouse - SANDS Representative

Ms Kal Nawaz - Joint Services Manager with Early Years Childcare Service

Dr Sam Oddie - Consultant Paediatrician

Ms Julia O'Hara - Chairman

Dr Sue Proctor - Chief Nurse, Strategic Health Authority

Ms Julie Rhodes - Principal Officer (Housing), CBMDC

Ms Sheila Rye - Head of Early Years

Ms Isobel Scarborough - CNet Community Network, Lay Representative

Mr Barry Schofield - Vice Chair, Royds Community Association

Cllr Martin Smith - Portfolio Holder for Health

Mr Derek Tuffnell - Consultant Obstetrician

Ms Lynnette Throp - Chair of Health Improvement Forum

Ms Zoe Wood - Maternity Services User Group, Representative

Ms Gemma Young - Maternity Services User Group, Representative

Ms Jan Smithies - Commission Co-ordinator

Miss Sadie Binns - Commission Secretariat

Communications Team -
Ron Miller, Sadie Binns
& Mark Brealey

APPENDIX 3 - Summary Table of Statistics

Live births, infant deaths and infant mortality rates by ethnicity in Bradford 1996 - 2003

Factor	Category	Infant Deaths	Live births	Infant Mortality Rate
Ethnicity	White	211	29848	7.07
	Pakistani	241	18637	12.93
	Bangladeshi	9	1403	6.41
	Other	24	3440	6.98

Source: Prepared by Bradford Health Informatics Service from the linked dataset

Calculation of Population Attributable Risk for White Ethnicity

Factor	Category	Infant Deaths	Live births	Infant Mortality Rate	Relative Risk	Confidence Interval for RR	Population Attributable Risk
Gestational Age	24-27	57	118	483.05	151.13	(112.87, 202.37)	27.22%
	28-31	20	222	90.09	28.19	(17.54, 45.30)	9.27%
	32-37	34	3094	10.99	3.44	(2.30, 5.14)	11.59%
	38+	76	23778	3.20	1.00	(0.73, 1.37)	-
Birthweight	<1000	82	157	522.29	182.11	(139.55, 237.66)	38.65%
	1000-1499	17	187	90.91	31.70	(19.15, 52.47)	7.80%
	1500-1999	17	472	36.02	12.56	(7.50, 21.04)	7.42%
	2000-2499	16	1486	10.77	3.75	(2.20, 6.41)	5.56%
	2500+	79	27546	2.87	1.00	(0.73, 1.37)	-
Deprivation	1	77	6135	12.55	8.28	(4.00, 17.13)	32.24%
	2	57	6114	9.32	6.15	(2.94, 12.88)	22.73%
	3	37	6172	5.99	3.95	(1.84, 8.48)	13.16%
	4	31	6140	5.05	3.33	(1.53, 7.24)	10.33%
	5	8	5277	1.52	1.00	(0.38, 2.66)	-
Age of Mother	<20	51	3599	14.17	3.71	(1.35, 10.23)	17.66%
	20-24	56	6556	8.54	2.24	(0.81, 6.15)	14.68%
	25-29	47	8445	5.57	1.46	(0.53, 4.03)	7.00%
	30-34	29	7598	3.82	1.00	(0.35, 2.83)	-
	35-39	24	3158	7.60	1.99	(0.69, 5.71)	5.66%
	40 & over	4	487	8.21	2.15	(0.54, 8.56)	1.01%
Parity	0	84	10984	7.65	1.49	(0.61, 3.65)	14.29%
	1	61	9094	6.71	1.31	(0.53, 3.23)	7.40%
	2	19	3699	5.14	1.00	(0.38, 2.66)	-
	3	15	1401	10.71	2.08	(0.76, 5.70)	4.04%
	4	9	534	16.85	3.28	(1.11, 9.72)	3.24%
	5 +	5	398	12.56	2.45	(0.71, 8.38)	1.53%

APPENDIX 3 - Summary Table of Statistics

Calculation of Population Attributable Risk for Pakistani Ethnicity

Factor	Category	Infant Deaths	Live births	Infant Mortality Rate	Relative Risk	Confidence Interval for RR	Population Attributable Risk
Gestational Age	24-27	36	91	395.60	68.12	(49.05, 94.61)	15.36%
	28-31	22	148	148.65	25.60	(16.51, 39.67)	9.15%
	32-37	60	2123	28.26	4.87	(3.52, 6.74)	20.64%
	38+	88	15153	5.81	1.00	(0.74, 1.34)	-
Birthweight	<1000	64	141	453.90	85.76	(65.01, 113.12)	26.47%
	1000-1499	25	192	130.21	24.60	(16.14, 37.49)	10.04%
	1500-1999	20	346	57.80	10.92	(6.80, 17.55)	7.60%
	2000-2499	43	1519	28.31	5.35	(3.73, 7.68)	14.63%
	2500+	87	16437	5.29	1.00	(0.74, 1.34)	-
Deprivation	1	137	10088	13.58	2.68	(0.85, 8.37)	35.60%
	2	78	6376	12.23	2.41	(0.76, 7.61)	18.94%
	3	23	1582	14.54	2.86	(0.86, 9.50)	6.21%
	4 and 5	3	591	5.08	1.00	(0.20, 4.93)	-
Age of Mother	<20	18	1324	13.60	1.20	(0.48, 3.00)	1.30%
	20-24	78	6744	11.57	1.02	(0.45, 2.33)	0.81%
	25-29	85	6071	14.00	1.24	(0.55, 2.81)	7.02%
	30-34	34	3013	11.28	1.00	(0.42, 2.36)	-
	35-39	14	911	15.37	1.36	(0.53, 3.51)	1.58%
	40 & over	6	243	24.69	2.19	(0.72, 6.69)	1.39%
Parity	0	69	5392	12.80	1.28	(0.76, 2.17)	7.14%
	1	51	4712	10.82	1.08	(0.63, 1.87)	1.87%
	2	43	3242	13.26	1.33	(0.76, 2.32)	5.00%
	3	24	1950	12.31	1.23	(0.67, 2.28)	2.13%
	4	9	902	9.98	1.00	(0.45, 2.23)	-
	5 +	17	814	20.88	2.09	(1.08, 4.07)	4.17%

Source: Prepared by Bradford Health Informatics Service from the linked dataset

Notes:

Design & Production by Bulletpoint www.bulletpointdesign.co.uk

Telephone: 01274 435486 Email: imcenquiries@bradfordvision.com Website: www.bdimc.bradford.nhs.uk