

Unequal at birth

Inequalities in the occurrence of low birthweight babies in Ireland

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Executive Summary

Rationale for the report

The proportion of babies who are born low birthweight (weighing less than 2500 grams) is a marker of overall population health. Low birthweight is a major public health concern, primarily because babies who are born low birthweight are at a greatly increased risk of death in the first week and the first year of life. Furthermore, low birthweight is associated with a number of adverse developmental, educational, behavioural and socio-economic outcomes in childhood, adolescence and later life.

In Ireland, inequalities in health outcomes between the richest and the poorest members of Irish society have been highlighted as an important aspect of poverty. The Working Group of the National Anti-Poverty Strategy (NAPS) and Health has included low birthweight in one of three core targets to reduce health inequalities in Ireland. The target states that:

The gap in low birthweight rates between children from the lowest and the highest socio-economic groups should be reduced by 10% from the 2001 level, by 2007.

This report was commissioned by the Department of Health and Children, funded by the National Children's Office and conducted by the Institute of Public Health in Ireland to quantify and assess the effect of socio-economic status on low birthweight in Ireland and consider these findings in the light of the NAPS target. Data on births in the Republic of Ireland is analysed in this regard. The report then provides a critical exploration of the relationship between socio-economic status and low birthweight and reviews the evidence of what works in reducing inequalities in the occurrence of low birthweight. Current knowledge on social and environmental determinants of low birthweight, with particular reference to observational data recorded in Ireland at population and service level are also included.

The report provided the impetus for an intersectoral discussion and the development of recommendations on tackling inequalities in the occurrence of low birthweight babies in Ireland at an 'Exploratory Workshop on Tackling Inequalities in the Occurrence of Low Birthweight Babies in Ireland' held in December 2005.

Methodology used in the report

Data provided by the National Perinatal Reporting System (NPRS) was used for the analysis. The socio-economic group of the parent was used as a measure of socio-economic status in this report, according to the socio-economic group coding used by the Central Statistics Office. Births were analysed according to socio-economic group, employment status, age of mother and marital status.

Data on all singleton births in the Republic of Ireland in 1999 is reported. A regional analysis of singleton births in the Republic of Ireland was conducted on the national dataset. A separate analysis of all births in the Eastern Regional Health Authority (ERHA) in the year 1999 to 2001 was also conducted. A further analysis of births in the ERHA dataset was conducted according to local authority regions.

A number of challenges were identified in utilizing data to examine the NAPS target for the reduction of inequalities in low birthweight. National data for only one year, 1999, is presented in the report as data pre-1998 was unavailable for analysis. Translating occupational data into meaningful socio-economic variables for the babies of parents who worked in the home and where data on only one parent was available presented much food-for-thought. A variable that merged available data on fathers and mothers occupation was devised for the analysis on the national dataset.

Results of the analysis

The analysis of all singleton births in the Republic of Ireland in 1999 is presented in part three of the report. The key findings from the analysis are listed below:

- Babies born to parents who are unemployed were at over twice the risk of being low birthweight in 1999, when compared to those parents recorded as higher professionals.
- Babies born to parents who are non-manual workers had an increased risk of between 46% and 60% of being low birthweight in Ireland in 1999, when compared to those parents recorded as higher professionals.
- Babies born to parents whose socio-economic status was recorded as unknown were at over twice the risk of being low birthweight in 1999, when compared to those parents recorded as higher/lower professionals (Socio Economic Group A).
- The greatest risk of being born low birthweight was recorded for babies born to parents who were classified in the Unknown and the Unemployed/Home Duties categories in the national sample in 1999.
- Teenage mothers and unmarried mothers had a significantly higher risk than the general population of having a low birthweight baby in 1999.
- If all socio-economic groups had the same proportion of low birthweight births as the highest socio-economic group, there would have been an estimated 695 fewer low birthweight babies born in 1999. This comprises approximately one third of the total number of low birthweight babies born in the Republic of Ireland in 1999.

The analysis of all births in the ERHA in the years 1999 to 2001 is presented in part four of the report. The key findings from this analysis are listed below:

- The greatest risk of being born low birthweight was recorded for babies born to parents who were classified in the Unknown and the Unemployed categories in the ERHA sample in the years 1999 to 2001.
- Babies born to parents resident in County Dublin exhibit a significantly higher proportion of low birthweight compared to the national figures.

- Babies born to fathers who are semi-skilled/unskilled manual workers were at a significantly higher risk of low birthweight in the ERHA between 1999 and 2001, compared to the average risk of low birthweight in the ERHA.
- Babies born in the ERHA to parents resident in Dublin City local authority were at a 22% higher risk of low birthweight in 2001, when compared to those born to parents in the Dun Laoighaire/Rathdown local authority. The geographic inequalities in low birthweight in the ERHA appear to have widened over the years 1999 to 2001.

Results of the review

Low birthweight is associated with a broad range of socio-demographic, environmental, cultural and psychological factors in addition to health behaviour and health service factors. Narrowing the gap in low birthweight rates will necessitate an improvement in the absolute and relative health of the poorest groups. Addressing both upstream and downstream factors on the causal pathway between lower socio-economic status and preterm birth and the causal pathway between lower socio-economic status and intra-uterine growth retardation is required. Interventions relevant to tackling inequalities in low birthweight are grouped as follows:

- Interventions aimed at the socio-demographic and socio-economic determinants of low birthweight.
- Interventions aimed at the psycho-social factors associated with low birthweight, with particular reference to lower socio-economic groups.
- Interventions aimed at health behaviour determinants of low birthweight, with particular reference to lower socio-economic groups.
- Interventions aimed at the health service determinants of low birthweight, with particular reference to lower socio-economic groups.
- Interventions aimed at disease-specific determinants of low birthweight.

There is a lack of integration of approaches to low birthweight between those conducting research in the field of obstetrics and perinatal medicine and those conducting research on socio-economic trajectories in birthweight at population level. As a result, the efficacy of multi-component strategies in preventing low birthweight is unclear from the international literature.

The literature is inconclusive on the effect of providing extra income during pregnancy in relation to improving birth outcomes. Further social policy analysis on the adequacy of current social welfare payments including Maternity Benefit and half-rate Maternity Benefit for unemployed women and low-paid women in Ireland is required.

Teenage pregnancy is more common among lower socio-economic groups and is associated with low birthweight, poor attendance at antenatal services, adverse health behaviours in pregnancy and adverse socio-economic outcomes in the long-term for mother and child. The prevention of unwanted teenage pregnancy and the improvement of birth outcomes in this group could make a small but significant contribution to reducing inequalities in low birthweight. Review-level evidence reports reductions in low birthweight babies to teenagers associated with specialist antenatal services, early enrolment and consistent attendance at antenatal services. The targeting of services to pregnant teenagers at local level in high-risk areas, based on local needs assessment is particularly effective.

A greater risk of low birthweight and adverse birth outcomes has been recorded for babies from minority ethnic groups in the international literature. Data on birth outcomes for Irish Travellers reports extremely high levels of early-life mortality among Traveller infants and therefore suggests that babies born into the Travelling community are at higher risk of low birthweight. No data on the efficacy of interventions to improve birth outcomes in this group was found.

An estimate of the risk of low birthweight experienced by babies born to ethnic minority women in Ireland was not available in the 1999 NPRS data. Data relating to parents country of residence and nationality on the National Perinatal Reporting System is now being collected. The relative contribution of ethnicity to socio-economic inequalities in low birthweight in Ireland is unknown. There is a lack of systematic review-level evidence on the effectiveness of interventions aimed at improving birth outcomes for ethnic minority groups in the international literature.

Interventions to reduce psychological stress and improve social support for women in pregnancy do not appear to have been successful in reducing the occurrence of low birthweight babies. The evidence-base relating to these factors is currently limited by methodological challenges.

Drug misuse among pregnant Irish women is increasing and opiate-using pregnant women in Ireland are young, poorly educated, regular tobacco smokers and tend to come from deprived areas. This group are at particular risk of delivering low birthweight babies. A Specialist Drug Liaison Midwife service has been established in Ireland to meet the needs of this group and has recorded birthweights well below the national average. There is some supporting evidence that specialist services associated with drug treatment services are effective in improving key neonatal outcomes. There is no review-level evidence on the efficacy of interventions in reducing low birthweight in babies born to drug misusing mothers. As the absolute numbers of drug-misusing mothers is small, the targeting of interventions to this high risk group will have a small impact at population level.

Smoking is strongly associated with low birthweight with supporting evidence for the existence of a dose-response relationship. Data from population-based surveys of health

behaviours in Ireland and observational data from studies in Irish Maternity Hospitals support the view that women from lower socio-economic groups are more likely to smoke in pregnancy. Systematic reviews support the efficacy of interventions to increase smoking cessation in pregnancy by up to 70%, but the overall gain in birthweight achieved was less than expected from these interventions. Smoking cessation interventions appear to be less successful among pregnant women from lower socio-economic groups. The reduction of smoking in pregnancy would have a major impact on narrowing the gap in inequalities in the occurrence of low birthweight.

There is a lack of high quality reviews relating to the efficacy of interventions focusing on nutrition and dietary health education in improving birthweight. Calcium supplementation and magnesium supplementation may have a role in reducing low birthweight for select groups of pregnant women. There is conflicting low quality review-level evidence regarding the effectiveness of balanced protein/ energy supplementation in preventing low birthweight. There is a lack of review level evidence on the routine use of combined iron and folate supplementation for the prevention of low birthweight. A 2003 Cochrane review reported no consistent benefit of nutritional advice on low birthweight.

Excess alcohol consumption in pregnancy is associated with low birthweight. There is no Irish data, as yet, to support the view that women from lower socio-economic groups are more likely to consume excess alcohol in pregnancy. Therefore the role of alcohol in the generation of inequalities in low birthweight in Ireland is unknown.

Babies born to women with 'no antenatal care' have mortality rates far in excess of those born to women with 'hospital antenatal care' or 'combined care' (GP and maternity hospital) in Ireland. The later a woman attends antenatal services in her pregnancy, the more likely she is to have a baby with worse birth outcomes. Teenage mothers, unmarried mothers and ethnic minority women are over-represented in those mothers not availing of the full antenatal care service in Ireland. Many of the factors associated with poor attendance are also associated with lower socio-economic group and with low birthweight. This would suggest that targeting interventions towards the early enrolment of pregnant disadvantaged women in antenatal services may have a role in reducing low birthweight births to these women.

Bacterial vaginosis is associated with an increased risk of preterm birth and thus low birthweight babies. Bacterial vaginosis is also more frequent among women in lower socio-economic groups. A Cochrane review concluded that there was no justification for establishing antenatal screening for all women for bacterial vaginosis.

An exploration of the relationship between socio-economic status and congenital anomaly in Ireland would serve to improve our understanding of the social gradients observed in relation to mortality and low birthweight.

Conclusions

Inequalities in the occurrence of low birthweight in Ireland are starkly demonstrated by the findings of the analysis. In a time of unprecedented economic growth and development in Ireland, such inequalities are an unacceptable feature of a developed, fair and wealthy society.

While increasingly sophisticated clinical interventions have greatly decreased the mortality and morbidity of low birthweight newborns over the past decade, there is some evidence to suggest that the proportion of Irish babies born low birthweight may be on the increase.

Despite the well-established relationship between socio-economic group and poor birth outcome, there is a lack of evaluation and efficacy data on what works in breaking this link and improving birth outcomes for the poorest members of society. Social policy analysis on social welfare payments and income provision for low paid and unemployed pregnant women in Ireland would be of benefit in building healthy public policy to reduce health inequalities in birthweight, with important lessons to be learned from the SureStart Plus programme operating in the UK.

The birth outcomes of Travellers are of particular concern and the birth outcomes of ethnic minority women are in need of increased and appropriately devised surveillance. Evaluation and audit of specialist services that have evolved in Ireland to meet the needs of vulnerable subgroups of pregnant Irish women (such as those for drug misusing, teenage and ethnic minority women) would be of great assistance in building the evidence-base for what works in reducing health inequalities in birthweight.

Sensitively and carefully designed interventions aimed at improving health behaviours in pregnancy, especially smoking, among deprived women have a role in reducing low birthweight. Antenatal care may have an important role to play in reducing the proportion of babies born low birthweight in Ireland, particularly to teenagers. The benefits of antenatal care can only be gained by those who attend and strategies aimed at encouraging early enrolment and attendance by women of lower socio-economic status are likely to assist in this regard.

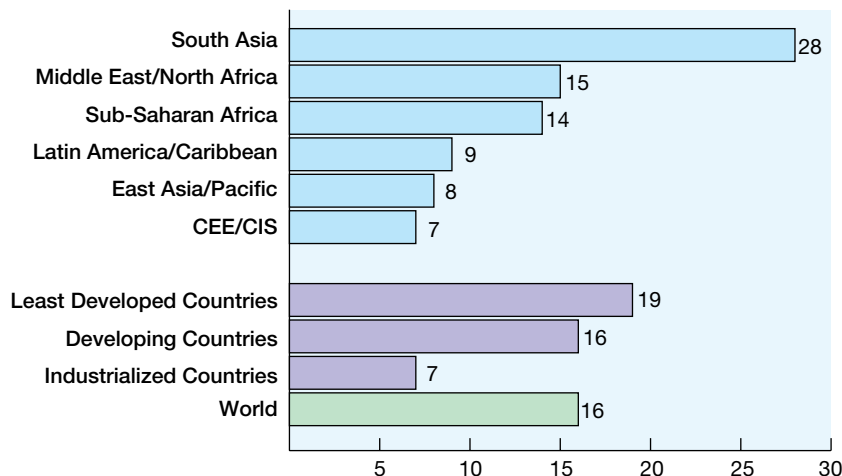
Part 1. Introduction

1.1 Understanding low birthweight

Low birthweight is a major public health concern but it is not a disease or a diagnosis. The term low birthweight is a convenient label to identify a group of babies with similar risks and has been defined by the World Health Organisation as a birthweight less than 2,500 grams.

The term low birthweight rate refers to the percentage of total births that weigh less than 2,500 grams. The highest low birthweight rates are found in developing countries. This is a stark reminder of the relationship between birth outcomes and the social and economic environment experienced by the pregnant mother. The global situation in terms of low birthweight rates is depicted in Figure 1, based on data collated for the year 2000 (UNICEF/WHO, 2004).

Figure 1. Global distribution of low birthweight rates



- Bars represent the percentage of total births that weigh less than 2,500 grams
- CEE/CIS refers to Central and Eastern Europe and the Commonwealth of Independent States

The low birthweight rate in the Republic of Ireland for the year 2000 was estimated at 4.9%.

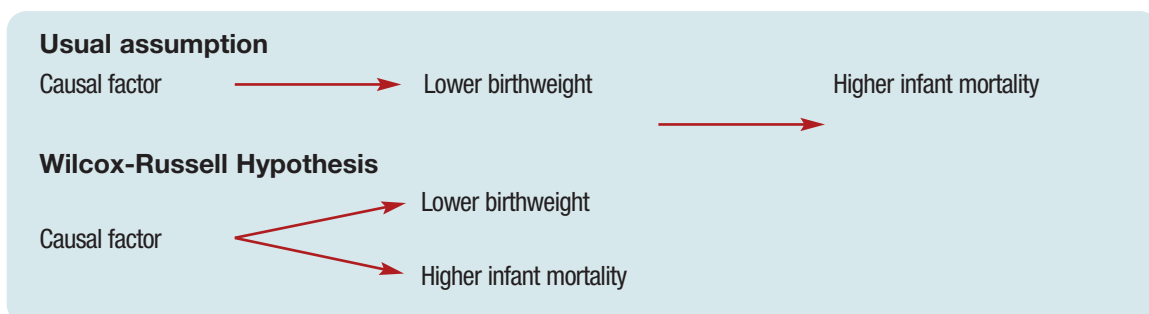
In Ireland, the last century has brought increases in birthweight across all social classes and associated declines in the mortality rates of babies, infants and children (Central Statistics Office, 2001). A review of labour ward registers in an Irish maternity hospital for the years 1900 to 2000 estimated that birthweights increased by 300 grams for male infants and 230 grams for female infants over the last century. The lowest mean birthweight was recorded in 1950, presumed to be an after-effect of World War II, with the greatest increases in mean birthweights in Ireland recorded for the period 1950 to 2000 (Connolly, 2005).

Ireland is clearly in a remarkably privileged position in the global league of low birthweight rates, but these positive birth outcomes are not shared equally by all Irish citizens. The level of relative income poverty in Ireland is the highest in the European Union and this has contributed to quite striking inequalities in health outcomes. There is a widening gap between the rich and the poor and this gap creates inequalities in health between different socio-economic groups in Ireland (Balanda & Wilde, 2003). In addition to wide disparities in mortality (Balanda & Wilde, 2001), there are considerable health inequalities evident in relation to low birthweight both in Ireland and in the UK (Moser et al, 2003). For example, in the early 1990s, unemployed Irish women were over twice as likely to give birth to low birthweight babies as women in the ‘higher professional’ socio-economic group (Barry et al, 2001).

The pathways by which a baby comes to be born weighing less than 2500 grams are complex, but can be considered in terms of two broad groupings. As a rule of thumb in developed countries, around two thirds of low birthweight babies are babies who are born premature (in the womb for less than 37 weeks). The other one third of low birthweight babies are those who are born after 37 weeks but whose growth while in the womb has been limited. The proportion of low birthweight babies that are premature and that are growth-limited varies between countries. For example in developing countries, the proportion of low birthweight babies who are born after 37 weeks but who are growth-limited is much higher. Socio-economic deprivation has an effect on both these pathways, being independently associated with both premature delivery and with babies who are not born early but who are born underdeveloped (Kramer et al, 2000).

The percentage of newborns who are low birthweight is often used as one measure of overall population health. While the association between low birthweight and infant mortality is universally accepted, the degree to which this relationship is causal has recently been questioned (Wilcox, 1997). The Wilcox-Russell Hypothesis postulates that low birthweight and infant mortality may have a common causal factor rather than low birthweight being the cause of infant mortality per se.

Figure 2. The Wilcox-Russell Hypothesis



However, the prevention of low birthweight remains an explicit part of World Health Organisation public health policy to decrease infant mortality. Furthermore the use of low birthweight as a measure of population health and a target for reducing health inequalities has importance above and beyond its association with mortality. Low birthweight is associated with a number of key developmental, educational and socio-economic outcomes in later life. Indeed, in Ireland, where the absolute numbers of babies dying in the first year is particularly small by international standards, a focus on reducing inequalities in low birthweight rather than mortality is preferred.

There are a number of key terms used to measure birth and health outcomes for babies. These terms are used in this report and described in Table 1.

Table 1. Guide to key terms and statistics for births and babies

Abbreviation	Perinatal statistic	Definition
Live birth	Live birth	Birth of a foetus weighing at least 500 grams
Stillbirth	Stillbirth	Birth of a foetus with no signs of life and weighing at least 500 grams
Total births	Total births	Live births + Stillbirths
Twinning rate	Twinning rate	Number of twin maternities per 1000 total number of maternities
LBW	Low birthweight	Babies born weighing less than 2,500 grams
LBWR*	Low birthweight rate	Proportion of total births weighing less than 2500 grams
IUGR-LBW	Intra-uterine growth retardation-low birthweight	Refers to babies born at more than 37 weeks of gestation weighing less than 2500 grams (replaces the term "small for gestational age" (SGA))
VLBW	Very Low Birthweight	Babies born weighing between 1001 to 1500 grams (included in the LBW category)
ELBW	Extremely Low Birthweight	Babies born weighing less than 1000 grams (included in the LBW category)
SR	Stillbirth rate	Stillbirths per 1000 total births
PMR	Perinatal mortality rate	Stillbirths plus deaths to babies under 7 days per 1000 total births
Adjusted PMR	Adjusted perinatal mortality rate	PMR excluding all stillbirths and deaths to babies under 7 days due to congenital anomalies
ENMR	Early neonatal mortality rate	Deaths to babies under 7 days per 1000 live births
NMR	Neonatal mortality rate	Deaths to babies under 28 days per 1000 live births
PNMR	Post-neonatal mortality rate	Deaths to babies aged 28 days and over and less than one year per 1000 live births
IMR	Infant mortality rate	Deaths to children under 1 year per 1000 live births

*The term LBWR has been used in other settings to refer to the proportion of live births that are low birthweight. We have including stillbirths weighing more than 500grams in our analysis of LBWR.

Low birthweight is strongly associated with all the mortality rates listed in Table 1. The relationship between birthweight and these mortality rates (based on Republic of Ireland data from the National Perinatal Reporting System) is presented in Figure 3, with the data listed in Table 2.

Figure 3. Relationship of birthweight to early-life mortality (2000)

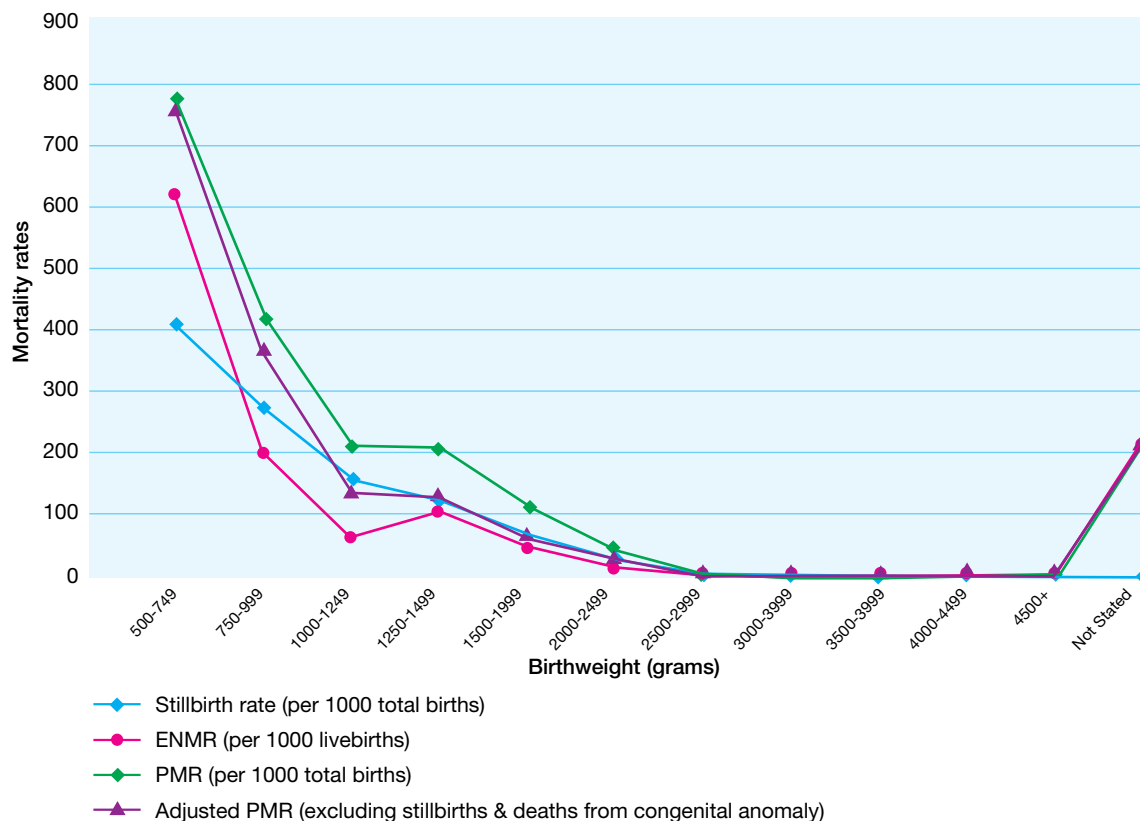


Table 2. Relationship of low birthweight to mortality rates in the Republic of Ireland (2000)

Birthweight (grams)	Stillbirth rate (per 1000 total births)	Early neonatal mortality rate (per 1000 live births)	Perinatal mortality rate (per 1000 total births)	Adjusted PMR (Minus stillbirths & deaths from congenital anomaly)
500-749	406.3	614	770.8	755.6
750-999	276.2	197.4	419.0	364.5
1000-1249	158.3	59.4	208.3	136.4
1250-1499	121.2	103.4	212.1	126.1
1500-1999	70.6	49.7	116.8	62.0
2000-2499	28.7	15.2	43.5	26.3
2500-2999	4.9	2.3	7.2	4.2
3000-3999	2.2	0.6	2.8	2.4
3500-3999	2.0	0.7	2.7	2.2
4000-4499	0.9	0.6	1.5	1.1
4500 +	3.4	1.2	4.6	4.6
Not stated	0	222.2	222.2	222.2

1.2 Consequences of low birthweight

Low birthweight babies have a less advantageous start to life that may have effects on their development as children and their adult lives. They are at increased risk of dying in the first few weeks of life and incurring a variety of serious health problems in the perinatal period such as feeding problems, breathing difficulties, brain damage and infections. Low birthweight is also strongly associated with death within the first month and within the first year of life.

Low birthweight is a critical aspect of child poverty. Low birthweight babies are at an increased risk of developing learning, physical and sensory disabilities (hearing and visual impairments) that will present major challenges to them as developing children and adolescents in terms of their education, employment and quality of life. Deprivation was found to be strongly associated with congenital hearing impairment in a sample of babies born in Greater Glasgow between 1985 and 1994, due to more prematurity and low birthweight in deprived families (Kubba, 2004). Longitudinal studies show that children who were low birthweight babies tend to have lower IQ's and/or poorer academic performance and an increased frequency of behavioural problems compared to babies born above the 2500 gram threshold (Hollo et al, 2002; Aylward et al, 1989).

For low birthweight babies born into socio-economic deprivation, these factors will hinder their chances of lifting themselves out of poverty as adults. In this regard, longitudinal studies show that low birthweight is significantly associated with socio-economic disadvantage in later childhood and adolescence (Bartley et al, 1994). Furthermore, the social inequalities evident in relation to birthweight may be an important mechanism by which the intergenerational cycle of poverty can be facilitated to repeat itself.

The effects of low birthweight are life-long. Longitudinal studies have shown that low birthweight babies are more likely to develop cardiovascular disease and diabetes in adulthood (Barker et al, 2001), although the mechanisms are as yet poorly understood. It has also been proposed that a non-genetic predisposition to low birthweight and increased risk of cardiovascular disease may be inherited across several generations (Drake & Walker, 2004).

Low birthweight babies have profound effects on families, on society and on the health services. Low birthweight babies are more likely to require longer periods of hospitalisation incurring a substantial emotional cost to the parents and interference in the early bonding that is critical to the development of a parent-child relationship. Low birthweight babies comprise the majority of patients in the Neonatal Intensive Care Units. The Neonatal ICU ranks among the most costly of all hospital care, with an estimated £8.03 million spent on this specialised service in the Republic of Ireland in 1986 (Connolly et al, 1989).

The causes and effects of low birthweight have traditionally been examined using two paradigms. At a population level birthweight has been included as a variable in longitudinal studies that generally begin at the time of birth, and therefore cannot

adequately record biological and other factors during pregnancy. No such study has been conducted in Ireland to date. However, a National Longitudinal Study of Children in Ireland is commencing in 2006 under the auspices of the Office of the Minister for Children (formally the National Childrens Office) and it is hoped that birthweight will be included as one of the variables.

On the other hand, low birthweight has been examined at service and individual level through research conducted in the field of obstetrics and perinatal medicine. This research generally uses a biomedical paradigm and often omits measures of socio-economic relevance. It has been suggested that the causes and effects of low birthweight will be better understood if the biological and socio-economic trajectories are investigated in combination (Bartley et al,1994).

1.3 Statistics for low birthweight in Ireland

Data from the Report on Perinatal Statistics for 2000 (Bonham, 2004) is used to describe births in the Republic of Ireland in this section.

In 2000, 55,166 births were notified to the National Perinatal Reporting System (NPRS) in the Republic of Ireland. The average birthweight of babies born in that year was 3,491 grams. There were an estimated 2703 low birthweight babies recorded in 2000, representing 4.9% of all births. Between 1991 and 2000 the proportion of low birthweight babies has increased by 15.1% (ref. Figure 2.3 in Report on Perinatal Statistics, 2000). It is not possible to conclude whether this increase observed in the proportion of low birthweight babies born is significant, representing a true increase, or whether it could be attributed to improvements in the NPRS data collection system since 1998 (as detailed in part two of this report).

Approximately 43.35% of multiple births and 3.8% of singleton births comprised low birthweight babies. Of the low birthweight singleton births, an estimated 64% were born premature and the remainder were born after 37 weeks of gestation.

There were 308 stillbirths in the Republic of Ireland in 2000. The stillbirth rate was recorded as 5.6 per 1000 total births in 2000. This is an increase of 0.3 per 1000 since 1999, but an overall decrease of 1.8% over the previous decade.

There were 484 perinatal deaths in the Republic of Ireland in 2000 including 348 adjusted perinatal deaths i.e. the number of deaths excluding stillbirths and deaths related to congenital anomaly. The perinatal mortality rate was recorded as 8.8 per 1000 total births in 2000, which demonstrates an increase of 7.3% since 1999 and an overall decrease of 11.1% in the PMR over the last decade.

There were 176 early neonatal deaths in the Republic of Ireland in 2000. The early neonatal mortality rate was recorded as 3.2 per 1000 live births in 2000, with the overall early neonatal death rate decreasing by 23.8% in the period 1991 to 2000.

Average gestational age (length of pregnancy) has remained constant at 39.5 weeks.

The twinning rate was recorded as 12.8 per 1000 maternities comprising 698 twin births, 16 triplet births and 1 quadruplet birth.

Infants weighing less than 500 grams are not included in the National Perinatal Reporting System statistics in the Republic of Ireland.

1.4 Poverty and low birthweight – the policy context

In 1997, Ireland's National Anti-Poverty Strategy was published, which outlined the causes and consequences of poverty and set targets for the reduction of poverty in Ireland. People are considered to be living in poverty if their income and resources (material, cultural and social) are so inadequate as to preclude them from having a standard of living which is regarded as acceptable to Irish society generally (National Anti-Poverty Strategy, 1997). As a result of inadequate income and other resources people may be excluded and marginalised from participating in activities which are considered the norm for other people in society.

Poverty can be measured by various means. Statistics on poverty in Ireland have mainly been derived from the Living in Ireland Survey (Callan et al, 1999), which was replaced by the EURO-SILC survey in 2003. These surveys measure the level of household income and the experience of deprivation i.e. the effect of that income on the household's ability to purchase goods and services that are accepted as the norm in society such as adequate meals or home-heating.

The number of people below half of the population average income, or 60% of median income, is effectively a measure of income inequality, this measure being commonly referred to as 'the poverty line'. The percentage of people living below this line is referred to as relative income poverty and is a rough measure of the distribution of wealth within a population. Relative income poverty in Ireland is estimated at 22.7% for the year 2003, the highest in the European Union and this gap between the richest and the poorest members of society has been widening in Ireland in the last decade (Combat Poverty Agency, 1999).

Applying consistent poverty as an indicator of poverty combines a measurement of relative income with a measurement of deprivation, using indicators of deprivation based on what Irish people consider are necessary to ensure an adequate standard of living (Office for Social Inclusion, 2005). It has been noted in Ireland's National Action Plan against Poverty and Social Exclusion (NAPS/inclusion) that consistent poverty had fallen steadily from 15.1% in 1994 to 8.2% in 1998 to 5.2% in 2001. This decline reflects the positive impact of reductions in unemployment and enhanced income supports arising from a buoyant economy. Lone parents, families with more than four children and the unemployed are over-represented in those living in consistent poverty.

A lack of adequate data does not permit the level of consistent poverty being experienced by Travellers or other ethnic minority groups to be examined (Office for Social Inclusion, 2003).

Indicators of socio-economic status act as proxy measures for the risk of poverty. Socio-economic status is typically measured according to occupational status but can also be measured by means of income or educational attainment.

The first National Anti-Poverty Strategy (NAPS) in the Republic of Ireland acknowledged the influence of poverty on health but did not set specific targets to reduce health inequalities from the outset. A NAPS and Health Working Group was established to develop health targets (Institute of Public Health in Ireland, 2001). Three core targets for the reduction of health inequalities in Ireland were derived, one of which refers specifically to the reduction of inequalities in birthweight.

The target states that:

The gap in low birthweight rates between children from the lowest and highest socio-economic groups should be reduced by 10% from the 2001 level, by 2007.

1.5 Key partners in developing the report

This report was commissioned by the Department of Health and Children and funded by the National Children's Office in order to address the NAPS health target on low birthweight set by the Working Group on NAPS and Health (Institute of Public Health in Ireland, 2001). The National Children's Office is a statutory body whose role is to encourage co-ordination of policy and service delivery for children at national and local level and to support the Minister for Children in overseeing the National Children's Strategy (Department of Health and Children, 2000).

The Institute of Public Health in Ireland is an all-island body which supports and strengthens work for public health. The aim of the Institute is to improve health in Ireland, by working to combat health inequalities and influence public policies in favour of health. The Institute aspires to develop a coherent response to tackling health inequalities in both parts of the island.

1.6 Socio-economic status, poverty and low birthweight in Ireland – unravelling the connection

The analysis conducted for this report endeavours to quantify the effect of socio-economic group on low birthweight in Ireland and consider these findings in the light of the NAPS target for reducing health inequalities in birthweight, as outlined in section 1.4. The analysis presented in parts three and four of the report also examines the influence of other factors such as mother's age and marital status on the occurrence of low birthweight babies within Ireland in the context of the NAPS target.

While the association between lower socio-economic group and the risk of low birthweight is consistently reported, the dynamics of this relationship remain elusive. A small-area analysis of low birthweight in Dublin between 1986 and 1989 concluded that the proportion of the population covered by the GMS (medical card) was the best predictor of low birthweight, explaining around 22% of the variance (Johnson, 1994). The mechanisms by which this association occurs are inherently complex encompassing social, nutritional, lifestyle, medical, psychological, educational, environmental and cultural factors. A brief overview of our current level of knowledge on low birthweight based on Irish research is presented in this section.

From observational studies conducted in Ireland and from previous annual reports of Ireland's National Perinatal Reporting System, it is evident that women in lower socio-economic groupings are more likely to experience a teenage pregnancy and, as young mothers (aged 19 years or less), they are more likely to deliver a low birthweight baby. Teenage pregnancies are associated with prematurity and the preterm delivery rate of teenagers far exceeded matched controls of women aged 20 – 24 years in one Irish maternity hospital (Connolly, et al,1998).

Almost ninety percent of attendees at a Dublin Adolescent Antenatal Booking Clinic were recorded as being in the lowest socio-economic group and most had poor educational attainment. Eighty seven percent of these mothers had left school. Eighty percent of them had not sat the Leaving Certificate with another ten percent reporting never sitting a state examination. A quarter of these women were over twenty weeks pregnant at first presentation to health services with over two thirds saying they were afraid to attend hospital earlier (Fitzpatrick et al,1997). It is also well recognised that pregnant schoolgirls are more likely to live in areas with poor housing, overcrowding and high unemployment rates (Smith, 1993).

Poor attendance at antenatal services is associated with poor birth outcomes, including low birthweight (Bonham, 2004). A study of the perinatal outcome in unbooked women (women presenting to the hospital for the first time while in labour) at the Rotunda Hospital in Dublin demonstrated that unbooked women were more likely to be unmarried and unemployed. The perinatal mortality rate for this group is 39/1000 compared to the Rotunda PMR of 8.1/1000 for 1998. Unbooked women were significantly more likely to deliver pre-term and to deliver a low birthweight baby. The babies of unbooked mothers had higher neonatal intensive care admissions and were more likely to die in the first week of life. Of unbooked women, 20 were refugees and 15 had concealed their pregnancy. Lower levels of education were found to be strongly associated with unbooked pregnancies (Treacy et al,2002).

The issue of late presentation is a critical one in relation to the fate of low birthweight babies. Early attendance and regular monitoring are particularly important for the detection of babies who are developing abnormally or inadequately in the womb and are at risk of being low birthweight. The appropriate management of the pregnancy at risk of low birthweight requires regular monitoring combined with appropriate timing and mode of

delivery. Such measures have been proven to prevent death and long-term handicap for some babies.

Smoking and drug misuse in pregnancy increase the risk of low birthweight babies and are more common health behaviours in women living in deprived circumstances and in younger women. Pregnant women who smoke are more likely to be younger and unmarried. Smoking was inversely related to education level in a sample of Irish pregnant women (Mehanni et al 2000). Over half of the teenagers attending a Dublin Adolescent Antenatal Booking Clinic continued to smoke in pregnancy and a quarter continued to drink alcohol (Fitzpatrick et al, 1997).

The rate of maternal cigarette smoking in low birthweight pregnancies, whether the baby was subsequently stillborn or liveborn, is approximately sixty percent among mothers delivering in the National Maternity Hospital in Dublin between 1989 and 1991 (Geary et al, 1997). This is far in excess of population-based estimates for smoking among women in Ireland at 30% +/- 2.4% (Office for Tobacco Control, 2003). A longitudinal population based cohort study of 1124 Irish mothers and infants has also reported a significant association between low birthweight and regular smoking (Segonds-Pichon et al, 2004).

The nutrition of young Irish women in lower socio-economic groups compares poorly to higher socio-economic groups (Friel et al, 1999). This may be a causative factor in the development of babies with congenital deformities and low birthweight babies. In particular, one study reported food poverty among pregnant asylum seeking women living in hostels in Ireland with the "direct provision" system causing hardship in accessing appropriate food and limited access to kitchen facilities (Kennedy & Murphy-Lawless, 2001). In 2005, the direct provision system provides asylum seekers with €19.10 per week per adult and €9.60 per child with accommodation and board (set meals) provided in designated hostels/centres. The direct provision systems means that this group are thereby prevented from accessing full rates of supplementary assistance.

Abuse during pregnancy is associated with low birthweight babies, abuse being defined as the wilful infliction of injury, unreasonable confinement, intimidation or punishment with physical harm, pain or mental anguish (Parker et al, 1995). Although there is no data to suggest a link between abuse and socio-economic status in Ireland (Womens Aid, 1995), studies from other countries have suggested that women living in poverty are more likely to be the victims of abusive behaviours (Bullock et al. 1989). One in eight pregnant women in an Irish survey described a personal experience of abuse during pregnancy and sixty-nine percent of this abuse was physical abuse (O'Donnell et al, 2000).

There are subgroups of women in Irish society who are particularly vulnerable to poverty and social exclusion. These groups may therefore be at risk of worse birth outcomes from their pregnancies. These would include teenage mothers, lone parents, disabled women, Travellers, refugees and asylum seekers, other ethnic minority women, women prisoners, homeless women and female sex-workers. There is very little up-to-date and reliable data on the birthweight and mortality profile of babies born to such women in Ireland. The

stillbirth rate, perinatal mortality rate and infant mortality rate of Travellers in Ireland far exceed those of the general population with twelve times the national rate of Sudden Infant Death Syndrome (Barry et al. 1989). The adjusted perinatal mortality rate of babies born to married parents at 5.1 per 1000 total births is far exceeded by the PMR for divorced (6.8/ 1000), separated(7.3/1000), widowed (27.8/1000) and single (7.6./1000) mothers (Bonham, 2004).

1.7 Outline of report content

Part two of this report outlines the methodology used in the analysis of low birthweight babies in Ireland. Issues relating to perinatal data quality and the limitations of the analysis are addressed in this section.

Part three of the report presents national figures for low birthweight in Ireland, with particular reference to disparities in the frequency of low birthweight according to socio-economic group. In view of the availability of multi-annual data for birthweight recorded in the eastern region, a specific sub-analysis of low birthweight in the former Eastern Regional Health Authority is then presented in part four. Key findings from the analyses are listed at the end of each section (sections 3.9 and 4.7 respectively).

Part five of the report examines the evidence-base in terms of interventions to reduce socio-economic inequalities in low birthweight. Risk factors for low birthweight are highlighted and evidence of the effectiveness of interventions or strategies that have aimed to reduce or prevent low birthweight in infants born to women from lower socio-economic backgrounds are summarised.

Part six of the report presents some conclusions based on the key findings of the analysis and the review and discusses the approaches that might be taken at population level to address the inequalities detected in parts three and four of the report.

Part seven gives an overview of the recommendations arising from the 'Exploratory Workshop on Tackling Inequalities in the Occurrence of Low Birthweight Babies in Ireland' held in December 2005 which was informed in part by this report. Recommendations are listed under the headings of (a) research and data (b) social determinants of maternal and child health (c) health behaviours (policy and practice) and (d) health services and antenatal services.

Part 2. Methodology

2.1 Data source

Data provided by the National Perinatal Reporting System (NPRS) is used for the analysis in this report. The principle aim of the NPRS is the provision of national statistics on perinatal events. Primary responsibility for the collection and processing of data required for the NPRS was contracted to the Economic and Social Research Institute (ESRI) in 1999.

All births are registered and notified on a standard four-part form. Data recorded in this form are listed in Appendix 1.

Data used in this report was coded in the NPRS unit of the ESRI. Occupations are coded according to the Central Statistics Office system of socio-economic group classification (see Table 4 in section 2.2.3). Data entry is conducted by a private company and validated, processed and compiled into annual reports by the ESRI using SAS software. Further information on the NPRS can be accessed from the HIPE and NPRS Unit of the ESRI (www.esri.ie).

Data analysis in this report was conducted using SAS and statistical significance was taken as $p < 0.05$.

2.2 Issues in relation to data quality and analysis

2.2.1 Accessing multi-annual national perinatal data

There are considerable challenges implicit in accessing multi-annual and up-to-date national data on low birthweight babies in Ireland. Data for 1999 and 2000 is available from the NPRS. The data for the 1994 to 1998 period is not available for analysis purposes. Consequently, the national figures presented in this report are based on one year and therefore cannot account for year-to-year fluctuations.

2.2.2 Quality of occupational data on the National Perinatal Reporting System

There are considerable difficulties in the recording of occupational data for the National Perinatal Reporting System, such occupational data being required to code for socio-economic status, as shown in Table 4.

There are increasing numbers of records where the father's occupation is coded as "non-applicable" related to the increase in births to single mothers. Proportions of forms filled as "non-applicable" rose from 9% in 1986 to 29% in 1993 (Barry et al. 2001). To address this issue, the NPRS now collects data on both the father's occupation and the mother's occupation. The collection of maternal occupation was introduced as a new variable for the 1999 dataset but over 10% of mother's occupation was then left blank ('Not stated' category).

The final category of 'Unknown' has also been differentiated into five distinct groups for the purpose of the National Perinatal Reporting System.

Those groups are:

- Unemployed [occupation as unemployed and no previous occupation stated]
- Not classifiable [indecipherable, unclear, unlisted occupations where efforts to clarify information have failed]
- Not applicable [applies to father's occupation only and is entered when marital status of mother is given as single/widowed/separated/divorced/ father's occupation was left blank].
- Home duties
- Not stated [marital status of mother is recorded as either married or not stated and where father's occupation has been left blank].

2.2.3 Coding for socio-economic group based on available occupational data

For this analysis, the socio-economic group that the babies are born into was based on the occupational status of the parents recorded by the NPRS. Table 4 presents the occupations coded and grouped according to the CSO system of socio-economic groupings.

Table 3. Classification of socio-economic group

Occupation	Socio-economic group
Farmers	Farmers
Higher professionals	SEG-A
Lower professionals	
Employers & managers	SEG-B
Salaried employees	
Non-manual wage earners	SEG-C
Other non-manual workers	
Skilled manual workers	
Semi-skilled manual workers	SEG-D
Unskilled manual workers	
Farm labourers	
Unknown	Unknown

Historically, the occupation of the baby's father was taken as the measure of the socio-economic group the baby is born into. However, with rising numbers of unmarried mothers, the meaningfulness of this variable in measuring the socio-economic status of the baby is questionable. In fact, occupational analysis using only one gender (i.e. father's occupation or mother's occupation) proves problematic in terms of the number of forms where little or no information on occupation is recorded. For example, if an occupational analysis uses solely the father's occupation, 19% are recorded as 'non applicable' in the 1999 dataset. It is consequently impossible to make a judgement on the socio-economic grouping of the baby for almost one in five births. All we can definitively state in this case is that infants in this group are born to single mothers. Similarly, an analysis using solely

the occupation of the mother is problematic insofar as a large proportion of the mother's occupation is coded as 'home duties', which means that 39.8% of forms are uninformative in terms of socio-economic group.

In light of these issues, it was decided to merge the occupations of fathers and mothers to form a new variable. Our new variable was derived as follows: the occupational group was primarily classified using father's occupation, however if this was recorded as 'not applicable' the occupation of the mother was used. This new variable was then used as a proxy measure of socio-economic grouping for the parents, and thus the babies, in the analysis presented in part three. We felt that this approach would provide a more meaningful measure of socio-economic status than one derived exclusively from either the father's or the mother's occupation. This approach provided a dataset with the most entries per socio-economic group i.e. the lowest percentage of unknown occupations recorded. However, despite the use of these methods, the proportion of data entries with an unknown occupation remains high (See Table 4).

It is acknowledged that the merits of using this approach over conducting separate analyses on mother's and father's occupation have not been proven.

2.2.4 Addressing vulnerable subgroups of women in the analysis

Certain women are especially vulnerable to poverty and social exclusion and are therefore likely to suffer health inequalities in relation to their pregnancy and their babies. These groups were identified in section 1.6 and include teenage mothers, lone parents, disabled women, Travellers, refugees and asylum seekers, other ethnic minority women, women prisoners and homeless women (Combat Poverty Agency, 1999).

The analysis presented in this report has explored the relationship between both age/marital status and low birthweight in the national and ERHA babies, allowing the analysis to address, to a limited degree, the extent of inequalities affecting babies born to teenage mothers and unmarried mothers/lone parents. However, the NPRS does not collect data in relation to maternal disability, membership of the Travelling community, ethnic group and immigrant status, homelessness or whether the mothers are currently or previously prison inmates. Therefore, no analysis could be performed in relation to these factors. However, data derived from smaller studies and from the annual and clinical reports of the Dublin maternity hospitals has been incorporated into the report related to some of these groups.

In mid-2003 the NPRS was requested by the General Register Office to include new fields relating to nationality and country of residence for both mother and father. From this data, inferences in terms of the effect of ethnic group on birth outcomes may be examined at national level. This data is currently unavailable but is being collected and will be reported in the national perinatal statistics from 2004.

Part 3: Results: Analysis of singleton births in the Republic of Ireland in 1999

3.1 Occupational data on all singleton births (1999)

The difficulties in terms of the quality and meaningfulness of occupational data on the National Perinatal Reporting Scheme have been highlighted in section 2.2.2. Table 4 demonstrates the scale of the problem of missing data, with 19% of forms missing the father's occupation and 39.8% missing the mother's occupation. The table also demonstrates how the number of unknown entries were minimised by using the coding methods set out in section 2.2.3.

Table 4. Percentage of singleton births in the Republic of Ireland with 'Unknown Occupation' classification (1999)

Parents Occupation	Not classifiable	Not applicable	Not stated	Home duties	Total	Percent with unknown occupation
Father's occupation	336	14,974	694	N/A	16,004	19.0%
Mother's occupation	1503	N/A	5780	13,722	21,005	39.8%
Mother's occupation (if 'home duties' then father's occupation used)	1641	3420	5986	N/A	11,047	20.9%
Father's occupation (if 'not applicable' then mother's occupation used)	1490	N/A	4124	3420	9044	17.1%

It is acknowledged that the quality of the occupational data has been greatly enhanced in the years subsequent to 1999, based on the learning from the year when the new variables were introduced. The data presented in this report may therefore present an excessive number of missing variables compared to the situation in 2000 and subsequent years.

3.2 Frequency of low birthweight by parent's occupation

Table 5 presents a detailed breakdown of the number of births in each occupational group. The father's occupation is used unless it is classified as 'not applicable' in which case the occupation of the mother is used. The low birthweight rates experienced by the different occupational groups are depicted in Figure 4.

The inequalities in low birthweight are expressed in terms of relative risk (RR). RR is defined as P_s/P_r where P_s is proportion of low birthweight in a specific occupational group (unskilled, unemployed, manual etc.) and P_r is the proportion in the reference group (in this case, higher professionals). RR therefore quantifies the increase in the chance of having a low birthweight baby relative to the highest occupational group.

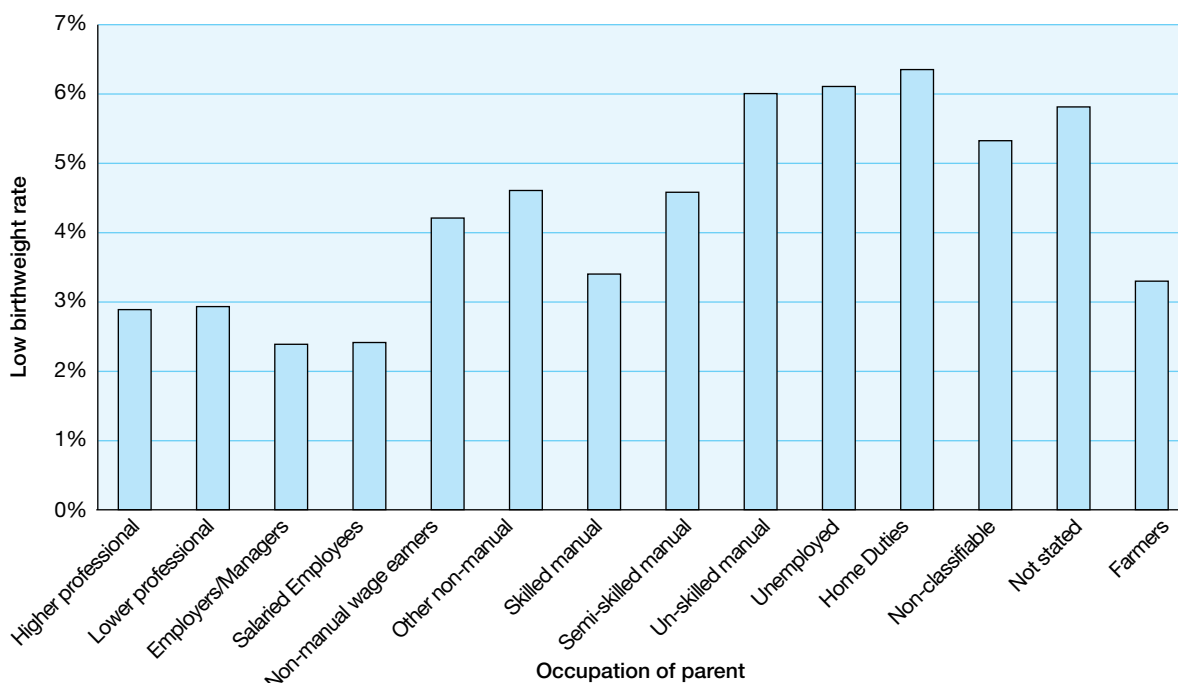
Table 5. Low birthweight by parent's occupation in the Republic of Ireland (1999)

Occupation	Total births (n)	Total births (5)	Number of weighing <2,500g	% of births weighing <2,500g	RR	95% CI
Farmers & farm managers	2978	5.6	98	3.3%	1.14	0.86 -1.51
Other agricultural & fishermen	689	1.3	25	3.6%	1.25	0.81-1.94
Higher professionals	3007	5.7	87	2.9%	1.00	Reference
Lower professionals	2327	4.4	67	2.9%	1.00	0.73-1.36
Managers	4706	8.9	113	2.4%	0.83	0.63-1.09
Salaried employees	1390	2.6	34	2.4%	0.85	0.57-1.25
Non-manual workers	6685	12.7	282	4.2%	1.46*	1.15-1.85
Other non-manual workers	6019	11.4	279	4.6%	1.60*	1.26-2.03
Skilled manual workers	10075	19.1	345	3.4%	1.18	0.94-1.49
Semiskilled manual	4204	8.0	192	4.56%	1.58*	1.23-2.02
Unskilled manual	752	1.4	42	5.6%	1.93*	1.35-2.77
Unemployed	2444	4.6	148	6.1%	2.09*	1.61-2.71
Not classifiable	1490	2.8	79	5.3%	1.83*	1.36-2.47
Home Duties	3420	6.5	216	6.3%	2.18*	1.71-2.79
Not Stated	2644	5.0	154	5.8%	2.01*	1.56-2.60
Total	52830	100	2161	4.1%	1.41*	1.14-1.75

* indicates statistical significance using 'higher professionals' as the reference group

The figures indicate that babies born to parents whose occupational status is classified as Unemployed or Not stated were at over twice the risk of being low birthweight in Ireland in 1999, when compared to the higher professional group. Babies born to parents who are manual and non-manual workers were also significantly more likely to be low birthweight than those in the higher professional group.

Figure 4. Low birthweight rates by parent's occupation in the Republic of Ireland



3.3 Frequency of low birthweight according to socio-economic group

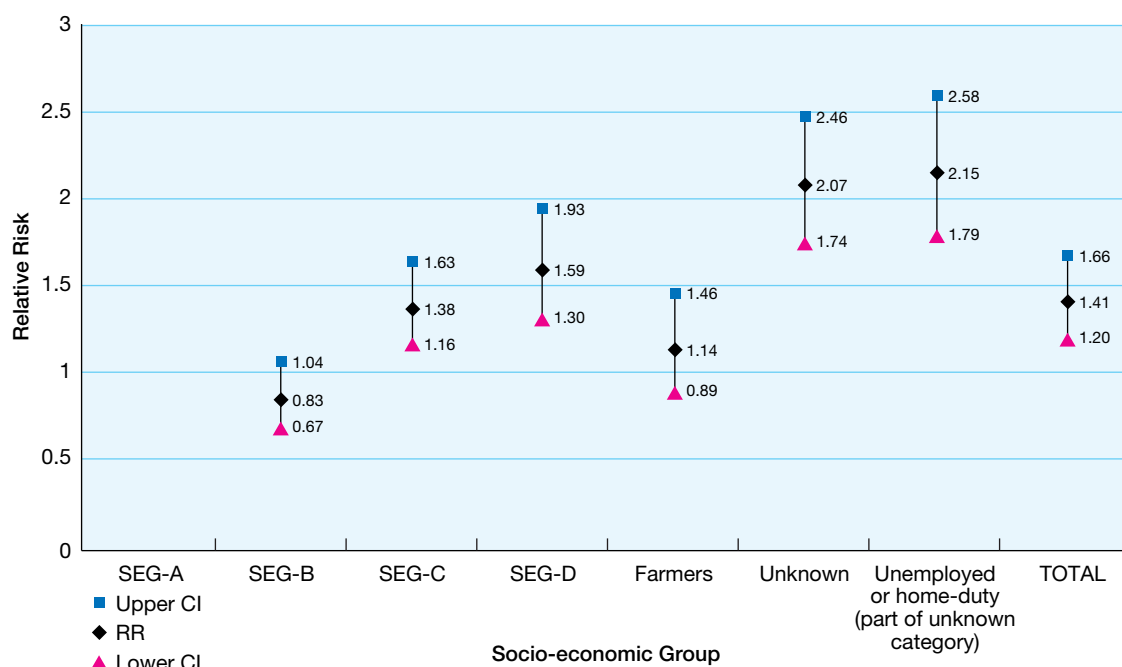
The odds of giving birth to a low birthweight baby in 1999 among different socio-economic groups were compared using relative risks. The risk of giving birth to a low birthweight baby relative to the risk of giving birth to a low birthweight baby in socio-economic group A (the highest socio-economic group) were calculated and presented graphically in Figure 5. These results are presented in column two of Table 6. The risk of giving birth to a low birthweight baby relative to the risk in the general population in 1999 is presented in the fourth column of Table 6.

Table 6. *Relative risk of low birthweight by socio-economic group in the Republic of Ireland (1999)*

Socio-economic group	Relative Risk (Using SEG-A as reference)	95% Confidence Interval	Relative Risk (Using the total population as reference)	95% Confidence Interval
SEG-A	1.00	REFERENCE	0.71*	0.60 - 0.83
SEG-B	0.83	0.67 - 1.04	0.59*	0.50 - 0.70
SEG-C	1.38*	1.16 - 1.63	0.97	0.90 - 1.05
SEG-D	1.59*	1.30 - 1.93	1.12	0.99 - 1.27
Farmers	1.14	0.89 - 1.46	0.80	0.66 - 0.98
Unknown	2.07*	1.74 - 2.46	1.46*	1.34 - 1.59
Unemployed / home duty	2.15*	1.79 - 2.58	1.52*	1.36 - 1.69
TOTAL	1.41*	1.20 - 1.66	1.0	REFERENCE

* indicates statistical significance

Figure 5. Relative risk of low birthweight by socio-economic group (using SEG-A (higher/ lower professionals) as reference)



- Legend: SEG-A (higher/lower professionals) (Reference Group)
- SEG-B (employers/ managers/ salaried employees)
- SEG-C (non-manual wage earners/skilled manual workers)
- SEG-D (manual workers/ labourers)
- Farmers = farmers
- Unknown = unknown socio-economic group
- Unemployed/home duties (subsection of unknown category)

When compared to the highest socio-economic group, comprising higher and lower professionals, those parents in the socio-economic group comprising non-manual, skilled manual and other non-manual workers (SEG-C) had a 38% higher risk of having a low birthweight baby in 1999. Babies born to parents in the Unknown occupational category (which included those recorded as ‘not classifiable’ or ‘not stated’) were at twice the risk of being born low birthweight compared to the highest socio-economic group. The poor health outcomes found amongst the Unknown category has been previously reported in relation to birthweight and a variety of other health outcomes (Barry et al. 2001).

When compared to the total population, the unemployed group had around a 50% higher risk of low birthweight births and those with an Unknown occupation had around a 46% higher risk.

The National Anti-Poverty Strategy low birthweight target aims to reduce by 2007 the gap in low birthweight rates in children from the lowest and the highest socio-economic groups by 10% from the 2001 level. This gap is depicted in Table 7. If the data presented in this report for 1999 were considered the baseline for the NAPS target, the target would

equate to a reduction of 0.17% in the proportion of low birthweight births among manual workers (SEG-D) from 4.59% now to 4.51% in 2007. If the Unemployed/Home Duties group are taken as the lowest socio-economic group, the NAPS target would equate to a reduction of 0.33% in the proportion of low birthweight births in this group from 6.21% now to 5.88% in 2007.

Alternatively, it may be preferable to measure progress in narrowing the gap set in the NAPS target by seeking a reduction in the relative risks in the lowest socio-economic groups relative to the highest socio-economic group.

Table 7. Data relating to the National Anti-Poverty Strategy target to reduce inequalities in low birthweight

Socio-economic	Total births	LBW births	LBW rate	Gap (% excess)	Gap (n excess)
Highest					
SEG-A (Higher & lower professionals)	5327	154	2.89%	N/A	0
Lowest					
SEG-D (Manual & non-manual workers)	4956	234	4.59%	+1.7%	96 additional LBW babies
(Unemployed/ Home Duties)	5864	364	6.21%	+3.32%	195 additional babies
Unknown group (incl. unemployed/ home duties)	9998	597	5.97%	+3.09%	368 additional babies

3.4 Estimate of “preventable” low birthweight births in 1999

In a hypothetical situation, where all socio-economic groups had the same proportion of low birthweight babies as the highest socio-economic group, an estimated 695 fewer low birthweight babies would have been born in 1999. This comprises approximately 29% of the total number of low birthweight babies born in 1999. This hypothetical figure was calculated by applying the percentage of low birthweight babies among the SEG-A (higher and lower professionals) to each of the other groups and subtracting the expected number of low birthweight births from the actual observed number (2007- 1312=695).

3.5 Frequency of low birthweight by maternal age

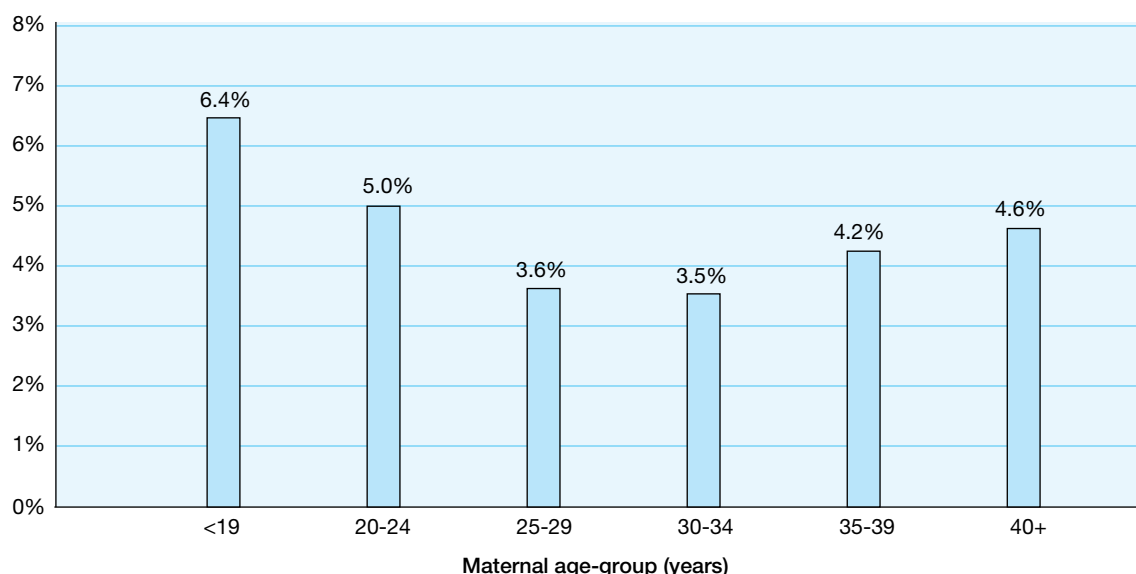
Table 8 demonstrates the frequency of low birthweight babies born to mothers in different age groups. In 1999, teenage mothers were 57% more likely to have a low birthweight baby when compared to the total population. Figure 6 depicts the percentage of low birthweight babies born to mothers in each of the five-year age groups and shows a fairly typical pattern of increases in the proportion of low birthweight babies at the extremes of maternal age.

Table 8. Low birthweight by maternal age (1999)

Age (years)	Total births (n)	LBW births (n)	LBW births (%)	Relative Risk	95% CI
<19	3324	212	6.4%	1.57 *	1.37 - 1.80
20-24	7613	377	4.95%	1.22 *	1.09 - 1.35
25-29	13543	488	3.6%	0.88 *	0.81 - 0.98
30-34	17338	609	3.5%	0.86 *	0.79 - 0.94
35-39	9172	382	4.16%	1.02	0.92 - 1.14
40+	1713	78	4.55%	1.12	0.90 - 1.39
TOTAL	52703	2146	4.1%	1.0	REFERENCE

* indicates statistical significance

Figure 6. Low birthweight rate (% of births weighing <2,500g) by maternal age



3.6 Frequency of low birthweight by marital status

Table 9 shows the frequency of low birthweight babies to married and unmarried women in 1999. Unmarried women comprise women who are single, who have been widowed, separated and divorced. Unmarried women were significantly more likely to have low birthweight babies than married women in 1999.

Table 9. Low birthweight according to marital status (1999)

Age (years)	Total births (n)	LBW births (n)	LBW births (%)	Relative Risk	95% CI
Married	38231	1269	3.3%	1.0	REFERENCE
Unmarried	16635	886	5.3%	1.60*	1.48 - 1.74

3.7 Regional analysis of low birthweight babies in Ireland

An analysis was performed to examine regional differences in the percentage of low birthweight babies in Ireland in 1999. This analysis does not take account of differing demography and other possible confounding factors between the regions, for which sophisticated modelling would be required which was considered beyond the scope of

this report. It is recognised that maternal age and socio-economic status of mothers may vary according to county. In this regard, limited inferences can be drawn from the analysis.

The number and percentage of low birthweight babies were compared according to the county of residence of the mother. Relative risks were calculated, indicating the risk of a mother in that region delivering a low birthweight baby relative to the risk found in the total population. These figures are presented in Table 11.

The table shows that mothers resident in counties Tipperary NR, Mayo, Donegal, Kerry and Kildare were significantly less likely to have low birthweight babies compared to the nation as a whole. Births occurring to mothers resident in Dublin city exhibited a significantly higher proportion of low birthweight babies when compared to the national sample. This finding has been previously reported in relation to regional analysis on birthweights for the period 1986-1993 (Barry et al. 2001).

Table 10. Low birthweight by county of residence of mother (1999)

County	Births (n)	LBW births (n)	LBW births (%)	RR	95% CI
Leitrim	278	0	0%	0	N/A
Tipperary, N.R.	643	12	1.87%	0.456 *	0.26 – 0.80
Meath	1749	58	3.32%	0.811	0.63 – 1.05
Mayo	1348	35	2.60%	0.635 *	0.46 – 0.88
Donegal	1842	50	2.71%	0.664 *	0.50 – 0.87
Kerry	1538	42	2.73%	0.668 *	0.49 – 0.90
Cavan	726	21	2.89%	0.707	0.46 – 1.08
Laois	757	22	2.91%	0.710	0.47 – 1.07
Monaghan	687	30	4.37%	1.068	0.75 – 1.52
Louth	1444	44	3.05%	0.745	0.56 – 1.00
Kildare	2519	78	3.10%	0.757 *	0.61 – 0.95
Roscommon	526	17	3.23%	0.790	0.49 – 1.26
Clare	1405	46	3.27%	0.800	0.60 – 1.07
Sligo	723	24	3.32%	0.812	0.55 – 1.21
Kilkenny	972	33	3.40%	0.830	0.59 – 1.16
Longford	410	14	3.41%	0.835	0.50 – 1.40
Carlow	652	23	3.53%	0.862	0.58 – 1.29
Galway	2587	92	3.56%	0.869	0.71 – 1.07
Tipperary, S.R.	1174	43	3.66%	0.895	0.67 – 1.20
Westmeath	1078	40	3.71%	0.907	0.67 – 1.23
Waterford	1346	51	3.79%	0.926	0.71 – 1.22
Wicklow	1714	65	3.79%	0.927	0.73 – 1.18
Wexford	1648	64	3.88%	0.949	0.74 – 1.21
Cork	5733	233	4.06%	0.994	0.87 – 1.13
Offaly	840	32	3.81%	0.931	0.66 – 1.31
Limerick	2362	108	4.57%	1.118	0.93 – 1.35
Dublin (city & county)	15900	693	4.36%	1.066	0.98 – 1.16
Dublin city	12100	586	4.84%	1.184 *	1.08 – 1.29
Dublin county	3800	107	2.82%	0.688 *	0.57 – 0.83
TOTAL	52830	2161	4.09%	1.0 (REF)	N/A

3.8 A note on inequalities in multiple births in Ireland

Separate analysis was not conducted on the national data relating to low birthweight among multiple births. The annual reports of the NPRS report on the perinatal outcomes for multiple births in Ireland including analysis of the occupational status of the parents.

There were 1463 multiple births recorded in the Republic of Ireland in 1999 and 1429 in 2000. Multiple births are associated with considerably higher rates of stillbirth (13.8 per 1000 total births=multiple; 5.4 per 1000 total births=singleton), neonatal mortality (16.1 per 1000 live births=multiple; 2.9 per 1000 live births= singleton) and perinatal mortality (29.7 per 1000 total births= multiple; 8.2 per 1000 total births= singleton). Multiple births are strongly associated with low birthweight. 43.35% of multiple births are low birthweight, as compared to 3.84% of singleton births (Bonham, 2004).

Data on the proportions of stillbirths, early neonatal and perinatal mortality rates according to father's occupation and according to mother's occupation are presented in the 2000 annual report of the NPRS (ref. Tables 3.18 and 3.19). While there is no clear social gradient observed, this may be due in part to small numbers in some of the occupational categories. There is some indication of an excess of stillbirths among those multiple birth babies born to fathers whose occupations are manual workers and whose occupation is unknown. The stillbirth rate for all multiple births was 13.8 stillbirths per 1000 total births, whereas for manual workers this was reported as 26.4 per 1000 total births (skilled) and 30.8 per 1000 total births(semiskilled), rising to between 40 and 250 per 1000 total births in the unknown groupings.

There is no clear social gradient in terms of the mortality rates observed for multiple births according to maternal occupation, but this observation is limited by small numbers in some of the categories. However, the perinatal mortality rate observed in the Not stated (83.3 per 1000 total births) and Skilled Manual Worker (90.9 per 1000 total births) categories exceeds the PMR for all multiple births (21.6 per 1000 total births).

Further analysis to explore the nature of socio-economic inequalities in relation to the mortality rates and birthweight profile of multiple births in Ireland is required.

3.9 Summary of key findings

- The method of combining father's and mother's occupation (as described in section 2.2.2) was considered a more meaningful measure of the socio-economic circumstances that the baby was born into. This offered one method of potentially increasing the validity and reliability of the dataset.
- Babies born to parents whose occupational status is classified as unemployed or is not stated were at approximately twice the risk of being low birthweight in Ireland in 1999, when compared to the higher professional occupational group.
- Babies born to parents who are non-manual workers had an increased risk of between 46% and 60% of being low birthweight in Ireland in 1999, when compared to those parents recorded as higher professionals.
- The increased risk of low birthweight babies being born to parents in socio-economic groups C and D (manual and non-manual workers) relative to the risk of being born to parents from socio-economic group A (higher and lower professionals) is statistically significant.
- The greatest risk of low birthweight was recorded for babies born to parents who were classified in the Unknown categories including those categorised as Unemployed/ Home Duties.
- If all socio-economic groups had the same percentage of low birthweight births as the highest socio-economic group (higher and lower professionals), there would have been an estimated 695 fewer lower birthweight babies in Ireland in 1999.
- Teenage mothers (aged 19 years and under) had a significantly higher risk than the general population of having a low birthweight baby in Ireland in 1999.
- Unmarried mothers were significantly more likely to have low birthweight babies than married mothers in 1999 (RR= 1.60, 95% CI = 1.48 – 1.74).
- The proportion of babies born to parents resident in County Dublin is approximately 18% higher than the proportion of babies born low birthweight in the national figures.

Part 4. Analysis of all births in the Eastern Regional Health Authority (1999-2001)

4.1 Frequency of low birthweight babies in the ERHA (1999-2001)

In view of the large number of births and the relatively high proportion of low birthweight births in the eastern region (part three), an analysis of low birthweight in the Eastern Regional Health Authority was conducted. Data over the three year period 1999 to 2001 was made available for this analysis.

The methodology used in the ERHA analysis differs from that used on the national sample in two ways. Firstly, all analysis presented in this section of the report examines data combining both singleton and multiple births. It was considered that the relatively small number of multiple births was unlikely to skew the analysis. Secondly, with regard to the analysis of occupational data, and thus socio-economic group, the father's occupation is used and is therefore subject to a large 'Unknown' group, which has not been divided into the five distinct categories.

Table 11. *Frequency table of low birthweight in the ERHA (1999-2001)*

Year	Total births (n)	Low birthweight births (n)	Low birthweight births (%)
1999	20,641	1,024	5.0%
2000	21,097	1,049	5.0%
2001	22,013	1,165	5.3%
Total 1999 – 2001	63,571	3,238	5.1%
Annual average	21,250	1,079	5.1%

4.2 Frequency of low birthweight by father's occupation

Table 12, presented overleaf, shows the percentage of low birthweight babies born to each of the occupational groups in the ERHA. As the absolute numbers of low birthweight births are small in many of the occupational group category, limited inferences can be drawn. The occupational status of the fathers was recorded as unknown in between 13.8% and 14.8% of births in the ERHA, indicating a considerable amount of missing data.

However, certain patterns are observed that are common to those found in the national data presented in part three. The groups with the highest percentage of low birthweight births in each of the years 1999, 2000 and 2001 were the Unknown group and the Unskilled Manual Workers (range 6% to 8% of births).

Conversely, babies born to the Higher Professional group exhibited lower percentages of low birthweight over the three years (range 2.9% to 3.9%).

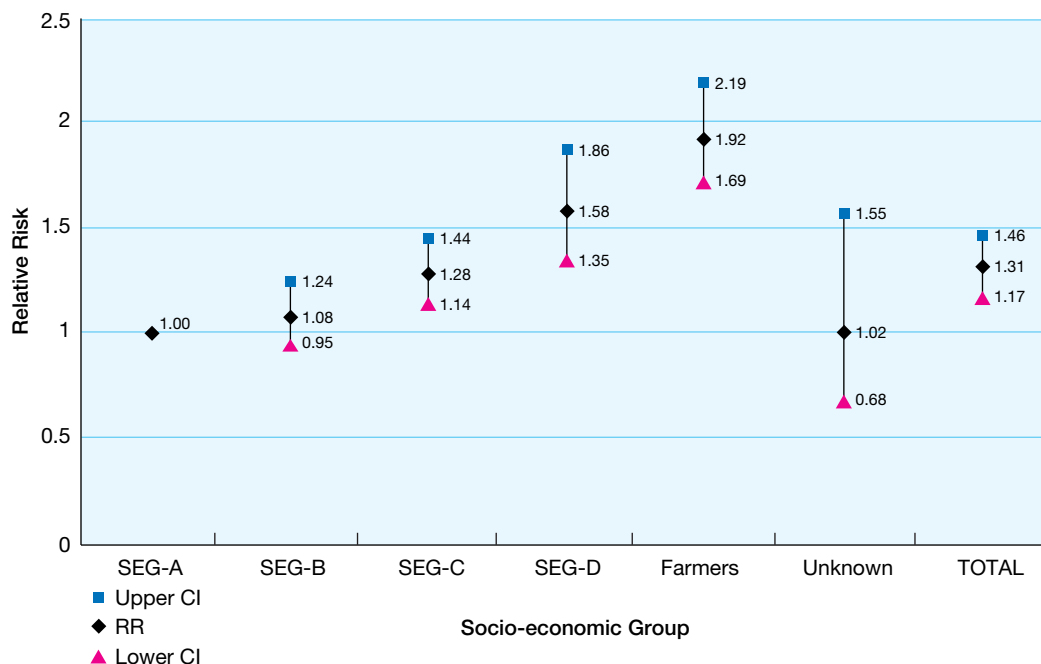
Table 12. Low birthweight according to the father's occupation in the ERHA

Occupation of father	1999				2000				2001			
	Total births (n)	LBW births (n)	% of ERHA Births	% of LBW babies in that occ. group	Total Births (n)	LBW (n)	% of ERHA births	% of LBW babies in that occ. group	Total births (n)	LBW births (n)	% of ERHA births	% of LBW babies in that occ. group
Farmers & Farm managers	234	9	1.1%	3.8%	199	5	0.9%	2.5%	171	9	0.8%	5.3%
Higher professional	1506	46	7.3%	3.0%	1761	54	8.3%	3.1%	1917	74	8.7%	3.9%
Lower professional	1209	42	5.9%	3.5%	1184	65	5.6%	5.5%	1235	58	5.6%	4.7%
Employers/Managers	3378	140	16.4%	4.1%	3657	145	17.3%	4.0%	4035	158	18.3%	3.9%
Salaried employee	718	19	3.5%	2.6%	646	34	3.1%	5.3%	835	39	3.8%	4.7%
Non-manual workers	1946	95	9.4%	4.9%	1647	63	7.8%	3.8%	1361	61	6.2%	4.5%
Skilled manual workers	4795	260	23.2%	5.4%	5102	276	24.2%	5.4%	5270	273	23.9%	5.2%
Other non-manual workers	2491	124	12.1%	5.0%	2403	121	11.4%	5.0%	2667	163	12.1%	6.1%
Semi-skilled manual workers	716	38	3.5%	5.3%	480	22	2.3%	4.6%	264	13	1.2%	4.9%
Unskilled manual workers	659	53	3.2%	8.0%	719	43	3.4%	6.0%	882	59	4.0%	6.7%
Labourers	132	6	0.6%	4.5%	168	6	0.8%	3.6%	207	9	0.9%	4.3%
Unknown	2857	192	13.8%	6.7%	3131	215	14.8%	6.9%	3179	249	14.4%	7.8%
Total	20641	1024	100%	N/A	21097	1049	100%	N/A	22023	1165	100%	N/A

4.3 Frequency of low birthweight by socio-economic group

Table 13 and Figure 7 present the relative risks of low birthweight according to socio-economic group within the ERHA. Data from births from 1999 to 2001 are used and a three-year average is calculated to allow for year-to-year fluctuations. The risk of being born low birthweight in each of the socio-economic groups compared to the risk for the highest socio-economic group comprising higher and lower professionals (SEG-A) are presented in column two of Table 13. The risk of being born low birthweight in each of the socio-economic groups compared to the mean risk of being born low birthweight in the ERHA is presented in column four of Table 14.

Figure 7 Relative risk of low birthweight by socio-economic group in the ERHA (Using SEG-A (higher/ lower professionals as reference)



- Legend:
- SEG-A (higher/lower professionals)
 - SEG-B (employers/ managers/ salaried employees)
 - SEG-C (non-manual wage earners/skilled manual workers)
 - SEG-D (semi-skilled/ unskilled manual workers/ labourers)
 - Farmers= farmers & farm managers
 - Unknown= unknown socio-economic group

Table 13. Relative risks of low birthweight by socio-economic group in the ERHA

Socio-economic group (SEG-A as reference)	RR (SEG-A as reference)	95% CI	RR (mean ERHA rate as reference)	95% CI
SEG-A	1.0	N/A	0.76*	0.69 – 0.85
SEG-B	1.08	0.95 – 1.24	0.83*	0.76 – 0.91
SEG-C	1.28*	1.14 – 1.44	0.98	0.92 – 1.04
SEG-D	1.58*	1.35 – 1.86	1.21*	1.07 – 1.37
Farmers	1.02	0.68 – 1.55	0.78	0.52 – 1.17
Unknown	1.92*	1.69 – 2.19	1.47*	1.36 – 1.59

* indicates statistical significance

These figures show that, when compared to those in the highest socio economic group (SEG-A), babies born to parents who are skilled manual workers/non-manual wage earners were 28% more likely to be low birthweight. Babies born to parents who are semi-skilled and unskilled manual workers/farm labourers were 58% more likely to be low birthweight than those born to higher/lower professionals.

Babies born to fathers in the ERHA whose occupational status is categorised as “Unknown” are at the highest risk of being low birthweight. These fathers are approximately twice as likely to have a low birthweight baby. Unskilled/ semiskilled manual workers and the Unknown grouping all exhibit frequencies of low birthweight babies that are significantly higher than the ERHA average.

Table 14 presents the relative risks for being born low birthweight according to socio-economic group of the parent within the ERHA for each of the years 1999 to 2001. The risk of being born low birthweight is presented relative to the risk of being born low birthweight in the highest socio-economic group comprising higher and lower professionals(SEG-A).

Table 14. Relative risks of low birthweight by socio-economic group in the ERHA from 1999 to 2001 (SEG-A as reference)

Socio-economic group	1999		2000		2001	
	RR	95% CI	RR	95% CI	RR	95% CI
SEG-A	1.0	REFERENCE	1.0	REFERENCE	1.0	REFERENCE
SEG-B	1.33*	1.03 – 1.72	1.03	0.82 – 1.29	0.97	0.78 – 1.20
SEG-C	1.40*	1.12 – 1.75	1.24*	1.02 – 1.52	1.28*	1.06 – 1.54
SEG-D	2.21*	1.66 – 2.92	1.29	0.96 – 1.71	1.43*	1.09 – 1.87
Unknown	2.30*	1.80 – 2.95	1.70*	1.37 – 2.11	1.87*	1.52 – 2.30
Farmers	1.32	0.67 – 2.58	0.62	0.26 – 1.50	1.26	0.65 – 2.43
Total pop.	1.50*	1.21 – 1.86	1.23*	1.02 – 1.48	1.26*	1.06 – 1.51

*indicates statistical significance

Figure 8. Relative risk of low birthweight in the ERHA in 1999 (SEG-A as reference)

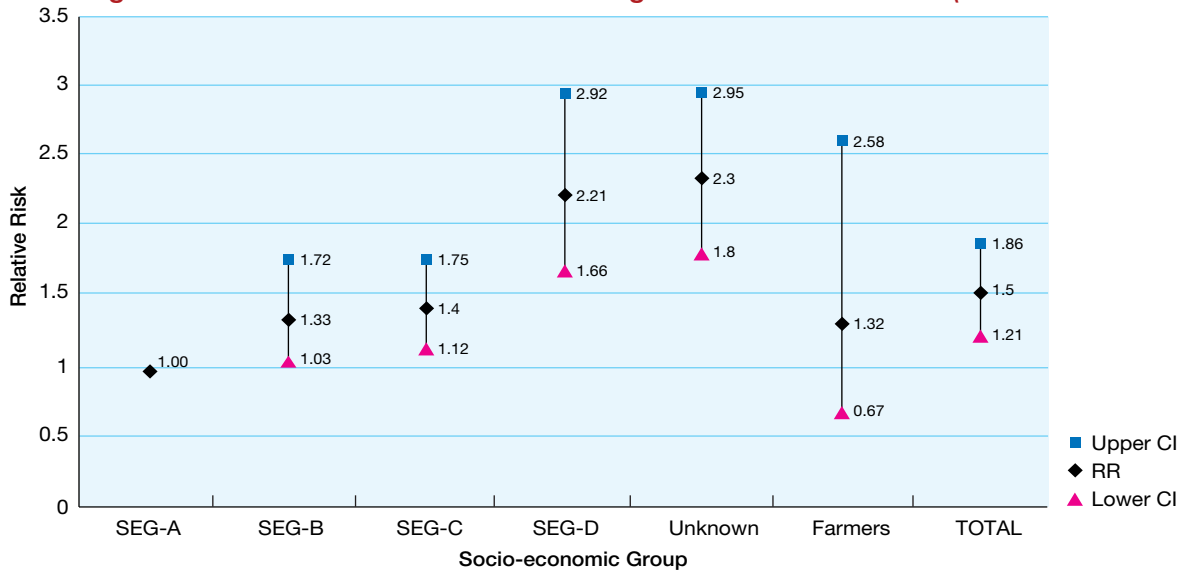


Figure 9. Relative risk of low birthweight in the ERHA in 2000 (SEG-A) as reference

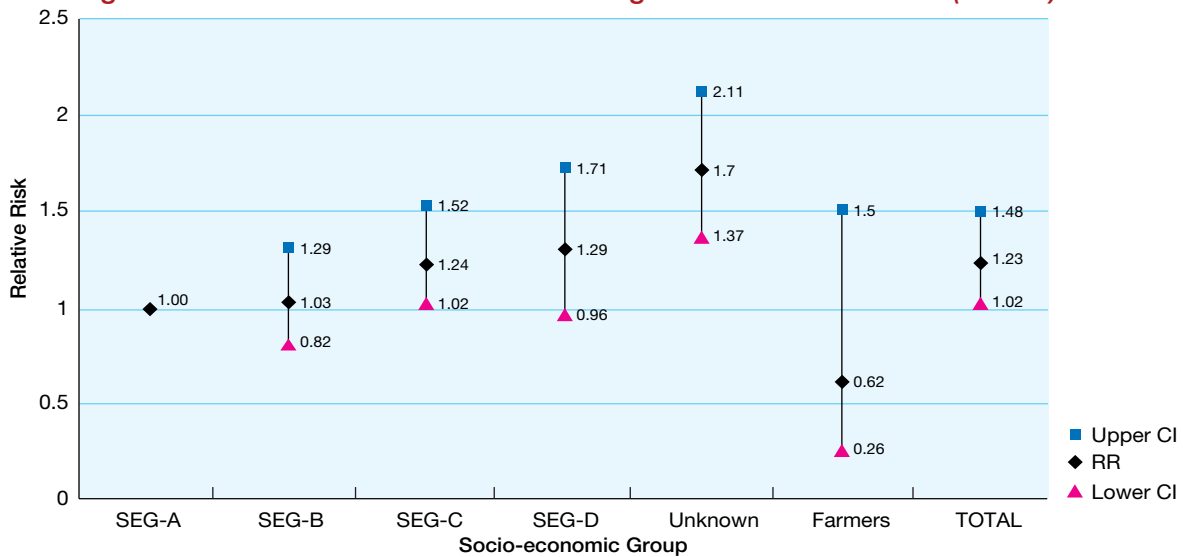
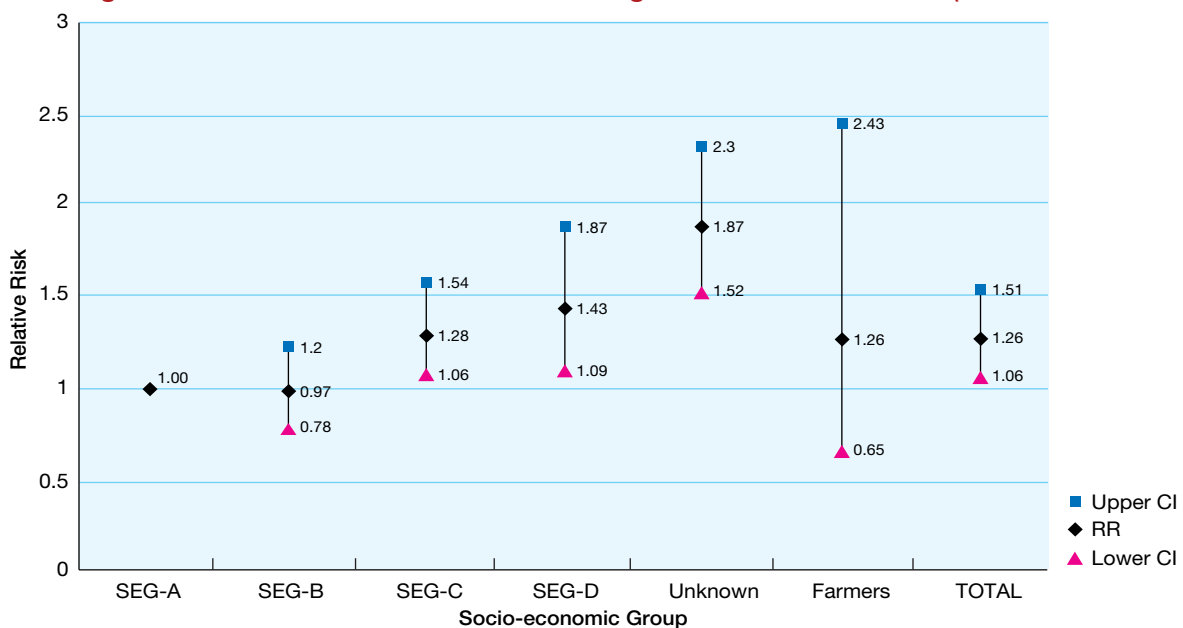


Figure 10. Relative risk of low birthweight in the ERHA in 2001 (SEG-A as reference)



When compared with the highest socio-economic group (SEG-A), babies born to fathers who are Manual/Non-manual workers had a significantly higher risk of being low birthweight in each of the years 1999 and 2001. The greatest disparity in the risk of low birthweight was detected in relation to babies born low to the Unknown group compared to those born to higher/lower professionals (SEG-A) in 1999.

4.4 Frequency of low birthweight by maternal age

The percentage of low birthweight babies born to women in different age groups were compared using a mean annual rate derived from the three years of data, 1999 to 2001. These figures are presented in Table 15, along with the risk of low birthweight relative to the average percentage of low birthweight births for the population of the ERHA. The results indicate that mothers aged under 19 years were significantly more likely to have had a low birthweight baby (relative risk 1.35 95%CI= 1.10 -1.66) than women in general in the ERHA, in the years 1999 to 2001.

Table 15. Low birthweight according to maternal age in the ERHA

Age (Years)	Total births (n)	LBW births (n)	LBW births (%)	Relative Risk	95% CI
<19	1335	92	6.9%	1.35*	1.10 - 1.66
20-24	3140	168	5.3%	1.05	0.89 - 1.23
25-29	5227	268	5.1%	1.00	0.88 - 1.14
30-34	7058	329	4.7%	0.91	0.81 - 1.03
35-39	3753	189	5.0%	0.98	0.85 - 1.15
40+	590	33	5.6%	1.09	0.78 - 1.53
TOTAL	21,103	1079	5.1%	1.0	REFERENCE

* indicates statistical significance

4.5 Frequency of low birthweight by marital status

Based on a three-year average, those women classified as unmarried were significantly more likely to have a low birthweight baby than married women, (Chi square=30.7; $p < 0.0001$).

Table 16. Frequency of low birthweight according to marital status in the ERHA

Marital status	Total births (n)	LBW births (n)	LBW births (%)	RR	95% CI
Married	13453	602	4.5%	1.0	Reference
Unmarried	7667	477	6.2%	1.37*	1.24 - 1.56

4.6 Frequency of low birthweight by local authority region in the ERHA

A regional analysis of low birthweight was conducted that examined figures for births in the ERHA according to local authority.

Table 17 presents relative risks for low birthweight for each of the ERHA local authority areas. The risk of being born low birthweight in each authority is presented relative to the risk of being born low birthweight in the DunLaoghaire/ Rathdown area. This region exhibits the lowest 3-year average proportion of low birthweight births of all local authority areas in the ERHA.

The proportion of low birthweight babies in each local authority area are also compared to the mean proportion of low birthweight babies born in the ERHA for the years 1999 to 2001. These results are presented in Table 17.

Table 17. Relative risks of low birthweight by local authority in the ERHA (1999- 2001)

Local Authority region	RR (DunLaoghaire/ Rathdown as reference)	95% CI	RR (ERHA as reference)	95% CI
Wicklow	1.32*	1.12 - 1.55	0.99	0.87 – 1.12
DunLaoighaire /Rathdown	1.0	REFERENCE	0.75*	0.66 – 0.84
Kildare	1.18*	1.02 - 1.37	0.89*	0.80 – 0.98
Fingal	1.17*	1.01 - 1.36	0.88*	0.80 – 0.97
Dublin city	1.59*	1.40– 1.80	1.19*	1.12 – 1.27
Belgard/South Dublin	1.36*	1.19 – 1.56	1.02	0.94 – 1.11
Total ERHA population	1.34*	1.19 - 1.50	1.0	REFERENCE

* indicates statistical significance

The proportion of births that are low birthweight is significantly higher in the Dublin City local authority and in Belgard/South Dublin local authority when compared to Dun Laoighaire/Rathdown. When compared to the average rate for low birthweight in ERHA, the rate in Dublin city was 19% higher and the rate for DunLaoghaire/Rathdown, Kildare and Fingal were significantly lower.

The percentage of births that are low birthweight were compared according to local authority in each of the years 1999, 2000 and 2001. Geographic disparities in low birthweight in the ERHA were examined using relative risks. The relative risks compare the risks of low birthweight in each local authority relative to the local authority with the lowest proportion of low birthweight. These results are presented in Table 19. The local authority with the lowest proportion of low birthweight births was Kildare in 1999 and DunLaoighaire/ Rathdown in 2000 and 2001. Babies born to parents resident in Dublin City local authority demonstrated the highest risk of low birthweight in each of the three years. Babies born to parents resident in the Dublin City local authority were at almost

twice the risk of low birthweight in 2001, compared to those born to parents in DunLaoghire/Rathdown. Furthermore, the relative risk between local authorities with the highest and lowest rates of low birthweight births appears to be increasing over time. This would indicate that the geographic inequalities in low birthweight may have been widening over the years 1999 to 2001.

Table 18 presents relative risks for low birthweight in each of the local authorities relative to the risk in the ERHA in general. This table demonstrates that the risk of low birthweight is significantly lower in the Kildare and Fingal regions in 1999 and significantly lower in the DunLaoighaire/Rathdown region in 2000 and 2001. The risk of low birthweight for babies born to parents resident in the Dublin City local authority is significantly higher than the ERHA average ranging from 1% higher in 1999 to 22% higher in 2001.

Table 18. Relative risks of low birthweight according to ERHA local authority (Total ERHA population for each year as reference)

Local Authority region	1999		2000		2001	
	RR	95% CI	RR	95% CI	RR	95% CI
Wicklow	1.06	0.87 – 1.31	0.82	0.65 – 1.03	0.82	0.90 – 1.35
DunL/Rath	0.95	0.80 – 1.15	0.69*	0.56 – 0.86	0.69*	0.48 – 0.75
Kildare	0.73*	0.59 – 0.90	0.96	0.80 – 1.14	0.96	0.80 – 1.11
Fingal	0.80*	0.67 – 0.96	0.92	0.78 – 1.10	0.92	0.77 – 1.06
Dublin city	1.17*	1.05 – 1.32	1.22*	1.09 – 1.36	1.22*	1.06 – 1.31
Belgard	1.05	0.90 – 1.22	1.00	0.86 – 1.16	1.00	0.88 – 1.16
Total (ERHA)	1.00	REFERENCE	1.00	REFERENCE	1.00	REFERENCE

Table 19. Relative risks of low birthweight according to ERHA local authority (Local authority with lowest proportion of low birthweight for each year as reference)

Local Authority region	1999		2000		2001	
	RR	95% CI	RR	95% CI	RR	95% CI
Wicklow	1.46*	1.10 – 1.93	1.18	0.87 – 1.59	1.83*	1.36 – 2.47
DunL./Rath.	1.31*	1.01 – 1.70	1.00	REFERENCE	1.00	REFERENCE
Kildare	1.00	REFERENCE	1.38*	1.06 – 1.79	1.57*	1.20 – 2.06
Fingal	1.1	0.84 – 1.43	1.33*	1.03 – 1.74	1.51*	1.16 – 1.97
Dublin city	1.61*	1.29 – 2.01	1.75*	1.40 – 2.19	1.97*	1.55 – 2.50
Belgard	1.44*	1.13 – 1.83	1.44*	1.13 – 1.84	1.69*	1.31 – 2.18
Total (ERHA)	1.37*	1.11 – 1.69	1.44*	1.17 – 1.78	1.67*	1.33 – 2.10

* indicates statistical significance

4.7 Summary of key findings

- Babies born to fathers classified as Unskilled Manual Workers and fathers whose occupational status was Unknown had the highest risk of low birthweight in each of the years 1999, 2000 and 2001 in the ERHA.
- Babies born to fathers whose socio-economic group was Unknown were at approximately twice the risk of low birthweight, when compared to the risk of babies born to fathers who were higher/lower professionals, in the ERHA between 1999 and 2001.
- Teenage mothers (aged 19 years and under) were significantly more likely to have low birthweight babies than all mothers in the ERHA between 1999 and 2001 (RR= 1.37, CI= 1.24 –1.56).
- Unmarried mothers were significantly more likely to have low birthweight babies than married mothers in the ERHA between 1999 and 2001.
- Babies born to parents from the DunLaoghaire/Rathdown local authority exhibited the lowest percentage of low birthweight of all local authority areas in the ERHA in 2000 and 2001. Babies born to parents from the Kildare local authority exhibited the lowest percentage of low birthweight births in the ERHA in the year 1999.
- The risk of low birthweight for babies born to parents resident in the Dublin City local authority is significantly higher than the ERHA average in each of the years 1999 to 2001, ranging from 17% higher in 1999, to 22% higher in 2001.
- Babies born to parents resident in Dublin City local authority were at almost twice the risk of low birthweight in 2001, when compared to those born to parents in DunLaoghaire/Rathdown. The difference in risk of low birthweight comparing babies born in the local authorities with the highest and lowest rates of low birthweight births is increasing over time. This would indicate that the geographic inequalities in low birthweight in the ERHA may have been widening over the years 1999 to 2001.

Part 5. A critical exploration of what works in reducing socio-economic inequalities in the occurrence of low birthweight babies

5.1 Inequalities in low birthweight – a complex reality

International literature and the results presented in parts three and four of this report demonstrate that the relationship between socio-economic status and low birthweight is highly significant. The mechanism by which this association occurs are inherently complex encompassing social, nutritional, lifestyle, genetic, psychological, educational, environmental and cultural factors, which have been briefly alluded to in section 1.4 of this report.

In fact, lower socio-economic status, stress, incomplete antenatal care, tobacco use, extremes of maternal age, maternal malnutrition and maternal infections are all associated with an increased risk of low birthweight, and to some degree with each other. The interactions between these factors mean that it is challenging to assess the effects of both single factors and groups of factors on low birthweight.

5.2 Towards a conceptual framework to reduce inequalities in the occurrence of low birthweight

5.2.1 Approaches to tackling inequalities

There are several approaches that could be adopted to tackle the socio-economic inequalities in birthweight in Ireland at population level. There are, broadly speaking, three generally recognised conceptual approaches to tackling health inequalities (Graham, 2004):

- 1) Focussing solely on improvements in the health of the poorest groups
- 2) Reducing the health differences between the poorest and the richest groups (i.e. narrowing the gap)
- 3) Lifting levels of health across the socio-economic hierarchy to those at the top (i.e. lessening the gradient)

While these approaches differ in the focus of their primary endpoint, they are to a great extent mutually enhancing.

The target for tackling inequalities in low birthweight proposed by the Working Group on the National Anti-Poverty Strategy and Health (Institute of Public Health in Ireland, 2001) proposes the second of these conceptual approaches, as follows:

The gap in low birthweight rates between children from the lowest and the highest socio-economic groups should be reduced by 10% from the 2001 level, by 2007.

Narrowing health gaps of this nature requires 'raising the health of the poorest fastest' (Milburn, 2001). It requires both improving the health of the poorest and doing so at a rate which outstrips that of the wider population. Effective policies in achieving this goal will therefore achieve both an absolute and a relative improvement in the health of the poorest groups. A faster rate of improvement in disadvantaged groups is therefore the essential criterion of effectiveness in the situation where narrowing gaps is the policy goal (Graham, 2004).

Using the data for the year 1999 as a baseline, reducing the gap between the highest and the lowest socio-economic group by 10% would entail lifting 195 babies born to parents in the lowest socio-economic group out of the low birthweight range in the Republic of Ireland by 2007. (Taking the unemployed/ home duties socio-economic group as the lowest socio-economic group and making an artificial assumption that low birthweight rates and proportions of births in each of the socio-economic groups remain stable over that time).

However, if we consider the third conceptual approach to tackling inequalities, that of lifting levels of health across the socio-economic hierarchy to those at the top, this would entail lifting 695 babies across the socio-economic groups out of the low birthweight range in the Republic of Ireland (See section 3.4).

An effective framework to achieve these sorts of gains in the birth outcomes of lower socio-economic groups in Ireland must positively affect key factors along the causal pathway between lower socio-economic status and low birthweight. In a temporal sense, this causal pathway encompasses factors that determine the mother's health prior to, and at, conception as well as those that affect each trimester of pregnancy.

In order for a factor to be an important mediator of socio-economic disparity in low birthweight at population level it must satisfy at least two statistical requirements (1) the factor must have a sizeable aetiological fraction for the outcome i.e. low birthweight (2) it must be strongly associated with socio-economic status i.e. it should be far more prevalent among the poor than among the socio-economically advantaged (Kramer et al, 2000). The aetiological fraction estimates the influence of that factor (e.g. smoking/ethnic group) on low birthweight at population level rather than examining risk factors at individual level. The aetiological fraction depends on both the absolute numbers of babies involved and the magnitude of the relative risk. For example, in the case of drug misuse in pregnancy where the relative risk is much higher in lower socio-economic groups but the absolute numbers of babies affected is quite small, the aetiological fraction is diminished.

There are two distinct causal pathways to consider in relation to the outcome of low birthweight, namely the preterm birth pathway and the growth limitation (IUGR/LBW) pathway, as described in section 1.1. An examination of the relative influence of certain factors on these pathways at population level, based on meta-analysis data, has been conducted (Kramer et al, 2000). Kramer presented the results of this examination schematically using pie-charts to depict the relative contribution of different factors to

preterm births and to intra-uterine growth retardation at population level. These diagrams are reproduced overleaf in figure 11 and 12.

The diagram should be interpreted in relative terms only, because the factors shown are not mutually exclusive for any individual woman. Thus the total aetiological fraction is far less than the 90% or so suggested in the diagram (Kramer et al. 2000).

Explanation of terms for Figures 11 and 12:

- 'PIH' refers to pregnancy-induced hypertension (high blood pressure)
- 'low BMI' refers to women who are underweight
- 'prior PTB' refers to a previous pre-term birth
- 'GU infection' refers to genitor-urinary infection in pregnancy
- 'abruptio placentae' refers to a condition where the placenta, which supplies the baby with oxygen and nutrients, dislodges prematurely

Pie charts reproduced from 'Socio-economic disparities in pregnancy outcome: why do the poor fare so poorly?' MS Kramer et al. Copyright Blackwell Science Ltd. Paediatric and Perinatal Epidemiology 2000, 14, 194 -210.

Figure 11. Aetiological determinants of preterm birth in a developed country in which 25% of the women smoke during pregnancy and a substantial minority are non-white

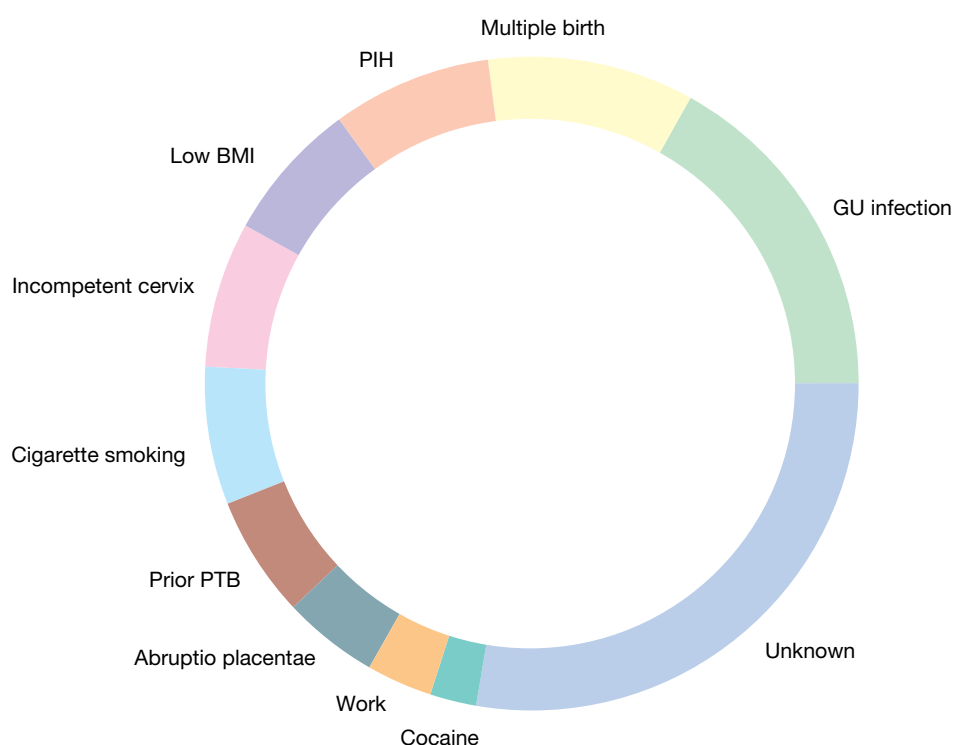
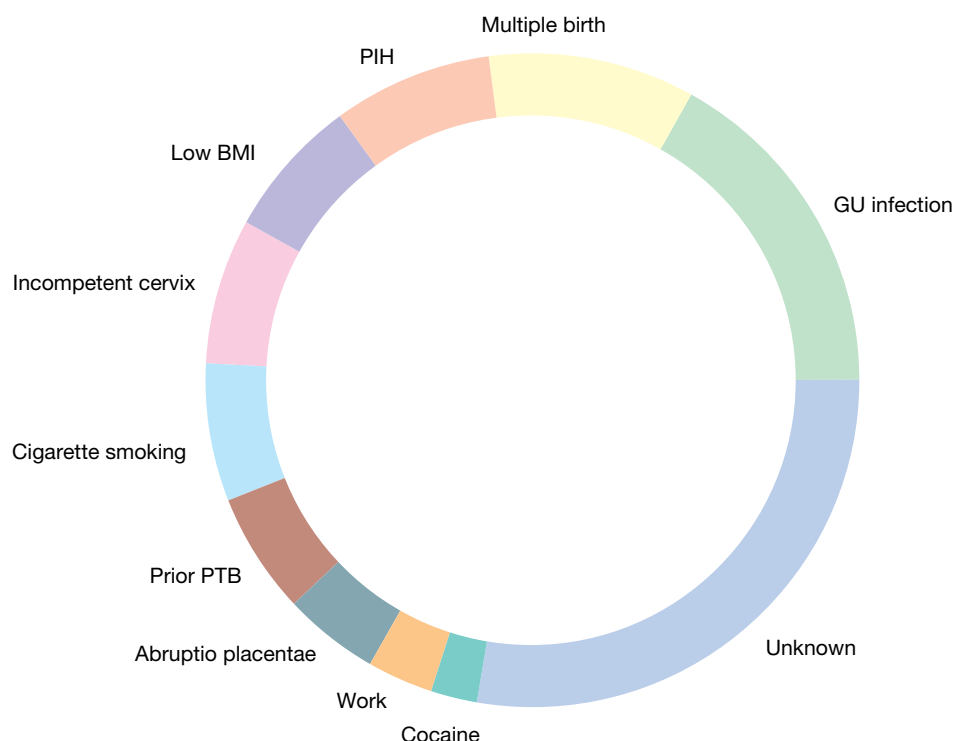


Figure 12 *Aetiological determinants of IUGR in a developed country in which 25% of the women smoke during pregnancy and a substantial minority are non-white*



This report examines these determinants of low birthweight with particular consideration of the influence of socio-economic status. ‘Upstream’ factors such as ethnic group and socio-economic determinants like income and social protection policy are discussed. Environmental and behavioural factors are also examined in the light of the conceptual framework specified above. The relative importance of ‘downstream’ factors such as access and attendance at antenatal services are also examined in the review. For the sake of clarity, each determinant is addressed individually, although it is clearly recognised that in reality there is a complex interplay of many of the determinants. Current knowledge on each determinant is highlighted, with particular reference to relevant observational data recorded in Ireland at population and service level, so as to contextualise the issue under discussion. The evidence for the efficacy of interventions in relation to reducing inequalities in low birthweight is then summarised in relation to each of these determinants.

It is acknowledged that research conducted in other countries may not be entirely applicable to the Irish context. The varying definitions of poverty or ‘at risk’ and definitions of ‘standard ante-natal care’ and ‘social support’ may differ, in addition to definitions of the key perinatal statistics presented in Table 1.

5.3 Objectives of the review

A literature review was conducted to assess the evidence-base for interventions to address socio-economic disparities in low birthweight in Ireland and globally. The review sought to

- identify socio-economic and biological determinants of low birthweight
- report on the effectiveness of interventions or strategies to prevent low birthweight with particular reference to lower socio-economic groups
- provide guidance to inform policy and practice in public health initiatives to address social inequalities in low birthweight births in Ireland.

5.4 Methodology of the review

A literature search was carried out. Electronic databases were searched and published studies were identified.

The following databases were searched:

- MEDLINE
- Cochrane Library
- World Health Organisation Reproductive Health Library
- ERIC
- Health Development Authority library

Public health reports from other countries were also obtained. The reference lists from reviews and reports were examined to include possible additional material. Articles included were limited to the English language.

Key words used in the searches were: Low birth weight, fetal growth, fetal development, infant, preterm, Prematurity, IUGR, intrauterine growth, SGA, small for gestation, maternal age, teenage pregnancy, adolescent pregnancy, maternal weight, weight gain, pre-pregnancy weight, vitamin, multivitamin, maternal nutrition, nutrition education, marital status, parity, infant mortality, neonatal death, prenatal exposure, smoking, tobacco pregnancy, alcohol, drinking, infection pregnancy, stress, anxiety, psychosocial factors, psychological factors, poverty, socioeconomic group/status, physical work, social support, antenatal care, prenatal care, health education. Outcomes were: low birthweight, preterm birth, SGA (Small for Gestational Age), IUGR (Intra-Uterine Growth Retardation).

In addition, the annual reports and clinical reports of the Dublin maternity hospitals were consulted for relevant data.

A recent text by Nick Spencer “Weighing the Evidence, how birthweight is determined?” is also included in this review.

5.5 Objective 1: Identify biological and socio-economic factors associated with low birthweight

Table 20 overleaf presents factors that demonstrate an association with low birthweight in the international literature. Research conducted on Irish samples is marked with an asterisk(*).

Table 20. Factors positively associated with low birthweight

Environmental factors	Reference
Living in rental housing	(Spencer &Coe, 2003)
Living in crowded housing/shared apartments	(Grjibovski et al, 2004)
Living in smoking households	(Spencer, 2003)
Abuse during pregnancy	(Parker, 1994)
Psychological factors	
Parental attitude to pregnancy	(Keeley et al,2004)
Socio-demographic factors	
Low income family	(Dickute et al, 2004)
Father's occupation/ mother's occupation	(Sanjose et al, 1991)
Lower parental educational attainment	(Dickute et al, 2004)
Lower educational attainment (grandmother)	(Segonds-Pichon et al. 2004)*
Parental unemployment	(Dickute et al, 2004)
Unmarried marital status	(Bonham, 2004)*
Number of cars per house	(Johnson et al, 1994)*
Maternal height, weight & body mass index	(Thomson & Billewicz, 1963)
Extremes of maternal age	(Dickute, et al, 2004)
Cultural factors	
Ethnic group	(Office for National Statistics UK, 2000)
Asylum seekers/refugees	(Office for National Statistics UK, 2000)
Health behaviours	
Poor nutrition during pregnancy	(Osrin et al. 2000)
Smoking during pregnancy	(Kramer et al. 2000)
Alcohol excess during pregnancy	(Holman et al. 1996)
Drug misuse (cocaine/ opiates/ marijuana)	(Gerada et al. 1990)
Health services	
Medical card status	(Johnson et al. 1994)*
Antenatal care	
- late presentation	(Treacy et al. 2002)*
- poor attendance	(Slap & Schawartz 1989)
Specific diseases & deformities	
Hypertension	(Teberg et al. 1989)
Infection	(Hillier et al. 1995)
History of previous low birthweight baby	(Raine, 1994)
Congenital anomalies, including genetic disorders	(Bonham, 2004)*
Maternal mortality from cardiovascular disease	(Davey Smith et al., 2000)
Obstetric history of mother	
Teenage pregnancy	(Bonham, 2004)*
Short duration of time between pregnancies	(Lieberman et al. 1989)
Multiparity	(Bonham, 2004)*
Assistive reproductive technology	(Schieve et al.2004)
Multiple birth	(Bonham, 2004)*

5.6 Objective 2: Report on the effectiveness of interventions to prevent low birthweight with particular reference to lower socio-economic groups

A number of interventions have been devised to attempt to counteract the adverse effects of socio-economic status on birth outcomes. These interventions can be grouped as follows, with more 'upstream' factors at the top of this list and 'downstream' factors at the end of the list:

- Interventions aimed at the socio-economic and socio-demographic determinants of low birthweight
- Interventions aimed at the psycho-social factors associated with low birthweight, with particular reference to lower socio-economic groups
- Interventions aimed at health behaviour determinants of low birthweight, with particular reference to lower socio-economic groups
- Interventions aimed at health service determinants of low birthweight, with particular reference to lower socio-economic groups
- Interventions aimed at disease-specific determinants of low birthweight, with particular reference to lower socio-economic groups

The efficacy of multi-component strategies in preventing low birthweight is unclear as studies have been hampered by methodological challenges. To date, the majority of intervention strategies attend to the health consequences of social and economic disadvantage rather than addressing the underlying causes of disadvantage. It has been argued that the lack of integration of social strategies with health policy has limited the impact of interventions in reducing low birthweight (Hughes & Simpson, 1995).

5.7 Interventions targeting the socio-economic and socio-demographic determinants of low birthweight

5.7.1 Income

5.7.1.1 The relationship between income and low birthweight

A relationship between low income and low birthweight has been consistently reported in a number of studies (Parker et al. 1994; Wilcox et al. 1995). However, remarkably few studies have adequately measured the income of pregnant women and fewer have adequately explored the dynamics of this relationship between income and birthweight, beyond noting that a relationship between low income and low birthweight exists. Evidently lower income may directly affect a pregnant woman's chances of affording resources that may affect the well-being of her baby such as a nutritious diet, transport to

antenatal services or home-heating but is also likely to have already had profound effects on her own development and her own state of health pre-conception.

A preliminary systematic review of the effect on income inequality and macro-level social policy on infant mortality and low birthweight in developed countries was recently published (Spencer, 2004). This review found that three studies had shown that low birthweight was associated with higher levels of income inequality. More evidence is needed to confirm this finding. A statistically significant association between higher income inequality (and other indicators of less redistributive social policy) and infant mortality rates was noted.

5.7.1.2 Irish data on income and income support and low birthweight

A minimum income standard for pregnant women has not been defined in Ireland. In the Republic of Ireland, Maternity Benefit is paid to women on maternity leave from work provided they have paid a certain amount of PRSI (Pay Related Social Insurance). The amount of money paid each week depends on the mothers current earnings and is paid for eighteen weeks. Leave must be taken at least two weeks, and not more than fourteen weeks, before the end of the week the baby is due. Therefore, this benefit may be used by women in the last trimester of pregnancy who choose not to work for the last fourteen weeks of pregnancy. Maternity Benefit ranges from a minimum of €182.60 to a maximum of €265.60 per week (2006 rates). Women on certain social welfare payments receive half-rate Maternity Benefit, as detailed in Appendix 2. However, unemployed women who are not in receipt of these social welfare payments do not qualify for maternity benefit or any additional financial assistance during the first, second or third trimesters of their pregnancy.

No nationally representative data could be found on what levels of income and deprivation are being experienced by pregnant women in Ireland nor on how these factors influenced their access to resources or health behaviours. It may be possible to source some data through secondary analysis of nationally representative surveys that include pregnancy as a variable.

5.7.1.3 Evidence of the effectiveness of income support interventions on low birthweight

The literature is inconclusive on the effect of providing extra income during pregnancy in relation to improving birth outcomes such as low birthweight. No association was found between low birthweight and low levels of parental leave entitlement in a review of macro-level social policy and low birthweight (Spencer, 2004).

5.7.1.4 Estimate of the effectiveness of income support/ social policy measures in reducing inequalities in low birthweight

Social policy measures and income support may have an important role in improving the birth outcomes of the poorest groups, in narrowing the gap between richest and poorest and, to a lesser degree, in decreasing the social gradient in the frequency of low birthweight. Social protection measures may have the capacity to positively affect birth outcomes for babies born to parents in the unemployed/home duties category, which accounted for 17% of all low birthweight babies born in the Republic of Ireland in 1999.

Babies born to parents classified as manual workers (who form a substantial proportion of the 'working poor') accounted for 10.7% of all low birthweight babies born in the Republic of Ireland in 1999. The impact of improved social policy measures could be broad having a positive impact at population level and the potential to bring gains to large numbers of babies.

5.7.1.5 Issues for further consideration

- Income support is one of a number of social policy issues that may have important effects on pregnant women and the well-being of their babies. The scope and nature of social policy issues that most affect the income of pregnant women in Ireland has not been comprehensively addressed in this report. Consultation with pregnant disadvantaged women would be of pivotal importance in such an exercise.
- Further research into the adequacy of current social maternity welfare payments for unemployed and low-paid women in Ireland is required. Furthermore, a policy analysis comparing social protection measures for pregnant women in Ireland with other countries would be of use in building healthy public policy to reduce health inequalities for babies of disadvantaged mothers in Ireland. In the UK, for example, Statutory Maternity Pay (SMP) is equivalent, in principle, to the Maternity Benefit in Ireland except it is offered for 26 weeks instead of 18 weeks. Furthermore, a Maternity Allowance is provided to women who do not qualify for SMP, also for 26 weeks. In addition, £60 million was allocated to the Sure Start programme to support parents-to-be living in disadvantaged areas in the UK in 2001. This programme included a SureStart Maternity Grant for mothers who were on income support from the 29th week of pregnancy. The evaluation report of the SureStart programme, due out in 2007 should be considered in terms of the introduction of additional income support for pregnant women living in disadvantage in Ireland.

5.7.2 Teenage pregnancy

5.7.2.1 The relationship between teenage pregnancy and low birthweight

Young girls from lower socio-economic groups are more likely to become pregnant in their teenage years (Swann et al. 2003). The prevalence of low birthweight in teenage mothers is higher and they are at an increased risk of a lack of financial resources (Botting et al. 1998). The risk of preterm birth is increased with younger maternal age (Scholl et al. 1992) and this relationship is strongly influenced by poverty and other social factors. Teenage mothers often suffer extreme stress due to an unplanned pregnancy and tend to not avail of timely antenatal care.

There are adverse socio-economic outcomes of early fertility for mother and child in terms of maternal educational attainment, unemployment and the propensity for lone parents to be at an increased risk of poverty. Teenage pregnancy and lone parenthood are strongly related to child poverty in terms of both cause and effect.

A review of teenage conception rates across Europe conducted by Kane and Wellings (1999) found the following country-level factors to be associated with teenage pregnancy:

- Teenage marriage rates
- Overall wealth of a country
- Income distribution
- Mean years of education
- Strength of religion.

The Social Exclusion Unit report on Teenage Pregnancy in the UK (Social Exclusion Unit, 1999) identified these key risk factors for teenage pregnancy at individual level:

- Young women in care
- Experience of physical or sexual abuse
- Involvement in crime
- Poor mental health
- Poverty/disadvantage
- Family history of teenage pregnancy
- Low educational attainment

The National Child Development Study concluded that low educational attainment was the most powerful single factor associated with the chances of becoming a young parent (Kiernan, 1995).

The explanation for higher teenage pregnancy rates in deprived areas is complex including a range of individual factors such as low self-esteem, lower educational and occupational aspirations, less knowledge of contraception and sexual health services and higher gender power differentials (Diamond et al. 1999). Residing in dangerous neighbourhoods and in a lower socio-economic family, living with a single parent and having older sexually active siblings place teenagers at elevated risk. Daughters of teen mothers have a higher probability of becoming a teen parent (Burghes & Brown, 1995). A study of young people aged sixteen and over who had recently left care in Northern Ireland found that teenage pregnancy is a disproportionate feature of the leaving care experience for young women (Pinkerton & McCrea, 1996).

5.7.2.2 Irish data on teenage pregnancy and low birthweight

In 2000, there were 93 conceptions among women under the age of sixteen in Ireland, 29% of whom travelled to the UK for termination. In the same year, there were 4019 conceptions among older teenagers (aged under 20), of whom 22% travelled to the UK for a termination (Fullerton, 2004). Recent international comparisons of births among fifteen to nineteen year olds in 28 developed countries showed Ireland to be in the top ten highest (UNICEF, 2001).

There were 212 low birthweight babies born to mothers aged 19 and younger in Ireland in

1999. Approximately 9.9% of all low birthweight babies in Ireland in 1999 were born to women aged 19 years and under (See Table 8).

5.7.2.3 Evidence of the effectiveness of interventions aimed at the issue of teenage pregnancy and low birthweight

There are two considerations in relation to teenage pregnancy that may have a role in reducing the proportion of low birthweight births in lower socio-economic groups at population level.

Firstly, a reduction in the incidence of teenage pregnancy could have the capacity to reduce numbers of low birthweight babies to lower socio-economic groups, given the association between teenage pregnancy and low birthweight observed in part three and four of this report. The avoidance of teenage pregnancy can reduce the risk of consistent poverty for girls in lower socio-economic groups, in part by improving their chances in terms of educational attainment and employment. It is considered that avoiding an unplanned teenage pregnancy is one route by which young women from lower socio-economic groups can escape the poverty trap and that this could have important positive effects on the risk of low birthweight to their subsequent offspring.

Secondly, targeting approaches to reduce the risk of low birthweight to pregnant teenagers, and in particular teenagers in lower socio-economic groups, may contribute to narrowing the gap in birth outcomes across socio-economic groups.

(i) Preventing teenage pregnancy

The Crisis Pregnancy Agency Ireland has produced a comprehensive review of effectiveness research on preventing teenage pregnancy and promoting positive adolescent sexual health (Fullerton, 2004). This report presents a synthesis of effectiveness information derived from extensive literature reviews in teenage pregnancy prevention (NHS Centre for Reviews and Dissemination 1997, Dicenso et al, (2002), Silva (2002), Swann et al, (2003)). The review also includes findings from relevant literature reviews and discussion papers on the topic of teenage pregnancy.

Three approaches to the prevention of teenage pregnancy are reviewed by the Crisis Pregnancy Agency in Ireland, namely, what works in the provision of sex education, what works in the provision of contraceptive services and counselling and what works in terms of general and vocational education (Fullerton, 2004).

Key findings from the review

- Sex education designed to reduce teenage pregnancy and promote positive sexual health among adolescents does not lead to early sexual behaviour
- Adopting a multi-faceted approach linking sex education with youth development projects and/or contraceptive services can lead to reduction in teenage pregnancy rates
- Only a small number of programmes have attempted to tackle social, economic and educational factors associated with teenage sexual behaviours

- There is good evidence to support school-based sex education, particularly linked to contraceptive services
- There is good evidence to support community-based education programmes and family outreach services
- Programmes focussing on poor educational attainment have demonstrated positive effects especially where programmes have a combined focus on the sexual and non-sexual antecedents of teenage pregnancy.

Key findings from the review of contraceptive services

- There is a lack of Irish research on the effectiveness of different approaches to the delivery of contraceptive services
- Contraceptive services must take into account local circumstances and needs and be based on needs assessment in order to have maximal effect
- Contraceptive services should ensure and publicise easy access (outside school hours & weekends) and confidentiality
- Services that focus on local high-risk groups have demonstrated success
- Services that include interpersonal skills development such as negotiating and refusal skills are effective
- Putting services and interventions aimed at preventing pregnancy within the context of other services for young people and working in partnership with local communities is effective

(ii) Reducing the risk of low birthweight babies for pregnant teenagers

A systematic review of the effectiveness of strategies aimed to prevent or reduce low birthweight births to adolescents has been conducted by the PHRED, Canada (Brunton 2001; Ontario 2001). Their findings indicate that a combination of home-visiting and clinic services has a significant effect in reducing the incidence of low birthweight births to adolescent mothers. The review reported that programmes that enrolled adolescents early in pregnancy indicated a significant improvement in low birthweight incidence. A meta-analysis by Scholl et al. also found antenatal care for adolescents incorporating social and behavioural services in conjunction with traditional medical care to be effective (Scholl 1994). A recent meta-analysis of antenatal care programmes for pregnant teenagers also found consistent evidence for effectiveness of comprehensive programmes in reducing poor maternal outcomes (Burghes 1999). Indeed, a multivariate analysis of risk factors for low birthweight to adolescent mothers in the USA found that the variable 'fewer than five antenatal visits' accounted for the largest proportion of low birthweight in this group (Slap & Schwartz, 1989).

The Health Development Authority reported that interventions that are tightly focused and targeting one particular vulnerable group are likely to be the most effective (Meyrick & Swann, 1998), with the caveat that the most vulnerable groups can often be the most difficult to reach. Comprehensive needs assessment at local and service level is recommended.

5.7.2.4 Estimate of the effectiveness of targeting approaches to reducing low birthweight by reducing rates of teenage pregnancy & improving outcomes from teenage pregnancies

The prevention of teenage pregnancy is important in the prevention of consistent and relative income poverty for both mother and child and in this regard deserves special attention in a consideration of socio-economic inequalities in low birthweight. However, it is acknowledged that less than 10% of all low birthweight babies are born to teenage mothers, representing a relatively small proportion of the overall problem of low birthweight.

Improving access for teenage mothers to antenatal services represents a tangible action within a strategic framework to reduce inequalities in low birthweight, with good evidence of effectiveness.

Issues for further consideration

There has been a notable development in the attention given to policy at governmental level in the UK with the publication of the UK Teenage Pregnancy Strategy in 2000.

5.7.3 Ethnic group

5.7.3.1 The relationship between ethnicity and low birthweight

Ethnic differences in birthweight and perinatal mortality have been consistently reported in the United Kingdom. Birthweight distributions vary by minority ethnic group and mother's country of birth and the degree to which this attributed to biological, cultural and socio-economic factors has been much debated. In 2000, women born in West Africa and in the Caribbean had the highest percentage of babies weighing under 1500grams in the UK i.e. VLBW babies (Office for National Statistics UK, 2004). Several databases in the United States have highlighted major disparities among birth outcomes to women from different ethnic backgrounds, with African-American women most likely to have babies of low birthweight, which may be attributed to their lower socio-economic status in American society (Parker et al, 1994b).

5.7.3.2 Irish data on ethnicity and low birthweight

Travellers are Ireland's largest minority ethnic group and traditionally have a higher fertility rate and get married younger compared with the general Irish population. The last nationally representative data on birth outcomes for Travellers was produced over fifteen years ago (Barry, Herity & Solan, 1989). Perinatal, neonatal and infant mortality rates far exceeded the national mortality rates. The occurrence of Sudden Infant Death Syndrome among Traveller families in 1999 was twelve times the national average. These findings were highlighted in Ireland's national strategy document, Traveller Health: A National Strategy 2002 -2005 (Department of Health & Children, 2001). No estimate of the proportion of babies born low birthweight in the Travelling community in Ireland could be found. The total number of Traveller families in 2000 was 4,898, with an average 3.5

children per family and a general fertility rate of 164.2 per 1000 women aged 15 to 49 (1987 estimate). In view of the lack of adequate data, no estimate of the number of births to Travellers in Ireland can reasonably be derived at this time.

There has been a rapid increase in the number of other ethnic minority groups in Ireland in the past decade. Approximately 200,000 such people are living in Ireland, the majority of whom reside in the Eastern region. The Eastern Regional Health Authority Regional Health Strategy for Ethnic Minorities 2003 describes the arrival of expectant mothers on an unscheduled basis to maternity hospitals in an advanced stage of pregnancy with significant medical complications as a “common problem”. Low uptake of antenatal and family planning services is also reported. There are significant numbers of attendees at a Dublin-based outreach antenatal clinic for asylum-seeking women testing positive for Hepatitis C and B and for HIV (Rotunda Hospital Clinical Report, 2003)

In mid-2003 the National Perinatal Reporting System was requested by the General Register Office to include new fields relating to nationality and country of residence for both mother and father. From this data, inferences in terms of the effect of ethnic group on birthweight as well as perinatal mortality and neonatal mortality at national level may be examined, to some degree. However, this data is not yet available for analysis. Data from the Dublin Maternity Hospitals Combined Dataset indicate that twenty percent of births in the Eastern region in 2002 were to women who were not born in Ireland. The majority of these women were from Britain (n=389, 5.25%), non-EU Europe (including Russia (n=222, 3%)) and Africa (n=394, 5.32%), with smaller numbers from the Far East (n=103, 1.39%) and Australasia (n=112, 1.51%). Percentages presented in brackets represent the percentage of all births in the Dublin Maternity Hospitals attributed to mothers born in that country or group of countries.

A review of pregnancy outcomes for asylum seeker women in the former Southern Health Board in 2000-2001 recorded the mean birthweight of 224 babies as 3319 grams (range: 1085-5190grams). This compares to a national average of 3491 grams but it is not known whether this difference is statistically significant. 2% of babies were 1000-2000 grams and 30% were 2000 to 3000 grams (Foley Nolan et al, 2002). As the 2500 gram cut-off was not used, the proportion of babies who could be classified as low birthweight could not be deduced. It is therefore not possible to state at this time whether babies born to asylum-seekers and other ethnic minority women in Ireland are at higher risk of low birthweight. The “healthy immigrant” effect has been recorded in relation to birthweights to asylum seekers and refugees, so adequate national data is required prior to making any assumptions (Malamitsu-Puchner et al, 1994; Yoong et al, 2004). It is, however, highly likely that babies born to Travellers are at higher risk of low birthweight based on their adverse perinatal and neonatal mortality profile recorded in 1989(Barry, et al,1989).

5.7.3.3 Evidence of effectiveness in reducing low birthweight among minority ethnic groups

Despite the higher prevalence of low birthweight recorded among specific ethnic groups in the UK, and internationally, there is a striking lack of systematic review-level evidence

regarding the effectiveness of interventions targeting such groups. There are a few studies testing the effectiveness of interventions for minority ethnic women but these have tended to focus outcomes such as breastfeeding, rates of induction of labour or diseases such as sickle cell disease, which are more common among certain ethnic groups. Health advocacy and linkworkers were found unsuccessful in improving birthweight to babies born to minority ethnic groups in two small studies (Parsons & Day, 1992; Mason, 1990).

No evidence was found relating to the success or failure of interventions aimed at improving the birthweight of babies born into the Travelling community in Ireland. The maternity behaviours of Travellers are unique with a greater number of pregnancies and a younger age at first pregnancy than the rest of the population. Travellers may experience shorter durations between pregnancies which may affect the birthweight profile of their babies. A study of Travellers perceptions and experiences of maternity services recommended the extension of cultural-awareness for maternity services and for Travellers and the provision of outreach antenatal classes (NUIG, 2001). A Traveller-friendly ParentCraft and antenatal service has been developed in the Rotunda Hospital in recent years.

An Outreach Maternity Clinic has been established to address the particular needs of pregnant asylum seekers and refugees, but no evaluation of the efficacy of the clinic in improving birth outcomes was found.

5.7.3.4 Estimate of the effectiveness of targeting ethnic minority groups in reducing inequalities in low birthweight in Ireland

The proportion of Ireland's low birthweight babies that are born to ethnic minority women in Ireland is unknown. The degree to which women from Africa, the Far East and non-EU Europe may or may not carry the poorer birth outcomes of their native country with them cannot be estimated at this time. While data from the Dublin Maternity Hospitals data would indicate that the absolute numbers of births to such women is less than 10%, this may not be reflective of the country as a whole.

In the absence of both the absolute number of ethnic minority babies in Ireland and of data to provide an estimate of the relative risk of low birthweight compared to the general population, the contribution of ethnicity to socio-economic inequalities in low birthweight is unknown.

5.7.3.5 Issues for further consideration

- Assessment of the maternity needs of some ethnic minority women has been conducted in Ireland (Kennedy & Murphy-Lawless, 2001; Foley Nolan et al. 2003). A comprehensive review of the findings of these needs assessments has not been included in this report. Should future analysis uncover a disparity in low birthweight between ethnic minority groups and the general population, the findings of such needs assessments would be of use in guiding practice towards tackling health inequalities in birthweight.

- A comprehensive review of the range and coverage of specialist antenatal services for ethnic minority groups in Ireland is not included in this report. The extent of the provision of own-language health education materials, culturally appropriate antenatal classes and translation services in Ireland is unknown. It is not known whether evaluation data on such services exists in the Irish context.

5.8 Interventions aimed at the psycho-social factors associated with low birthweight

5.8.1 Psychological stress

5.8.1.1 The relationship between psychological stress and low birthweight

It has been argued that women from lower socio-economic backgrounds may be subjected to prolonged stress in pregnancy arising from a lack of economic resources, which compounded by insufficient coping skills, may facilitate the adoption and maintenance of unhealthy behaviours (Rutter & Quine, 1990). Such stressors may be emotional, financial and practical and have a negative impact on the developing baby and increase the risk of preterm birth (Newton & Hunt, 1984; Lobel et al, 1992). Psychological stress may play an important role in how and when pregnant women access antenatal care services.

Chronic and acute stressors may impact directly on stress hormones such as CRH which are associated with pre-term birth (Sandman et al, 1997).

5.8.1.2 Irish data on psychological stress in pregnancy and low birthweight

No data could be found on the levels of psychological stress experienced in a nationally representative sample of Irish pregnant women or in an observational sample in the literature search.

5.8.1.3 Evidence of effectiveness of stress reduction in reducing low birthweight

Overall, there was no convincing evidence in the international literature to prove that increased prevalence or levels of stress are directly related to low birthweight. There was some evidence to suggest that stress may be excessively affecting pregnant women in lower socio-economic groups (Peacock et al, 1995; Rutter & Quine, 1990). There was no research found to suggest that interventions aimed at reducing stress levels among pregnant mothers increased birthweight, irrespective of socio-economic status considerations. However, it has been suggested that stressors that are present in early pregnancy are most likely present before the pregnancy therefore, if we are to improve pregnancy outcomes, it is necessary for interventions to begin prior to pregnancy (Hobel & Culhane, 2003).

5.8.1.4 Estimate of the effectiveness of stress reduction measures in reducing inequalities in low birthweight in Ireland

The inconsistent results reported in relation to the effect of stress on low birthweight may arise from methodological difficulties in achieving a meaningful measure of stress for

pregnant women. It has been suggested that daily hassles and chronic stressors including poor and crowded housing, unemployment and living without a partner may have a greater effect than stressful 'life events'. Such chronic stressors have been relatively ignored in favour of stressful life events in the research literature (Hoffman & Hatch, 1996). The majority of published studies also refer to individual hospitals or communities, which limits the generalisability of the findings at population level.

In the absence of data on the nature of stressors affecting pregnant women in Ireland, their levels of perceived stress and the relationship between that stress and behaviours that may effect the development of their babies, no conclusion on the magnitude of the effect of stress in socio-economic disparities in low birthweight in Ireland can be drawn. It follows therefore that no estimate of the effectiveness of stress reduction measures in reducing inequalities in low birthweight can be derived.

5.8.1.5 Issues for further consideration

- Data on the levels of stress and mental ill-health experienced by pregnant women in Ireland would be of assistance in devising mechanisms to promote the mental health of Irish women in pregnancy, although the effect of these mechanisms on birth outcomes is difficult to predict.
- The differing role that stress may have in preterm births and other low birthweight births needs to be evaluated.

5.8.2 Social support

5.8.2.1 The relationship between social support and low birthweight

It is hypothesised that social support could act as a buffer to the effects of the lack of material resources, partner support and psychological stress that may inordinately affect women in lower socio-economic groups.

There are a number of methodological issues in studying the effect of social support on birth outcomes. Such difficulties would include varying characterisations of what constitutes a meaningful definition of social support in the international literature. It would seem that the concept encompasses emotional support, practical support and indeed financial support to varying degrees. Low socio-economic status women report less social support during pregnancy (Nordentoft et al, 1996).

Some authors take the view that maternal psychosocial factors are not related to low birthweight so that interventions in this regard are unlikely to yield positive results (Zimmer-Gembeck & Helfand, 1996)

5.8.2.2 Irish data on social support and low birthweight

No data could be found on actual or perceived levels of social support among pregnant Irish women.

5.8.2.3 Evidence of the effectiveness of social support in reducing low birthweight

A Cochrane review on the efficacy of additional social support during pregnancy for women deemed to be at high risk of delivering a low birthweight baby was conducted in 2003 (Hodnett & Fredericks, 2003). The review included interventions where the provision of support was a major component, which included emotional support, tangible assistance (e.g. transport provision) and interventions offering such support in the first or second trimester. This review did not include purely educational interventions or interventions based primarily on smoking cessation.

Overall, the evidence would suggest that social support alone is not sufficient to improve pregnancy outcomes in populations deemed at risk (Da Silva 1994). The Cochrane review also concluded that there was no evidence of a significant advantage of additional social support during pregnancy in preventing low birthweight, irrespective of socio-economic group. The authors of the review consider that the effects of social support during pregnancy may not be strong enough to improve birth outcomes given the levels of social deprivation experienced by vulnerable women before and during pregnancy. The ineffective identification of high-risk women may have hindered the ability of the various studies to detect a significant effect of increased social support on birth outcomes.

Indeed, while some observational studies have derived supporting evidence for the role of social support, this beneficial effect has not been reported in a number of randomised controlled trials (Hoffman & Hatch, 1996). However, one randomised controlled trial that examined the impact of social support as an intervention on pregnancy outcome among socially disadvantaged women with a previous history of having a low birthweight baby (n=509) found that the mean birthweight was higher than the control group. However, the mean birthweight was only 38 grams higher than the control group (Oakley et al, 1990). In this trial, the pregnant mothers was allocated to receive either social support intervention (which included home visiting by midwives, providing advice in relation to health behaviours, referrals to other health professionals, a listening service and 24 hour helpline) in addition to standard care. The other group just received standard care. An Australian randomised controlled trial of antenatal social support in a population deemed to be at-risk of delivering pre-term demonstrated similar results with an insignificant difference between intervention and control groups. The intervention included additional social support including home visitation, the controls received standard care by midwives. 12.5% of the women in the intervention group delivered a low birthweight infant compared to 12.9% in the control group (Bryce et al, 1991). One study observed a positive effect on birthweight related to increased neighbourhood support among white American women (Rich-Edwards et al, 2003).

5.8.2.4 Estimate of the effectiveness of improving social support in pregnancy for the reduction of inequalities in low birthweight in Ireland

The absence of data on both the nature and the effects of social support for pregnant women in Ireland limits our understanding of how addressing this factor may improve birth outcomes such as low birthweight.

The current evidence-base from the international literature does not support the use of social support interventions in the prevention of low birthweight, but this may be hampered by methodological issues.

5.9 Interventions aimed at the health behaviour determinants of low birthweight

5.9.1 Drug misuse (opiates/ cocaine/ marijuana)

5.9.1.1 The relationship between drug misuse and low birthweight

Pregnant women who use opiates such as heroin are a group at high risk of having low birthweight babies. Opiate use during pregnancy is associated with premature labour, maternal pre-eclampsia (high blood pressure), as well as potential infection with HIV or Hepatitis B or C (Gerada et al,1990). These complications may result directly from the quantity of drug used and route of drug administration as well as from the negative health effects of the "drug-using lifestyle" such as poor nutrition, poly-substance use and infrequent health care (Gerada et al,1990). A deficit of 250 grams in birthweight is reported associated with cocaine use (Shankaran et al, 2004) and an estimated deficit of 489 grams reported associated with heroin use during pregnancy (Hulse et al, 1997).

5.9.1.2 Irish data on drug misuse and low birthweight

Drug misuse in Ireland is more common among lower socio-economic groups with many girls living in deprived circumstances exposed to and offered drugs from a very young age. Ireland has among the highest rates of substance misuse among schoolchildren in Europe with considerable increases in the numbers of young girls attending addiction services as injection heroin users in the 1990s (Smyth & O' Brien, 2004).

There is no nationally representative data on the birthweights of babies born to drug-misusing mothers in Ireland. It is acknowledged that there would be a number of methodological challenges in collecting such data. The prevalence of chemical drug misuse in the antenatal population of one Irish maternity hospital was estimated at 2.8% and drug misuse was related to younger age and lower socio-economic status (Bosio et al, 1997). Irish women using drugs in pregnancy are more likely to be single and unemployed (Bosio et al, 1997). Several Irish studies show that opiate-using pregnant women tend to be young, poorly educated, regular tobacco smokers and from socially deprived areas (Farrell, 1999).

Ninety-three HIV positive infants have been reported in Ireland between 1985 and 1998 and the predominant underlying maternal risk factor for HIV infection was identified as intravenous drug use (96%) (Nourse et al, 1998). The mean birthweight of these infants is reported as 3125 grams.

The number of pregnant opioid-dependent women accessing drug treatment services in the Republic of Ireland has increased (Moran et al,1997; O'Brien et al, 2000). In 2003, 93 women on methadone maintenance programmes delivered their babies in the Rotunda

Hospital in Dublin, representing approximately 1.4% of births in that hospital (Rotunda Hospital Clinical Report, 2003). A Specialist Drug Liaison Midwife service was created in March 1999 to liaise between the three Dublin Maternity Hospitals and the Drug Treatment Services. The service aims to increase the engagement of opiate-using women with antenatal and drug services, to stabilize pregnant women on methadone and pro-actively address health and social care issues. The women attending this service had several markers of socio-economic deprivation such as high levels of unemployment, lower educational attainment and previous convictions. The mean birthweight of babies was 2948.91 grams, well below the national average of 3491 grams (Scully, 2004). The neonatal outcomes achieved through the service appear comparable to figures for similar services in the UK (Dawe et al, 1992; Myles, 2000), but further evaluation and audit of the service is required.

5.9.1.3 Evidence of effectiveness in reducing low birthweight among drug misusing mothers

No systematic review of the efficacy of interventions for drug misusing mothers in improving low birthweight could be found.

There is some supporting evidence that specialist mother and baby teams within a drug misuse treatment service are likely to be effective in engaging women misusing drugs and in improving key neonatal outcomes (Day et al, 2003). Most studies demonstrate an improvement in birthweight to pregnant women who are treated with methadone and a reduction in drug-related harms associated with needle-sharing (Hepburn, 1993; Sloan & O' Connor, 1998). However, one meta-analysis showed that heroine use while on methadone may counteract the birthweight advantage of methadone alone (Hulse, 1997). The housing of pregnant drug misusers has shown promising intermediate outcomes in terms of less drug use and higher treatment retention, but the relationship to the end-outcome, i.e. low birthweight, is not reported (Tuten & Jones, 2003). A hospital based multidisciplinary service for cocaine-abusing mothers also reported some success in relation to intermediate outcomes relating to maternal health and health behaviours (Haskett, 1992).

There is no evidence to support the role of selective screening of women infected with Hepatitis C in preventing low birthweight (Goldberg et al, 2001).

5.9.1.4 Estimate of the effectiveness of targeting interventions to drug misusing mothers in reducing inequalities in low birthweight in Ireland

The data suggests that the number of babies born to opiate-using mothers in Ireland is relatively small but that those babies are born to mothers at the lowest end of the socio-economic scale and that the risks experienced by these babies are exceptionally high. The numbers of babies affected by cocaine, marijuana and other street drugs is unknown but is presumed to be small in terms of the contribution to low birthweight at population level.

The targeting of interventions to drug misusing mothers therefore has an important role in the first approach to tackling health inequalities outlined in section 5.2, that of focussing

efforts on improving the health of the poorest groups. However, current data would suggest that the reduction of low birthweight related to drug misuse in Ireland will have only a small impact at population level in view of the small numbers of babies involved. The issue will need to be kept under constant review in the light of changing drug-use patterns and emerging data.

5.9.1.5 Issues for further consideration

The use of cocaine in Ireland has increased significantly in the past decade, but the effect on birth outcomes including low birthweight has not been assessed in the Irish context. The emerging trend of poly-substance use in pregnancy is also of particular concern (Stauber et al, 1982).

5.9.2 Cigarette smoking

5.9.2.1 The relationship between smoking and low birthweight

Smoking is a major factor contributing to the incidence of low birthweight. As such, half of the recent UK Health Development Authority evidence briefing on the prevention of low birthweight focused on smoking cessation (Bull 2003). The incidence of low birthweight is twice as high in smokers than non-smokers (Messecar 2001). There is evidence of a dose-response relationship and smoking is purported by some to be the most significant mediating factor in the relationship between socio-economic status and low birthweight. Smoking is related to both preterm birth and to a greater extent with intra-uterine growth retardation (Kramer & Kakuma, 2000).

Women with a lower level of education and lower income and employment status tend to continue smoking during pregnancy more than women from higher socio-economic groups (Graham & Der, 1999). These women report greater difficulty in committing to smoking cessation during pregnancy and perceive that their stress is alleviated by their tobacco smoking (Graham & Der, 1999). Others have gone so far as to argue that smoking has become a marker of socio-economic stress (Wilkinson, 1996). Wilkinson also argued that achieving success in smoking cessation is dependent on higher self-esteem, optimism about life and self-efficacy (feeling in control of one's own environment and choices) and concludes that generic smoking cessation programmes may be less effective, even ineffective, for lower socio-economic groups.

Marsh and Mckay (1994) considered that the main difference among socio-economic groups is not in the initiation of smoking but in the difficulty that persons from lower socio-economic groups have in stopping smoking. Significant factors for smoking cessation include motivation, psychosocial support and alleviated stress. Graham has argued that anti-smoking interventions targeting women from disadvantaged areas can prove counter-productive and the barriers that these women face need to be recognised (Graham, 1993). Interventions that also improve women's material circumstances may increase the success of smoking cessation programmes (Graham & Der, 1999).

It should also be noted that for mothers who have already had a low birthweight baby,

smoking in subsequent pregnancies independently increases the risk of having another low birthweight baby (Raine et al, 1994).

5.9.2.2 Irish data on smoking in pregnancy and low birthweight

An estimated 26% of Irish women are smokers, with the highest smoking rates recorded among younger women and women with lower educational attainment. 40% of Irish women aged 15 to 17 years and 40% of women aged 18 to 34 years are smokers, with rates rising to 50% of women among women with an incomplete secondary education. The mean number of cigarettes smoked daily is 9.9 among Irish female smokers with third level education and 17.6 for women with incomplete secondary education (Friel et al, 2002).

There is no nationally representative data on smoking habits among pregnant Irish women. Smoking was inversely related to education level in a sample of Irish pregnant women (Mehanni et al, 2000). The rate of maternal cigarette smoking in low birthweight pregnancies, whether the baby was subsequently stillborn or live born, was estimated at sixty percent among mothers delivering in the National Maternity Hospital in Dublin between 1989 and 1991 (Geary et al, 1997).

5.9.2.3 Evidence of effectiveness in smoking cessation and the reduction of low birthweight

While many studies have examined smoking in pregnancy, only two systematic reviews fulfilled the quality criteria for the Health Development Authority's evidence-base (Bull et al, 2003). Sixteen randomised controlled trials with validated smoking outcomes were included in the review. Thirteen trials provided counselling of varying duration, mostly using counsellors who were trained and supervised by the investigators. Booklets, pamphlets, self-help manuals, audio and video tapes were also used in the interventions. All studies used materials specifically directed for pregnant women. The authors calculated a combined risk ratio for smoking cessation after intervention and concluded that smoking cessation interventions were effective in increasing cessation in pregnancy. Risk ratios of 1.5 (95%CI = 1.61-2.34) were derived from the original meta-analysis and 1.7 (95%CI = 1.26-2.25) from the more recent update. Another meta-analysis of the effect of smoking cessation programmes on reducing low birthweight reported a small reduction in low birthweight although this finding was based on just two studies and measured cessation between the sixth and ninth month of pregnancy (Dolan-Mullen, 1999).

The review therefore concludes that intervention can increase smoking cessation in pregnancy by up to seventy percent. The degree of effectiveness varies among trials and within different subgroups of women and significant differences in treatment effects across individual studies were apparent. Formal smoking cessation interventions provided by specialists as part of antenatal care proved effective at helping some women to quit smoking in pregnancy. However, without specially employed staff to support smoking cessation programmes, other trials have reported less positive results. Evidence of lower quality has emphasized that more intensive interventions with multiple contacts produced larger effects, which may be beneficial among heavily addicted smokers who continue to

smoke in the last trimester. The components of successful interventions in smoking cessation in pregnancy are appropriate and intensive recruitment, the targeting of materials to the smokers, intensity of interventions, timing and training of health service providers in health behaviour modification and health education (Bull et al, 2003).

A review based on forty-four randomised or quasi-randomised controlled trials derived from databases between 1975 and 1998 was conducted in 2003 (Lumley et al, 2004). Diverse strategies including counselling, health education, relapse prevention, booklets, pamphlets and other self-help materials were assessed. Continued smoking in late pregnancy was the main outcome measure. A significant reduction in the likelihood of continued smoking in late pregnancy in the groups receiving intervention in an antenatal care setting was reported. However, there were slight variations when analysis was restricted to subsets of trials of high methodological quality, of higher intensity and with biochemically validated smoking cessation, but the finding remained statistically significant. A reduction in low birth weight among intervention groups and an overall increase in the mean birth weight of 29 grams was reported (Lumley et al, 2004).

Review-level evidence does not adequately describe the features of effective interventions to increase smoking cessation in particular relating to pregnant women living in deprivation or who are in the lower socio-economic groups. The Health Development Authority UK were unable to conclude whether any particular type of intervention increased the effectiveness of smoking cessation for pregnant women in lower socio-economic groups.

5.9.2.4 Estimate of the effectiveness of improved smoking cessation in reducing inequalities in the occurrence of low birthweight in Ireland

Smoking may be the most important variable mediating socio-economic disparities in the intra-uterine growth retardation component of low birthweight, with a less substantial effect on the preterm birth pathway (Kramer et al, 2000). The international literature and observational Irish data would suggest that success in reducing smoking among all pregnant women, and lower socio-economic status women in particular, would have a major effect on reducing inequalities in low birthweight in Ireland.

The reduction of smoking in pregnancy would have greatest effect in narrowing the gap between the richest and the poorest and in lessening the overall socio-economic gradient in low birthweight.

5.9.2.5 Issues for further consideration

- It has been proposed that health behaviour interventions will need to refocus and refine themselves in order to increase smoking cessation in lower socio-economic groups. In order to achieve this refinement, research should aim at identifying successful interventions for influencing behaviour within the context of the issues or barriers facing women from lower socio-economic groups (Chomitz et al, 1995).
- The Health Development Authority recommend that further trials are required to

adequately quantify and describe the effectiveness of smoking cessation interventions on improving birthweight. The lack of review-level evidence about what works to prevent relapse to smoking up to birth and beyond was also highlighted.

- Passive smoking is associated with low birthweight. The introduction of the workplace smoking ban in the Republic of Ireland may bring positive gains to the birthweight of infants born to mothers previously exposed to passive smoke in the workplace. The effect of the workplace smoking ban on inequalities in birthweight is unknown.

5.9.3 Nutrition

5.9.3.1 The relationship between nutrition and low birthweight

The relationship between pregnancy, nutrition and foetal growth has been described as ‘deceptively complex’ (Osirin et al, 2000). There is both retrospective and prospective evidence that poor maternal nutritional status at conception and inadequate maternal nutrition during pregnancy contributes to the development of low birthweight. The pace and balance of foetal growth is strongly determined by nutrition either directly, or indirectly through specific endocrine (i.e. hormonal) mechanisms (Jackson et al, 2003).

In the developing world, maternal weight pre-conception is the strongest predictor of infant weight and reflects nutritional stores potentially available to the developing foetus, with women weighing less than 40 kilograms at particular risk of having a small baby. The amount of maternal weight gain and energy intake during pregnancy are also closely related to low birthweight and are related to socio-economic status (Taffel, 1986).

However, in the developed world, where maternal malnutrition is relatively rare, the relationship between nutrition and birthweight is more difficult to understand.

5.9.3.2 Irish data on nutrition and low birthweight

In contrast to a wealth of research on infant feeding, especially breastfeeding, in the Irish context, no data could be found relating to nutritional patterns in pregnancy or the possible socio-economic variations therein. At population level, the contribution of fat and carbohydrates to total energy intake is increased among lower socio-economic groups in Ireland. Significant variation in nutrient intake levels has been observed among a nationally representative sample of Irish females across the different educational groups (Friel et al, 2003). Whether this pattern is also the case in pregnancy is unknown.

Maternal weight is routinely collected on the antenatal record in Ireland, with low maternal body mass index (BMI) positively associated with both the preterm delivery and IUGR pathways to low birthweight, as depicted in Figure 11 and Figure 12. Women who are underweight at conception and in pregnancy are therefore at increased risk of delivering low birthweight babies, although the degree to which this relationship is mediated by nutritional factors is unknown. The extent to which poor weight gain in pregnancy is the

cause of low birthweight or the extent to which it is actually a consequence of poor foetal weight gain is unclear.

Data on maternal BMI and weight gain should be available from the antenatal records held by the maternity hospitals and shared-care General Practitioners in Ireland but no analysis on the issue was sourced in the international literature.

5.9.3.3 Evidence of the effectiveness of nutritional interventions in preventing low birthweight

The Health Development Authority (HDA) evidence review noted a lack of high quality systematic reviews relating to nutrition and low birthweight (Bull et al, 2003). The quality of the studies and sample sizes investigated were diverse, which created difficulties in reporting the effectiveness of interventions between papers. In particular, the evidence-base with regard to nutritional interventions focusing on social disadvantage and low birthweight is rather limited.

Only two reviews fulfilled the quality criteria for the HDA evidence base. There is evidence to suggest that calcium supplementation may be effective in reducing preterm births and low birthweight. The effects appear to be greatest for women at high risk of hypertension (high blood pressure) in pregnancy (Hofmeyr et al, 2006). The HDA recommend that an investigation of calcium supplementation suitability for application in population-based policy is required. A second review on magnesium supplementation involved seven randomised controlled trials. There is presently no evidence to support the routine use of magnesium supplementation during pregnancy to prevent low birthweight (Makrides & Crowther, 2001).

There is conflicting low quality review-level evidence regarding the effectiveness of balanced protein/energy supplementation in preventing intra-uterine growth retardation or preterm births. There is evidence that isocaloric supplementation may be harmful. There is no high quality review-level evidence that isocaloric supplementation is effective for the prevention of intra-uterine growth retardation and preterm birth. There is low quality review-level evidence that supplementation of pregnant women is ineffective for the prevention of intra-uterine growth retardation and preterm births. There is evidence that high protein supplementation may be harmful. There is no high quality review-level evidence that high protein supplementation is effective for the prevention of low birthweight. There is low quality review-level evidence that supplementation of pregnant women is ineffective for the prevention of low birthweight.

There is a lack of review-level evidence regarding routine use of combined iron and folate supplementation for the prevention of low birthweight (Mahomed, 2006) and the HDA drew no conclusions about benefit or harm. Research is also needed to determine the effectiveness of multiple micronutrient supplementation (Merialdi et al, 2003).

The HDA could draw no conclusions about benefit or harm of nutritional advice in the prevention of low birthweight. Based on the lack of evidence (based on lower quality

systematic reviews) the HDA review concluded that the provision of nutritional advice was unlikely to be of major importance, that prevention educational programmes were of little benefit and that implications for foetal health cannot be judged from the available evidence (Bull et al, 2003).

A recent Cochrane review reported no consistent benefit observed on pregnancy outcomes in relation to energy and protein intake in pregnancy (Kramer & Kakuma, 2003). This analysis reported that in thirteen trials of balanced energy/protein supplementation, a substantial reduction in the risk of small for gestational age (SGA) babies was observed (although there was only a modest increase in mean birthweight). Dietary advice appears ineffective in terms of measurable benefits on infant/maternal health, but is effective in increasing pregnant women's energy and protein intake. Nutritional interventions likely to exert significant effects are best introduced in the early stages of pregnancy or ideally, preconception (Jackson et al, 2003).

Long-standing nutritional interventions such as the WIC program in the United States have proved successful (Ahluwalia et al, 1998) although discrepancies in findings have recently been reported, most studies have observed modest success rates in reducing low birthweight and preterm births (Brown et al, 1996). The WIC program also assists in smoking cessation and referral to antenatal care. The lack of effect reported in more recent studies could be due to differences in target populations, in terms of their 'at risk' status or alternatively, expanded eligibility may not have been effectively translated on the ground level with increased access to care (Hughes & Simpson, 1995). There are ethical issues involved in controlled trials that attempt to measure the efficacy of such interventions.

In conclusion, an increase in birthweight has been reported after nutritional supplementation programmes although results have been minimal and overall, the evidence is inconclusive. The range in benefits reported by various studies may be due in part to different study populations and methodological issues in study design.

5.9.3.4 Estimate of the effectiveness of nutritional intervention in reducing inequalities in the occurrence of low birthweight in Ireland

An estimate of the contribution of nutritional factors to the generation of socio-economic inequalities in the occurrence of low birthweight in Ireland is particularly difficult to achieve. While we can comfortably say that the nutritional value of the diets of lower socio-economic groups is poorer than higher socio-economic groups in Ireland, there is inadequate data relating to diets in these groups during pregnancy. There is a lack of data, or perhaps more specifically a lack of analysis, on even crude measures of nutritional status across socio-economic groups such as those relating to the BMI of the mother in early pregnancy and maternal weight gain, which have significant aetiological fractions in relation to low birthweight (see Figures 11 and 12).

This is further complicated by an absence of convincing review-level evidence of the benefit of nutritional advice and interventions.

It would be premature to dismiss the potentially sizeable contribution that nutritional factors may make to socio-economic inequalities in low birthweight. The current literature in terms of both epidemiology and intervention has not provided clear direction in relation to tackling inequalities in birthweight via nutritional interventions.

5.9.3.5 Issues for future consideration

- Factors such as low pre-pregnancy weight (low BMI) are clearly not modifiable once pregnancy is established and nutritional habits tend to be well established long before pregnancy. It has been argued that improving the nutritional status of adolescent girls is the ultimate nutritional intervention in terms of the prevention of low birthweight.
- Rising levels of obesity will have significant effects on the birthweight profile of babies born in Ireland and babies born to lower socio-economic groups in particular. This issue is explored in part 6 of the report.

5.9.4 Alcohol

5.9.4.1 The relationship between maternal alcohol consumption and low birthweight

Excessive alcohol consumption in pregnancy is associated with low birthweight babies. The range of effects of alcohol on the baby is known as the Foetal Alcohol Spectrum Disorders (FASD).

While some population-based studies have reported higher alcohol consumption in lower socio-economic groups in general, it is unclear whether alcohol consumption in pregnancy is related to socio-economic status. A number of observational studies have shown that women who were socio-economically deprived and women who smoked were more likely to abstain from alcohol in pregnancy (McLeod et al, 2002; Kwok et al, 1983). A multivariate analysis of factors associated with alcohol use in pregnancy showed that race, age and physical abuse were related to alcohol use, but socio-economic group was not (Haynes et al, 2003).

However, in the more extreme forms of FASD such as Foetal Alcohol Syndrome, a connection with socio-economic status has been reported. It is estimated that around one third of babies born to women consuming more than 18 units of alcohol a day in pregnancy will have this syndrome. Foetal alcohol syndrome is associated with births to older mothers who are multiparous and have low socio-economic status and long-standing alcoholism (Dehaene et al, 1981). However, the association with socio-economic status may be related to the social drift caused by longstanding alcohol excess rather than pre-dating the alcohol excess per se.

5.9.4.2 Irish data on alcohol consumption in pregnancy and low birthweight

There are no reliable estimates of the number or incidence of babies who develop Foetal Alcohol Spectrum Disorder in Ireland, and consequently no data on low birthweight

among affected babies could be derived.

There is no representative data to suggest that alcohol consumption among pregnant Irish women is associated with socio-economic group. Therefore no assumptions are made regarding the role of alcohol consumption in the relationship between low birthweight and lower socio-economic group.

Data from the Irish National Health and Lifestyle Survey indicated that 27% of women aged 18 to 34 years in social class 1-2 drink above acceptable limits, 34% in social class 3-4 and 22% in social class 5-6. This would indicate that there is no social gradient in excess alcohol consumption among Irish women in their child-bearing years (Friel et al, 2002). However, a small but consistent pattern of increased drinking among children in lower socio-economic groups was reported i.e. girls aged 12 to 17 in lower socio-economic groups more commonly reported drinking alcohol in the past month than similarly aged girls in higher socio-economic groups.

In a sample of one hundred Irish pregnant women, thirty-eight women had binged on alcohol on at least one occasion. Fifty eight per cent of this sample of women were aware of the harmful effects of alcohol during pregnancy, compared with 93% who were aware of harmful effects of smoking, with women reporting less advice from health professionals (Daly et al, 1992).

5.9.4.3 Evidence of effectiveness of interventions to reduce alcohol consumption in improving birthweight

A review of strategies and policy developments in preventing alcohol-related birth damage recommended that particular attention be given to the form and content of appropriate health behaviour messages, targeting of risk populations, the venue, and media of intervention. Birthweight was not considered in this review (Waterson & Murray-Lyon, 1990).

5.9.4.4 Estimate of the effectiveness of reduced alcohol consumption in pregnancy in reducing inequalities in low birthweight in Ireland

As the risk of low birthweight associated with moderate alcohol consumption is low and the frequency of exposure to very high levels of alcohol consumption is presumed to be low, it is concluded that alcohol probably makes a very small contribution to low birthweight at population level and a minimal contribution to inequalities in low birthweight. However, it is acknowledged that there are a number of serious birth outcomes related to moderate alcohol consumption that do not relate specifically to low birthweight.

The issue should be kept under review in the light of emerging research.

5.10 Interventions aimed at the health service determinants of low birthweight

5.10.1 Antenatal care

5.10.1.1 The relationship between antenatal care and low birthweight

A lack of antenatal care or untimely antenatal care has been cited as a risk factor for low birthweight (Kiely et al. 1994; Namkung, 2002).

The role of antenatal care in birth outcomes and the effectiveness of provision have been debated and reassessed in recent years (Alexander 2001). Key components of antenatal care include screening, nutritional advice, advice against substance misuse, possibly psychosocial support and early intervention. The quality of antenatal care is variable and as such the efficacy of antenatal care in general terms is difficult to measure.

Observational studies have generally reported improved birth outcomes, including birthweight after ample antenatal care, although whether these results are applicable to different populations is questionable. The absence of beneficial effects in randomised trials has been attributed by some to problems in study design methodology. While non-randomised trials of antenatal care interventions have yielded promising findings to support claims of benefits of antenatal care, randomised clinical trials of interventions to prevent preterm births have generated varying results. Current antenatal care approaches seem not to be particularly effective in preventing low birthweight, although clinical interventions in labour and after birth have undoubtedly improved outcomes for low birthweight babies. Due to discrepancies over what constitutes 'adequate' or 'standard' antenatal care, it is difficult to generalise findings from one population to another. There is also incomplete knowledge about the degree to which content and delivery of antenatal care is associated with other preconception and prenatal behaviours.

5.10.1.2 Irish data on antenatal care and low birthweight

Data from the 2000 Annual Report of the National Perinatal Reporting System demonstrates a trend towards higher mortality rates among mothers who have no antenatal care as compared to those with hospital only care/those with shared care with hospital and GP (Bonham, 2004). The disparity between mortality outcomes for multiple births is particularly striking. These findings are depicted in Table 21.

While no specific analysis was performed on antenatal care and birthweight, it is likely that low birthweight was at play in view of the adverse mortality rates recorded in this group, and the relationship between mortality and birthweight observed in Table 2.

Table 21. Comparison of mortality rates of singleton and multiple births according to no antenatal care or hospital antenatal care

Mortality rates	No antenatal care		Hospital antenatal care	
	Singleton	Multiple	Singleton	Multiple
Number of mothers	n=353	n=14	n=14,066	N=570
Perinatal mortality rate (per 1000 total births)	68.1	250	9.5	38
Early neonatal mortality rate (per 1000 live births)	31.2	142.9	3.9	22.8
Stillbirth rate (per 1000 total births)	38.1	125.0	5.6	15.5

It is important to consider that antenatal care can only provide a benefit to those mothers who actually attend the service. Poor attendance by teenage mothers and refugee and asylum-seeking women has been reported in Ireland. Data from the NPRS would also indicate better outcomes for those mothers who attend earlier in their pregnancy (Bonham, 2004). Younger mothers and unmarried mothers are more likely to present later in pregnancy in Ireland. Table 22 presents the mortality rates of Irish babies according to the time of presentation to a doctor.

Table 22 Comparison of mortality rates of singleton and multiple births according to time of presentation to antenatal services (S= singleton; M= multiple)

Time of presentation to doctor (weeks of pregnancy)	Percentage of live births		Stillbirth Rate (per 1000 total births)		Early Neonatal Mortality Rate (per 1000 total births)		Perinatal Mortality Rate	
	S	M	S	M	S	M	S	M
0 – 12 weeks	22.1%	21.5%	5.5	3.2	2.2	13.0	7.7	16.2
13-19 weeks	40.2%	39.6%	4.4	10.5	2.4	12.4	6.8	22.7
20 weeks +	33.5%	31.4%	6.2	23.9	3.5	17.8	9.6	41.3
Not stated	4.1%	7.5%	8.1	18.3	5.9	37.4	14.0	55.0
Total	100%	100%	5.4	13.8	2.9	16.1	8.2	29.7

Approximately 1783 Irish births in 2000 were unbooked (i.e. the mother presents to services for the first time in labour), representing 3.4% of all singleton births and 3.3% of all multiple births in that year. These unbooked births are associated with a greatly increased risk of death for the baby in the first week and first fortnight of life. The Perinatal Mortality Rate of unbooked pregnancies compares poorly to booked pregnancies for singleton births (29.2 unbooked vs. 7.5 booked) and for multiple births (61.2 unbooked vs. 28.6 booked).

It is not known whether women from lower socio-economic groups are more likely to attend antenatal services at a later stage of their pregnancy or are over-represented in

“unbooked” pregnancies. There is observational data from Dublin Maternity Hospitals to support this view (Treacy et al, 2002). Many of the factors associated with late attendance (teenage pregnancy, unmarried) are also associated with lower socio-economic status and, unsurprisingly, with low birthweight.

5.10.1.3 Evidence of effectiveness of antenatal care in reducing low birthweight

In terms of the particular situation of women in lower socio-economic groups, one randomised trial reported that women with lower incomes who obtained comprehensive care (which included multi-disciplinary care provided by mid-wives, social workers, nutritionists, psychologists and home visitors) were more likely to have higher birthweight first babies than women who received standard care (McLaughlin et al, 1992). The benefits of antenatal care for teenage mothers is fairly well established and discussed under section 5.7.2.3 (ii).

The availability of antenatal care is important and it can serve as a useful link to other service provision, for example to the WIC program in the United States (Shore, 2003) and can be used as a vehicle for encouraging behavioural change. Nonetheless, the timing and content of care is fundamental to improving birth outcomes. Alexander & Korenbrot (2001) argue that in order for antenatal care programs to be effective in reducing low birthweight they must address the causes of low birthweight. Some antenatal care programs are presently designed with the purpose of detecting major complications in pregnancy with the prevention of low birthweight as a secondary goal. It is also argued that antenatal care is often initiated too late to address low pre-pregnancy weight and often does not adequately incorporate intensive smoking cessation programmes (Alexander & Korenbrot, 2001).

5.10.1.4 Estimate of the effectiveness of health service interventions in reducing inequalities in low birthweight in Ireland

Observational data provides some compelling evidence that antenatal care has an important role to play in reducing inequalities in birth outcomes in Ireland. In particular the issues of late attendance and non-attendance among lower socio-economic groups may represent targets for interventions aimed at reducing inequalities in low birthweight.

However, evidence from randomised controlled trials does not strongly support the efficacy of antenatal care in securing improved birth outcomes. It has therefore been hypothesised that the association between the timing or number of antenatal visits and the risk of low birthweight may have less to do with what is gained from the visits than with the confounding psychological differences between women who initiate antenatal care early and those who do not (Kramer et al, 2000).

5.11 Interventions aimed at disease-specific determinants of low birthweight

5.11.1 Infections

5.11.1.1 Relationship between infection and low birthweight

Particular infections, including bacterial vaginosis are associated with an increased risk in preterm births and thus low birthweight babies (Hillier 1995). Several reviews exploring maternal infections and birth outcomes have highlighted the increased susceptibility to bacterial infections in women of lower socio-economic status (Hillier et al, 1995; Kramer et al, 2001).

5.11.1.2 Irish data on infection and low birthweight

No data on the prevalence of genitor-urinary infections among pregnant women in Ireland disaggregated by socio-economic group was found.

5.11.1.3 Evidence of effectiveness in treating infection and reducing low birthweight

A Cochrane review (Brocklehurst et al, 2002) concluded that there was no justification for establishing antenatal screening for all women for bacterial vaginosis. Several other reviews examining the role of antibiotic treatments have not established a relationship with the prevention of preterm low birthweight births. Additional research is needed to ascertain the efficacy of screening routinely and early treatment.

5.11.2 Congenital anomalies

5.11.2.1 Relationship between congenital anomalies and low birthweight

Congenital anomaly is an important birth outcome, both in terms of its relationship to mortality and its relationship to developmental outcomes in childhood. A study of 2098 perinatal deaths in the West Midlands (UK) found that the risk of death attributed to congenital anomaly in the most deprived areas was twice that of the least deprived (Bambang et al, 2000). There is a body of international evidence to support the view that congenital anomaly is associated with lower socio-economic status.

5.11.2.2 Irish data on congenital anomaly and low birthweight

There were 45 stillbirths and 79 early neonatal deaths associated with congenital anomaly recorded in Ireland in 2000. Of these 124 deaths attributed to congenital anomaly, 69% (n=86) were also low birthweight (Bonham, 2004).

To date, no analysis has been conducted on the relationship between socio-economic status and congenital anomaly in Ireland. An analysis of the ratio of the directly standardised mortality rates of adults among the highest and lowest occupational classes found that congenital malformations and chromosomal abnormalities exhibited a very steep social gradient at 1037% (Balanda & Wilde, 2002).

5.11.2.3 Issues for further consideration

- An exploration of the relationship between socio-economic status and congenital anomaly in Ireland would serve to improve our understanding of the social gradients observed in relation to mortality and birthweight.

5.12 Summary of key findings

- Low birthweight is associated with a broad range of socio-demographic, environmental, cultural and psychological factors in addition to health behavioural and health service factors.
- An effective framework to achieve the National Anti-Poverty Strategy target for narrowing the gap in the occurrence of low birthweight between the highest and the lowest socio-economic groups will require effective policies for an absolute and a relative improvement in the health of the poorest groups and in the determinants of low birthweight at population level.
- An effective framework to achieve the National Anti-Poverty Strategy target for tackling inequalities in the occurrence of low birthweight must achieve gains in the health of lower socio-economic groups pre-conception and during pregnancy and must effect the causal pathways of preterm birth and growth limitation (IUGR).
- Income inequality is associated with low birthweight. In-depth economic and social research in addition to focussed social policy analysis on the adequacy of current social welfare payments in Ireland for unemployed and low-paid pregnant women in Ireland is required.
- Evidence to support the role of interventions to improve low birthweight by addressing psychological stress among women in lower socio-economic groups is inadequate.
- Review level evidence did not report a significant advantage of additional social support during pregnancy in preventing low birthweight, irrespective of socio-economic group, but this was hindered by methodological difficulties.
- There is a significant rise in the numbers of ethnic minority women giving birth in Ireland but there is no nationally representative data on birthweight according to ethnic group in Ireland. It is highly likely that babies born to Travellers are at greater risk of being low birthweight in view of their poor perinatal and neonatal mortality profile.
- Despite the higher prevalence of low birthweight recorded among ethnic minorities in the UK, there is a lack of review level evidence regarding the effectiveness of targeting interventions to ethnic minority women. Specialist antenatal services for asylum-seeking and refugee women have been developed in Ireland but no evaluation data could be found.
- Teenage pregnancies are associated with an increased risk of low birthweight and socio-economic deprivation in Ireland. 9.9% of all low birthweight babies in Ireland are born to mothers aged 19 years or less. A reduction in the incidence of teenage pregnancy could have the capacity to make a small but significant reduction in inequalities in low birthweight. Adopting a multi-faceted approach linking sex

education with youth development projects and contraceptive services can lead to a reduction in teenage pregnancy rates.

- Antenatal services have an important role to play in reducing the incidence of low birthweight babies born to teenage mothers. Services incorporating home visiting and clinic services and services that are targeted at vulnerable groups appear most effective in improving birth outcomes.
- The number of pregnant opioid-dependent women accessing drug treatment services in the Republic of Ireland has increased. These women report several markers of socio-economic deprivation and lower birthweight babies. Specialist services have been developed for this group, but further evaluation and audit of the service is required in relation to its efficacy in improving birthweight for disadvantaged women.
- Smoking is associated with low birthweight and higher smoking rates are recorded among women in lower socio-economic groups in Ireland. Review-level evidence would suggest that interventions can increase smoking cessation in pregnancy by up to 70%. There is evidence of limited success in smoking cessation among women in lower socio-economic groups.
- There is a lack of high quality systematic reviews relating to the efficacy of nutrition and nutritional interventions in improving low birthweight. Nutritional interventions likely to exert significant effects are best introduced in the early stages of pregnancy, or ideally pre-conception.
- There is no social gradient in excess alcohol consumption among Irish women in their childbearing years and no evidence to suggest that women from lower socio-economic groups consume more alcohol in pregnancy. Observational studies have reported a low level of awareness of the harmful effects of alcohol in pregnancy among Irish women. The role of alcohol in the generation of inequalities in low birthweight is assumed to be small at this time, but should be kept under review.
- Teenage, unmarried and ethnic minority women tend to present to antenatal services later in pregnancy. Late attendance and non-attendance at antenatal services in Ireland is associated with adverse mortality outcomes. There is some evidence to suggest that the early enrolment of teenagers and the provision of multi-disciplinary approaches to lower income women can improve birthweight.
- Particular infections, including bacterial vaginosis are more common among women from lower socio-economic groups and are associated with preterm birth and low birthweight. A Cochrane review concluded there was no justification for establishing antenatal screening for all women for bacterial vaginosis.
- The exploration of the relationship between socio-economic status and congenital anomaly in Ireland would serve to improve our understanding of the social gradients observed in relation to birthweight and mortality.

Part 6: Conclusions

The relationship between low birthweight and social disadvantage is starkly demonstrated by the findings of parts three and four of this report. In a time of unprecedented economic growth and development in Ireland, such inequalities are an unacceptable feature of a developed, fair and wealthy society.

The report has identified some of the challenges faced by the National Perinatal Reporting System in recording socio-economic status of parents, a task which the NPRS continue to tackle. The report has made a strong case for the inclusion of low birthweight and birth outcomes within a wider data collection and multi-disciplinary research agenda at national level and embedding the issue within longitudinal research in Ireland.

While increasingly sophisticated clinical interventions for the newborn have greatly decreased the mortality and morbidity of premature and low birthweight infants over the past twenty years, the absolute number of babies born low birthweight in Ireland has not decreased in the last decade. There are some worrying trends relating to inequalities in birthweight with an apparent widening of the geographic inequalities within local authority areas within the former Eastern Regional Health Authority. Epidemiological monitoring of inequalities in low birthweight and birth outcomes at national and regional level is imperative in the next decade. The birth outcomes recorded in the Travelling community, albeit based on rather dated research, are of particular concern. The birth outcomes of ethnic minority women are also in need of increased, and appropriately devised, surveillance. There are a number of different factors at play in the aetiology of low birthweight including socio-economic status, age, marital status, medical history and so forth. It is clear that multivariate analysis will be required to further unravel these connections.

Despite the well-established relationship between socio-economic group and low birthweight, there is a lack of evaluation and efficacy data on specifically designed interventions addressing this issue, beyond evaluations of a number of interventions specific to 'low-income' or 'deprived' women. Indeed, the paucity of research has hampered high quality reviews in this area. From the evidence available, it would certainly seem that strategies to improve the health of women from disadvantaged areas need to be instigated prior to conception in addition to during, and after pregnancy.

Inequalities in birthweight are compounded by a lack of information on the social and economic situation of pregnant women, especially pregnant teenagers. The issues of income, deprivation and social protection for pregnant women would benefit from in-depth and trans-national social policy analysis.

Cigarette smoking plays a major role in the generation of inequalities in low birthweight affecting both preterm birth and growth limitation (IUGR) and must form a key component in ongoing policy development and monitoring relating to tobacco control and smoking

cessation in Ireland. Inequalities in low birthweight are maintained by a lack of effective strategies to support positive health behaviours in pregnancy among deprived pregnant women. There is a lack of adequate national data on health behaviours in pregnant Irish women and a need for qualitative research focusing on the adoption and maintenance of health behaviours in this group.

The important role of antenatal services is emphasised in the national data with issues of late attendance and poor attendance amongst at-risk groups (teenagers, unmarried women, ethnic minority women) of particular concern in terms of adverse birth outcomes. Many health service interventions aimed at improving birth outcomes have evolved in recent years to address the maternity needs of vulnerable subgroups of women in Ireland, such as those relating to asylum seeking/refugee women, drug misusing women and booking clinics for pregnant teenagers. There is, as yet, a lack of audit and evaluation of the efficacy of such targeted interventions, with service development occurring on an ad hoc basis rather than within a strategic national focus.

It is acknowledged that most of the interventions examined in the report focus on high-risk groups and that these interventions have limited success at reducing inequalities at population level. The focus of many interventions is on high-risk pregnant women and on one single modifiable risk factor e.g. nutrition or smoking, whereas inequalities in low birthweight at population level are determined not so much by the risk factor of the individual women but by the social and health policies of those societies. There is a dearth of research on the profound impact that societal level interventions could have on pregnancy outcomes and a lack of information on the success of multi-intervention initiatives.

It is important at this juncture to consider the use of low birthweight as the sole definitive epidemiological endpoint in relation to inequalities in birth outcomes. Preventive interventions, such as those reviewed in Part 5, generally focus on the lower extremes of birthweight (<2,500 grams) without reference to potentially significant changes in the remainder of the birthweight distribution (which is normally distributed). As with the overwhelming majority of diseases and conditions open to preventive interventions, low birthweight is part of a continuum rather than a dichotomous state of disease versus normality (Spencer, 2001). It may therefore be preferable to 'narrow the gap' by focusing on increasing the numbers of babies within an optimal birthweight range rather than a focus on decreasing the number of babies below the 2500 gram threshold. Such an approach will also take account of increased numbers of babies who are overweight (>4,500 grams) who are at similar high risk of mortality and other adverse outcomes as those who are underweight. This issue is of particular concern in relation to the rising levels of obesity and diabetes affecting Irish women, and inordinately affecting lower socio-economic groups, which will lead to rising numbers of these high-risk overweight babies (Friel et al, 2001).

It has also been proposed that the pathways of preterm birth and of growth limitation

(IUGR) warrant individual attention in terms of measuring the success of interventions, in that they have quite different determinants, as depicted in Figures 11 and 12 (Kramer et al, 2001). It is also considered that the determinants examined in the review do not provide a full explanation for the disparities in low birthweight according to socio-economic group, and that there are likely to be many additional factors at play in the causal pathway that have not yet been reported in the international literature.

It is certainly the case that low birthweight is both an important cause of, and an important consequence of, inequalities in child and maternal health. Inequalities in child health should form a specific focus in relation to the ongoing monitoring of children's well-being in Ireland. Consideration should be given to developing a basket of child health inequality markers to compliment the recently developed National Set of Child Well-Being Indicators (National Children's Office, 2005). Such an approach would involve subanalyses of the existing markers in order to assess socio-economic inequalities in the existing key infant, childhood and teen health indicators including birthweight, mortality, injury, disability, dental health and so forth. Such data would compliment the current commitment to monitor children's wellbeing in the economic and educational domains.

There are a number of disciplines with expertise and experience in the area of low birthweight that have traditionally operated somewhat independently of each other. This report provided a springboard for bringing these disciplines together to formulate solutions to the shared problem of inequalities in low birthweight at an 'Exploratory Workshop on Tackling Inequalities in the Occurrence of Low Birthweight Babies in Ireland' held in December 2005. An outline of the workshop programme and the recommendations suggested are provided in part 7 of the report.

Part 7. Exploratory Workshop on Tackling Inequalities in the Occurrence of Low birthweight Babies in Ireland

7.1 Workshop overview

In December 2005 an ‘Exploratory Workshop on Tackling Inequalities in the occurrence of Low Birthweight babies in Ireland’ was organised and hosted jointly by the Institute of Public Health in Ireland, the Department of Health and Children and the National Children’s Office. The purpose of the workshop was to bring a range of stakeholders together to discuss the main issues arising from the report on ‘Inequalities in the occurrence of low birthweight babies in Ireland’ and to develop key actions to address the NAPS target ‘to reduce by 10% the difference in low birthweight rates between the highest and the lowest socio-economic groups by 2007’. The 38 attendees represented a range of disciplines including research and epidemiology, social policy and health policy, health promotion, and health and antenatal services.

The seminar commenced with an outline of the health and social policy context for policy work in the area of low birthweight babies and a presentation of the key findings from this report on the evidence base for tackling inequalities in low birthweight babies. Group discussions followed and were split into four categories:

Group 1: Research and data

Group 2: Social Determinants of Maternal and Child Health

Group 3: Health Behaviours - Policy and Practice

Group 4: Health Services and Antenatal Services.

7.2 Workshop Recommendations

Recommendations for tackling inequalities in low birthweight babies are split into four themes based on feedback from the workshop group discussions.

7.2.1 Research and Data

- Improved translation of recorded occupational data on socio-economic groups.
- Possibility of data linkage with social welfare records and HSE data which may be useful in defining disadvantaged groups.
- Further analysis of NPRS and HIPE pilot data using an ethnic identifier to gain a better understanding of the relationship between child health inequalities and ethnicity.
- Links should be made with the forthcoming ‘National Longitudinal Study of Children in Ireland’ and the ‘National Traveller Health Study’.
- Enhanced monitoring of low birthweight and birth outcomes particularly in relation to related issues such as access to health services and quality of services.
- Qualitative research into the experience of disadvantaged women in Ireland to inform interventions and investigate the causal factors of low birth weight.

7.2.2 Social determinants of maternal and child health

- Improved access to education pre conception and post birth for teenage mothers.
- Early childhood should be seen as a key intervention period for promoting health as evidence suggests that a mother's health during pregnancy is largely determined by her health during childhood. The following recommendations were suggested in order to achieve these goals:
 - Introduction of a minimum income standard and second tier child income payments
 - Improved access to pre-school education
 - Free healthcare for disadvantaged groups
 - Universal child care services.

7.2.3 Health behaviours – policy and practice

- A health promotion campaign on diet and lifestyle choices should be designed and implemented for pregnant women and pre-conceptual women. This should be consistently delivered across all sectors of the health care system including: GPs, public health nurses, antenatal services, pharmacists, health promotion departments, and dieticians as well as schools, as a module of the SPHE programme. The campaign should also link with community groups and use peer-led approaches to health education

7.2.4 Health services and antenatal services

- Peer learning and mutual support should be encouraged - the Traveller Primary Care model could be replicated.
- Consultation should take place with teenagers and disadvantaged women who tend not to avail of antenatal services in order to determine barriers to attending services, and steps should be taken to overcome these barriers e.g. childcare provision attached to antenatal service.
- Services should specifically be designed for women who have previously had low birthweight babies.

References

- Ahluwalia, IB., Hogan, VK., Grummer-Strawn, L., Colville, WR. & Peterson, A. (1998) The effect of WIC participation on small for gestational age births: Michigan 1992. *American Journal of Public Health*, 88(9), pp. 1374-7.
- Alexander, G. & Kotelchuck M. (2001) Assessing the role and effectiveness of prenatal care: history, challenges and directions for future research. *Public Health Reports*, 116, pp. 307-316.
- Aylward, GP., Pfeiffer, SI., Wright, A. & Verhulst, SJ. (1989) Outcomes studies of low birthweight infants published in the last decade: A meta-analysis. *Pediatric*, 115, pp. 515 - 520.
- Balanda, K. & Wilde, J. (2001) Inequalities in Mortality - a report on all-Ireland mortality data. Institute of Public Health in Ireland.
- Balanda, K. & Wilde, J. (2002) Inequalities in perceived health - a report on the all-Ireland social capital and health survey. Institute of Public Health in Ireland.
- Bambang, S. Spencer, NJ., Logan, S. & Gill, L. (2000) Cause-specific perinatal death rates, birthweight and deprivation in the West Midlands 1991-1993. *Child: Care, Health & Development*, 26(1), pp. 73-82
- Barker DJP, Forsen, T., Uutela, A., Osmond, C. & Eriksson, JG. (2001) Size at birth and resilience to effects of poor living conditions in adult life: longitudinal study. *British Medical Journal*, 323(7324), pp. 1273-6.
- Barry, J., Sinclair, H., Kelly, A., O'Loughlin, R., Handy, D. & O'Dowd, T. (2001) Inequalities in Health in Ireland - Hard Facts Dublin: Department of Community Health and General Practice, TCD.
- Barry, J. Herity, B. & Solan, J. (1989) The Travellers Health Status Study: Vital Statistics of Travelling People, 1987. The Health Research Board, Dublin, Ireland.
- Bartley, M. Power, C. Blane, D. Davey Smith, G. & Shipley, M (1994) Birthweight and later socio-economic disadvantage: evidence from the 1958 British cohort study. *British Medical Journal*, 309, pp.1475-1478.
- Bonham, S. (2004) Report on Perinatal Statistics for 2000. HIPE & NPRS Unit, ESRI.
- Bosio, P. Keenan, E. Gleeson, R. Dorman, A. Clarke, T. Darling, M. & O'Connor, J. (1997) The prevalence of chemical substance and alcohol abuse in an obstetric population in Dublin. *Irish Medical Journal*, 90(4), pp.149-50.
- Botting, B., Rosato, M. & Wood, R. (1998) Teenage mothers and the health of their children. *Population Trends*, 93, pp. 19-28.
- Brocklehurst, PH., Hannah, M. & McDonald, H. (2002) Interventions for treating bacterial vaginosis in pregnancy. *Cochrane Database of systematic reviews* (1).
- Brown, H., Watkins, K. & Hiatt, AK. (1996) The impact of the Women, Infants and Children food supplement program on birth outcome. *American Journal of Obstetrics & Gynecology*, 174 (4), pp. 1279-83.
- Brunton, G. T., H. (2001) The Effectiveness of Public Health intervention strategies to reduce and prevent the incidence of low birthweight in infants born to adolescents: A systematic review, PHRED, (Public Health Research Education and Development program).
- Bryce, R L., Stanley, FJ. & Garner, JB. (1991) Randomised controlled trial of antenatal social support to prevent preterm birth. *British Journal of Obstetrics & Gynaecology*, 98, pp. 1001-1008.
- Bull, J., Mulvihill, C., Quigley, R. (2003) Prevention of low birth weight: assessing the effectiveness of smoking cessation and nutritional interventions. Evidence briefing, London: Health Development Agency.

- Bullock, L., McFarlane, J., Bateman, L. & Miller, V. (1989) *The prevalence and characteristics of battered women in a primary care setting. Nurse Practitioner, 14 pp.47-56.*
- Burghes, L. Brown, M. (1995) *Single lone mothers: problem, prospects and policies.* London, Family Policy Studies Centre.
- Callan, T., Layte, R., Nolan, B., Watson, D., Whelan, C., Williams, J. & Maitre, B. (1999) *Monitoring Poverty Trends- Data from the Living in Ireland Survey conducted by the Economic and Social Research Institute. Research commissioned by the Department of Social, Community and Family Affairs and the Combat Poverty Agency.*
- Chomitz, V., Cheung, LW. & Lieberman, E. (1995) *The role of lifestyle in preventing low birth weight. Future of Children, 5 (1).*
- Combat Poverty Agency (1999) *Facts and Figures on Poverty.*
- Connolly, M. Fox, G. O'Connor, G. Clarke, TA. & Matthews, TG. (1989) *Cost of neonatal intensive and special care. Irish Medical Journal, 82(1); 34-6.*
- Connolly, G. Conroy, R. Byrne PJ. & Kennelly S. (1998) *Teenage pregnancy in the Rotunda Hospital. Irish Medical Journal, 91 (6), pp. 209-12.*
- Connolly, G. Mohd Shuhai, Z. McKenna, P. & Geary, M. (2005) *Birthweight trends in the Twentieth Century. Irish Medical Journal, 98(1) 6-7.*
- Cullen, G. (2002) *Report on Perinatal Statistics for 1999.* Dublin, ESRI, HIPE & NPRS.
- Daly, SF. Kiely, J. Clarke, TA & Matthews, TG (1992) *Alcohol and cigarette use in a pregnant Irish population. Irish Medical Journal, 85 (4), pp. 156-7.*
- Da Silva, O. (1994) *Prevention of Low birth weight/preterm birth. Canadian Task Force on preventive health care.*
- Davey Smith, G. Harding, S. & Rosato, M. (2000) *Relation between infants birth weight and mothers mortality: prospective observational study. British Medical Journal, 320, pp. 839-40.*
- Dawe, S. Gerada, C. & Strang, J. (1992) *Establishment of a liaison service for pregnant opioid dependent women. British Journal of Addiction, 87, pp. 867-71.*
- Day, E., Porter, L., Clarke, A., Allen, D., Moselhy, H. & Copello, A. (2003) *Drug misuse in pregnancy: the impact of a specialist treatment service. Psychiatric Bulletin; 27(3), pp. 99-101.*
- Dehaene, P. Crepin, G. Delahousse, G. Querleu, D. Walbaum, R. Titran. Samaille-Villette, C. (1981) *Epidemiological aspects of the foetal alcoholism syndrome: 45 cases. Nouvelle Presse Medicin, 10(32), pp. 2639-43.*
- Department of Health and Children (2000) *The National Children's Strategy: Our Children - Their Lives.* Stationery Office.
- Department of Health and Children (2001) *Traveller Health: A National Strategy 2002-2005.*
- Diamond, I. Clements, D. Stone, N. & Ingham, R. (1999) *Spatial variation in teenage conceptions in south and west England. Journal of the Royal Statistical Society, 162(3), pp. 273-89.*
- Di Censo, A. Guyatt, G., Willan, A. & Griffith, L. (2002) *Interventions to reduce unintended pregnancies among adolescents: a systematic review of randomised controlled trials. British Medical Journal, 324, pp. 1-9.*
- Dickute, J., Padaiga, Z., Grabauskas, V., Nadisauskiene, RJ., Basys, V. & Gaizasukiene, A. (2004) *Maternal socio-economic factors and the risk of low birthweight in Lithuania. Medicina (Kaunas), 40(5), pp.475-81.*
- Dolan-Mullen, P. (1999) *Maternal smoking during pregnancy and evidence based interventions to promote cessation. Primary Care, 26, pp. 577-89.*

- Drake, AJ. & Walker, BR. (2004) *The intergenerational effects of fetal programming: non-genomic mechanisms for the inheritance of low birth weight and cardiovascular risk. Journal of Endocrinology*, 180, pp. 1-16.
- Farrell, E. (1999) Women, Children and Drug Use. In: National Report on Drug Issues in Ireland. Moran, R. O'Brien, M. O'Farrell, E. & Dillon, L. (1999) Dublin: Drug Misuse Division. The Health Research Board.
- Finch, B. (2003) *Socioeconomic gradients and low birth-weight: empirical and policy considerations. Health Services Research*, 38, pp. 1819-41.
- Fitzpatrick, C., Fitzpatrick, PE. & Turner, M. (1997) Profile of patients attending a Dublin Adolescent Antenatal Booking Clinic. *Irish Medical Journal*, 90 (3), pp. 96-7.
- Friel, S. NicGabhainn, S. & Kelleher, C. (1999) The National Health and Lifestyle Surveys. Health Promotion Unit, Department of Health and Children.
- Friel, S., Kelleher, C., Nolan, G. & Harrington, J. (2003) *Social diversity of Irish adults nutritional intake. European Journal of Clinical Nutrition*, 57(7), pp. 865-75.
- Foley Nolan, C., Sheahan, A. & Cahill, C. (2002) A Better World Healthwise; A health needs assessment of immigrants in Cork and Kerry. Southern Health Board
- Fullerton, D. (2004) Promoting positive adolescent sexual health and preventing teenage pregnancy - a review of recent effectiveness research. Crisis Pregnancy Agency Ireland.
- Geary, M., Murphy JFA. & Rafferty G. (1997) Comparison of liveborn and stillborn low birthweight babies and analysis of aetiological factors. *Irish Medical Journal*, 90 (7), pp. 269-71.
- Gerada, C. Dawe, S. & Farrell, M. (1990) *Management of the pregnant opiate user. British Journal of Hospital Medicine*, 43(2), pp. 138-41.
- Goldberg, D., McIntyre, PG., Smith, RK., & Appleyard, J. (2001) *Hepatitis C virus among high and low risk pregnant women in Dundee: Unlinked Anonymous Testing. British Journal of Obstetrics and Gynaecology*, 108 (4), pp. 365-370.
- Government of Ireland (1997) *Sharing the progress: National Anti-Poverty Strategy*. Dublin, Stationary Office.
- Graham, H. (1993) *When life is a drag: Women, Smoking and Disadvantage*. London: HMSO.
- Graham, H. & Der, G. (1999) *Patterns and predictors of smoking cessation among British women. Health Promotion International*, 14, pp. 231-9.
- Graham, H. (2004) *Tackling health inequalities in England: remedying health disadvantages, narrowing gaps or reducing health gradients. Journal of Social Policy*, 33, pp. 115-31.
- Grijbovski, A., Bygren, LO., Svartbo, B. & Magnus, P. (2004) *Housing conditions, perceived stress, smoking and alcohol: determinants of foetal growth in Northwest Russia. Acta Obstetrica et Gynecologica Scandinavica*, 83(12), pp.1159-66.
- Haskett, ME. (1992) *Interventions with cocaine-abusing mothers. Families in Society*, 73 (8), pp. 451-462.
- Haynes, G., Dunnagan, T. & Christopher, S. (2003) *Determinants of alcohol use in pregnant women at risk for alcohol consumption. Neurotoxicology & Teratology*, 25(6), pp. 659-9.
- Hepburn, M. (1993) *Drug use in pregnancy. British Journal of Hospital Medicine*, 49(1) pp.51-5.
- Hickey, C. (2000) *Sociocultural and behavioural influences on weight gain during pregnancy. American Journal of Clinical Nutrition*, 71, pp. 1364s-70s.
- Hillier, SL., Nugent, RP., Eschenbach, DA. & Krohn, MA. (1995) *Association between bacterial vaginosis and preterm delivery of a low-birth-weight infant. New England Journal of Medicine*, 333(26), pp. 1737-1742.

- Hobel, C. & Culhane, J. (2003) Role of psychosocial and nutritional stress on poor pregnancy outcome. *Journal of Nutrition*, 133, pp. 1709s-1717s.
- Hodnett, E. & Fredericks, S. (2003) Support during pregnancy for women at increased risk of low birthweight babies. *Cochrane Database of Systematic Reviews*, (3)
- Hoffman, SH. & Hatch MC. (1996) Stress, social support and pregnancy outcome: a reassessment based on recent research. *Paediatric and Perinatal Epidemiology*, 179, pp. 186-93.
- Hofmeyr, GJ., Atallah, AN. & Duley, L. (2006) Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. *Cochrane Database of Systematic Reviews*, (3)
- Hollo, O., Rautava, P., Korhonen, T., Helenius, H., Kero, P. & Sillanpaa, M. (2002) Academic achievement of small-for-gestational age children at age 10 years. *Archives of Pediatric & Adolescent Medicine*, 56, pp.179-187.
- Holman, CD., English DR., Bower, C. & Kurinczuk, JJ. (1996) NHMRC recommendations on abstinence from alcohol in pregnancy. *National Health and Research Council. Medical Journal of Australia*, 164(11), pp. 699.
- Hughes, D. & Simpson, L. (1995) The Role of social change in preventing low birth weight. *The Future of children*, 5(1).
- Hulse, GK, Milne, E., English, DR. & Holman, CD. (1997) The relationship between maternal use of heroin and methadone and infant birth weight. *Addiction*; 92(11), pp. 1571-9.
- Institute of Public Health in Ireland (2001) Report of the Working Group on the National Anti-Poverty Strategy and Health.
- Jackson, AA., Zulfiquar, AB. & Lumbiganon, P. (2003) Nutrition as a preventive strategy against adverse pregnancy outcomes. *Journal of Nutrition*, 133(suppl), pp. 1589s-1591s.
- Johnson, Z. Dack, P. & Fogarty, J. (1994) Small area analysis of low birthweight. *Irish Medical Journal*, 87(6), pp.176-7.
- Kane, R. & Wellings, K. (1999) Reducing the rate of teenage conceptions: Data from Europe. Health Education Authority, London.
- Keeley, RD., Birchard, A., Dickinson, P., Steiner, J., Dickinson LM., Rymer, S. et al. (2004) Parental attitudes about a pregnancy predict birthweight in a low -income population. *The Annals of Family Medicine*, 2(2), pp. 145-9.
- Kennedy, P. & Murphy-Lawless, J. (2001) The Maternity Care Needs of Refugee and Asylum-Seeking Women. Womens Health Unit, Northern Area Health Board, ERHA.
- Kiely, J., Brett, KM., Yu, S. & Rowley,DL. (1994) Low birth weight and intrauterine growth retardation: In: Wilcox, LS., & Marks, JS., eds. *From Data to Action: CDC's Public Health Surveillance for Women, Infants, and Children*. Government Printing Office.
- Kiely, J. & Kogan, MD. (1994) Prenatal Care: In: Wilcox, LS., & Marks, JS., eds. *From Data to Action: CDC's Public Health Surveillance for Women, Infants, and Children*. Government Printing Office.
- Kiernan, K. (1995) Transition to parenthood: young mothers, young fathers - associated factors and later life experiences. Welfare State Programme Discussion Paper 113. London School of Economics.
- Kramer, M., Goulet, L., Lydon, J., Seguin, L. & McNamara, H. (2001) Socio-economic disparities in preterm birth: causal pathways and mechanisms. *Paediatric and Perinatal Epidemiology*, 15(suppl 2), pp. 104-123.
- Kramer MS, Kakuma R. (2003) Energy and Protein intake in Pregnancy. *Cochrane Database of Systematic Reviews*, (4)

- Kramer MS, Goulet, L., Lydon, J. Segun, L., McNamara, H., Dassa, C. et al. (2000) Socio economic disparities in pregnancy outcome: why do the poor fare so poorly? *Paediatric & Perinatal Epidemiology*, 14, pp. 194-210.
- Kwok, P. Correy, JF., Newman, NM. & Curran, JT. (1983) Smoking and alcohol consumption during pregnancy: an epidemiological study in Tasmania. *Medical Journal of Australia*, 1 (5), pp.220-3.
- Lieberman, E., Lang, JM., Ryan, KJ., Monson, RR. & Schoenbaum, SC. (1989) The association of inter-pregnancy interval with small for gestational age births. *Obstetrics and Gynaecology*, 74 (1), pp. 1-5.
- Lobel, M. Dunkel-Schetter, C. & Scrimshaw, SCM. (1992) Prenatal maternal stress and prematurity: a prospective study of socio-economically disadvantaged women. *Health Psychology*, 11, pp.32-40.
- Lumley J, Oliver SS, Chamberlain C. & Oakley L. (2004) Interventions for promoting smoking cessation during pregnancy. *Cochrane Database of Systematic Reviews*, (4)
- MacDowall, W. Gerressu, M., Nanchahal, N. & Wellings, K. (2002) Analysis of NATSAL 2000 data for Scotland. Health Education Board, Scotland.
- MacFarlane, A. & Mugford, M. (2000) Birth counts: statistics of pregnancy and childbirth. Volume 1: London: Stationery Office.
- Mahomed K. (2006) Iron and folate supplementation in pregnancy. *Cochrane Database of Systematic Reviews*, Issue 3.
- Makrides M., & Crowther CA. (2001) Magnesium supplementation in pregnancy. *Cochrane Database of Systematic Reviews*, (4).
- Malamitsu-Puchner, A., Tzala, L., Minaretzis, D., Michalas, D. & Aravantino, D. (1994) Preterm delivery and low birthweight among refugees in Greece. *Paediatric and Perinatal Epidemiology*, 8(4), pp. 384-90.
- Marsh A., & McKay S. (1994) Poor smokers. London: Policy Studies Institute. (PSI research report; no 771).
- Mason, E. (1990) The Asian Mother and Baby campaign (The Leicestershire experience). *Journal of the Royal Society of Health*, 110(1), pp. 1-4, 9.
- McLaughlin, F., Altermeier, WA., Christensen, MJ., Sherrod, KB., Dietrich, MS. & Stern, DT. (1992) Randomised trial of comprehensive prenatal care for low-income women: effect on infant birth weight. *Pediatrics*, 89(1), pp.128-132.
- McLeod, D., Pullon, S., Cookson, T. & Cornford, E. (2002) Factors influencing alcohol consumption during pregnancy and after giving birth. *New Zealand Medical Journal*, 115 (1157)
- Mehanni, M., Cullen, A., Kiberd, B., McDonnell, M., O'Regan, M., Matthews, T. (2000) The Current Epidemiology of AIDS in Ireland. *Irish Medical Journal*, 93 (9), pp. 264-8.
- Meraldi, M., Caroli, G., Villar, J., Ahalos, E., Gulmezoglu, AM., Kulier, R. et al. (2003) Nutritional interventions during pregnancy for the prevention or treatment of impaired fetal growth: An overview of randomised controlled trials. *Journal of Nutrition*, 133, pp. S1626-S1631.
- Messecar, D. (2001) Smoking cessation interventions for pregnant women: what does the evidence show? *Journal of the American Academy of Nurse Practitioners*, 13 (4), pp. 171-7.
- Meyrick, J. & Swann, C. (1998) An overview of the effectiveness of interventions and programmes aimed at reducing unintended conceptions in young people. Reducing the rate of teenage conceptions. London: Health Education Authority.
- Milburn, A. (2001). Breaking the link between poverty and ill health. Long-term Medical Conditions Alliance conference, Royal College of Physicians.
- Montquin, J. (2003) Socio-economic and psychosocial factors in the management and prevention of preterm labour. *British Journal of Obstetrics & Gynaecology*, 110 (Suppl 20), pp. 56-60.

Moran, R., O'Brien, M. & Duff, P. (1997) National Drug Treatment Reporting System, National Report 1996. Dublin: The Health Research Board.

Moser, K., Li, L. & Power, C. (2003) *Social inequalities in low birth weight in England and Wales: trends and implications for future population health. Journal of Epidemiology & Community Health, 57(9), pp. 687-91.*

Myles, J. (2000) Influence of illicit and licit substances for the pregnant user and the neonate. Pregnancy and Drug Misuse Update 2000. Strasbourg: Council of Europe Publishing.

Namkung, P. (2002) Health Status Report, 2002 Low Birth Weight. City of Berkeley, Public Health division.

National University of Ireland Galway (2001) Travellers Perceptions and Experiences of Maternal and Early Child Health Services: A Research Report Commissioned by the Traveller Health Unit of Western Health Board (Galway: National University of Ireland).

Newton, RW. & Hunt, PL. (1984) *Psychosocial stress in pregnancy and its relation to low birthweight. British Medical Journal, 288 (6435), pp.1191-1194.*

NHS Centre for Reviews and Dissemination (1997) Preventing and reducing the adverse effects of unintended teenage pregnancies. Effective Health Care Bulletin.

Nordentoft, M., Lou, HC., Hansen, D., Nim, J., Pryds, O. & Rubin, P. et al. (1996) *Intrauterine growth retardation and premature delivery: the influence of maternal smoking and psychosocial factors. American Journal of Public Health, 86 (3) pp. 347-354.*

Nourse, CB. Conlon, T. Hayes, E. Kaminski, G., Griffin, E. Hillary, I. & Butler, KM. (1998) *Mother to child transmission of human immunodeficiency virus (HIV) in Ireland: a prospective study. Irish Journal of Medical Science, 167(3) pp.145-8.*

Oakley, A., Rajan, I. & Grant A. (1990) *Social support and pregnancy outcome. British Journal of Obstetrics, 97, pp. 155-162.*

O'Brien, M., Moran, R., Kelleher, T. & Cahill, P. (2000) National Drug Treatment Reporting System, Statistical Bulletin, 1997 and 1998. Dublin: The Health Research Board.

O'Donnell, S., Fitzpatrick JM. & McKenna, PF. (2000). *Abuse in Pregnancy - The Experience of Women. Irish Medical Journal, 93 (8)*

Office for Social Inclusion (2002) National Action Plan against Poverty and Social Exclusion 2003 - 2005. Office for Social Inclusion, Department of Social and Family Affairs.

Office of Tobacco Control (2003) Irish Women and Tobacco: Knowledge, Attitudes and Beliefs.

Office for National Statistics (2002) Mortality statistics. Childhood, infant and perinatal. Series DH3. No. 33 London: Office for National Statistics. (www.statistics.gov.uk)

Ontario, P. (2001) Effective Public health Practice Project summary statement for practitioners/managers.

Osrin, D., DeL Costello, AM. & Adhikari, M. (2000) *Maternal nutrition and fetal growth: practical issues in international health. Seminars in Neonatology, 5, pp. 209-19.*

Paarlberg, KM., Vingerhoets, AJ., Heinen, AG., Passchier, J. Dekker, GA. & Van Geijin, HP. (1996) *Psychosocial factors as predictors of maternal well-being and pregnancy-related complaints. Journal of Psychosomatic Obstetrics & Gynaecology, 17(2), pp. 93-102.*

Parker, B., McFarlane, J. & Soeken, K. (1994a) *Abuse during pregnancy - effects on maternal complications and birthweight in adult and teenage women. Obstetrics & Gynaecology, 84(3), pp. 323-328.*

Parker, JD., Schoendorf, KC. & Kiely, JL. (1994b) *Associations between measures of socio-economic status and low birthweight, small for gestational age, and premature delivery in the United States. Annals of Epidemiology, 4, pp. 271-278.*

Parsons, L. & Day, S. (1992) *Improving obstetric outcomes in ethnic minorities: An evaluation of health advocacy in Hackney. Journal of Public Health Medicine, 14(2), pp. 183-191.*

- Peacock, J.L., Bland, M. & Anderson, H.R. (1995) *Preterm delivery: effects of socio-economic factors, psychological stress, smoking, alcohol and caffeine. British Medical Journal*, 311, pp.531-536
- Perry, G., Zyrkowski, C.L., Clark, L.D. & Yu, S. (1994) Pregnancy-related Nutrition. In: Wilcox, L.S., & Marks, J.S., eds. *From Data to Action: CDC's Public Health Surveillance for Women, Infants, and Children*. Government Printing Office.
- Pinkerton, J. & McCrea, R. (1996) *Meeting the Challenge? Young people leaving care of social services and training schools in Northern Ireland*. Centre for Child Care Research. QUB/DHSS.
- Raine, T., Powell, S. & Krohn, M.A. (1994) *The risk of repeating low birthweight and the role of prenatal care. Obstetrics and Gynaecology*, 85(1), pp.161-2.
- Rich-Edwards, J., Buka, S.L., Brennan, R.T. & Earls, F. (2003) *Diverging associations of maternal age with low birthweight for black and white mothers. International Journal of Epidemiology*, 32 (1), pp. 83-90.
- Ricketts, S. & Trierweiler, K. (2000) *Tipping the scales: weighing in on solutions to the low birth weight problem in Colorado*. Colorado Department of Public Health and Environment.
- Rotunda Hospital Dublin Clinical Report (2003). Master Michael Geary.
- Rutter, D.R. & Quine, L. (1990) *Inequalities in pregnancy outcome: a review of psychosocial and behavioural mediators. Social Science and Medicine*, 30, pp. 553-568.
- Sandman, C.A., Wadhwa, P.D., Chicz-DeMet, A., Dunkel-Schetter, C. & Porto, M. (1997) *Maternal stress, HPA activity and fetal/infant outcome. Annals of the New York Academy of Sciences*, 814, pp.226-227.
- Sanjose, S., Roman, E., Beral, V. (1991) *Low birthweight and preterm delivery, Scotland, 1981-84: effect of parents' occupation. Lancet*, 338 (8764) pp.428-31.
- Schieve, L.A., Ferre, C., Peterson, H.B., Macaluso, M., Reynolds, M.A. & Wrigley, V.C. (2004) *Perinatal outcome among singleton infants conceived through assisted reproductive technology in the United States. Obstetrics & Gynaecology*, 103 (6), pp. 1144-53.
- Scholl, T., Hediger, M.L. & Belsky, D.H. (1994) *Prenatal care and maternal health during adolescent pregnancy: a review and meta-analysis. Journal of Adolescent Health*, 15 (6), pp. 444-56.
- Scholl, T., Hediger, M.L., Huang, J., Johnson, F.E., Smith, W. & Ances, I.G. (1992) *Young maternal age and parity. Influences on pregnancy outcome. Annals of Epidemiology*, 2 (5), pp. 565-75.
- Scully, M., Geoghegan, N., Corcoran, P., Tiernan, M. & Keenan, E. (2004) *Specialized drug liaison midwife services for pregnant opioid-dependent women in Dublin, Ireland. Journal of Substance Abuse Treatment*, 26 pp. 27-33.
- Segonds-Pichon, A., Murrin, C., Kelleher, C., Hannon, F., O'Mahony, D., Murphy, A. et al. (2004) *Predictors of baby's birthweight in the Lifeways Crossgeneration Cohort Study in the Republic of Ireland*. Health Research Board unit for Health Status and Health Gain and Dept. of Public Health Medicine and Epidemiology, UCD.
- Shah, P. & Ohlsson, A. (2002) *Literature Review of Low Birth Weight, Including Small for Gestational Age and Preterm Birth*. Toronto, Toronto Public Health.
- Shankaran, S., Das, A., Bauer, C.R., Bada, H.S., Lester, B., Wright, L.L. et al. (2004) *Association between patterns of maternal substance use and infant birthweight, length and head circumference. Paediatrics*, 114(2), pp. 226-34.
- Shiono, P.H. & Behrman, R.E. (1995) *Low birth weight: Analysis and Recommendations. The Future of Children*, 5 (1).
- Shore, R. (2005) *KIDS COUNT Indicator Brief: Preventing low birth weight*. The Annie E. Casey Foundation.
- Silva, M. (2002) *The effectiveness of school-based sex education programs in the promotion of abstinent behaviour: a meta-analysis. Health Education Research* 17(4), pp. 471-481.

- Slap, GB. & Schwartz, JS. (1989) Risk factors for low birthweight to adolescent mothers. *Journal of Adolescent Health Care*, 10(4), pp. 267-74.
- Sloan, D. & O'Connor, J. (1998) *The Treatment of Opiate Addiction during Pregnancy*. Editorial in the *Irish Medical Journal*, 91 (5) pp.164-66.
- Smith, T. (1993) Influences of socio-economic factors on attaining targets for reducing teenage pregnancies. *British Medical Journal*, 306 pp.1232 -1235.
- Smyth, BP. & O'Brien, M. (2004) Children attending addiction treatment services in Dublin 1990-1999. *European Addiction Research*, 10(2), pp. 68-74.
- Social Exclusion Unit (1999) *Teenage Pregnancy: Report by the Social Exclusion Unity*. London: Stationery Office.
- Spencer, N. (2003) Social, economic and political determinants of child health. *Pediatrics*, 112(3) pp.704-06.
- Spencer, N. (2004) The effect of income inequality and macro-level social policy on infant mortality and low birthweight in developed countries - a preliminary systematic review. *Child: Care Health & Development*, 30(6), pp. 699-709.
- Spencer, N., Bambang, S., Logan, S. & Gill, L. (1999) Socio-economic status and birthweight: comparison of an area-based measure with the Registrar Generals social class. *Journal of Epidemiology and Community Health*, 53, pp. 495-8.
- Stauber, M. Schwerdt, M. & Tylder, E. (1982) Pregnancy, birth and puerperium in women suffering from heroin addiction. *Journal of Psychosomatic Obstetrics and Gynaecology*, 1, pp.129-38.
- Spencer, N. & Coe, C. (2003) Parent-reported longstanding health problems in early childhood: a cohort study. *Archives of Disease in Childhood*, 88(7), pp. 570-3
- Swann, C., Bowe, K., McCormick, G. & Kosmin, M. (2003) *Teenage pregnancy and parenthood: a review of reviews*. Evidence Briefing. London, Health Development Agency.
- Taffel, SM. (1986) Maternal weight gain and the outcome of pregnancy. *Vital and Health Statistics*. Series 21, No. 44. US National Centre for Health Statistics.
- Teberg, AJ., Settlege, R., Hodgman, JE., King, Y. & Aguilar, T. (1989) Maternal factors associated with the delivery of infants with birthweight less than 2000grams in a low socio-economic population. *Journal of Perinatology*, 9(3), pp. 291-5.
- Thomson, AM. & Billewicz, WZ. (1963) Nutritional status, maternal physique and reproductive efficiency. *Proceedings of the Nutrition Society*, 22, pp.55-60.
- Treacy, A., Byrne, PJ. & O'Donovan, M. (2002) Perinatal outcomes in unbooked women at the Rotunda hospital. *Irish Medical Journal*, 95(2).
- Tuten, M. & Jones, HE. (2003) Comparing homeless and domiciled pregnant substance dependent women on psychosocial characteristics and treatment outcomes. *Drug and Alcohol Dependence*, 69 (1), pp. 95-99.
- UNICEF and WHO (2004) *Low Birthweight: Country, Regional and Global Estimates*, New York, 2004.
- UNICEF (2001) *A league table of teenage births in rich nations*. UNICEF Innocenti Research Centre.
- Waterson, EJ. & Murray-Lyon, IM. (1990) Preventing alcohol related birth damage: a review. *Social Science & Medicine*, 30(3), pp.349-64.
- Wellings, K. (1999) Promoting the health of teenage and lone mothers: setting a research agenda. Health Education Authority.

Wilcox, AJ. (1997) *The Analysis of Birth Weight and Infant Mortality: An Alternative Hypothesis.*

Wilcox, MA., Smith, SJ., Johnson, IR. & Maynard, PV. (1995) *The effect of social deprivation on birthweight, excluding physiological and pathological effects. British Journal of Obstetrics and Gynaecology, 102, pp. 918-924.*

Wilkinson, R. (1996) *Unhealthy Societies: The affliction of inequality.* London, Routledge.

Womens Aid. (1995) *Making the links towards an integrated strategy for preventing violence against women in intimate relationships with men.*

Yoong, W., Wagley, A., Fong, C., Chukwama, C. & Nauta, M. (2004) *Obstetric performance of ethnic Kosovo Albanian asylum seekers in London: a case-control study. Journal of Obstetrics & Gynaecology, 24(5), pp. 510-2.*

Zimmer-Gembeck, M. & Helfand, M. (1996) *Low birth weight in a public prenatal care program: Behavioural and psychosocial intervention. Social Science & Medicine 43(2),pp 187-197.*

Appendices

Appendix 1: Data collected on each birth in the Republic of Ireland by the National Perinatal Reporting System

- Type and place of birth
- Date of birth
- Sex
- Birthweight
- Period of gestation (length of pregnancy)
- County of residence of both mother and father
- Nationality of mother and father
- Occupation of both mother and father
- Date of birth of both mother and father
- Marital status of mother and date of present marriage
- Number of previous live births, children still living, stillbirths and spontaneous abortions as well as date of last birth
- Type of antenatal care received by mother during this pregnancy including date of first visit to hospital and doctor
- Mothers immunity to rubella
- Method of delivery
- Maternal diseases affecting the foetus and infant
- Type of feeding
- BCG administration
- Diseases or congenital malformations affecting the infant
- Date of mothers admission and discharge and details of whether admission was booked
- Date of infants discharge
- Details of transfers to other hospitals for medical reasons

For each stillbirth and early neonatal death, the following additional data are recorded:

- Type of death
- Was an autopsy performed?
- Place of death
- For early neonatal death: age at death
- For stillbirth: did death occur before, during labour or at an unknown time

Appendix 2. Women entitled to half-rate maternity benefit in the Republic of Ireland

Half-rate Maternity Benefit is paid if the mother is receiving any one of the following benefits:

- One-parent Family Payment
- Widows (Contributory) Pension
- Widows (Non-contributory) Pension
- Deserted Wife's Benefit
- Prisoners Wife Allowance
- Orphans (Contributory) Allowance
- Orphans (Non-contributory) Pension
- Death benefit by way of Widows/Widowers or Dependent Parents Pension (under the Occupational Injuries Scheme)

For new claimants, payment of the half-rate Child Dependent Allowance will be discontinued where a recipients spouse's weekly income is more than €300.