

Maternal and Child Health Care Services:

Actions in the Primary Health Care Setting to Improve the Health of Aboriginal and Torres Strait Islander Women of Childbearing Age, Infants and Young Children

Sandra Eades, Menzies School of Health Research



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1 Abbreviations

ACIR	Australian Childhood Immunisation Register
AHS	Aboriginal Head Start
B.E.S.T.	Breastfeeding Education Support Team
CI	confidence interval
ECD	early childhood development
NHMRC	National Health and Medical Research Council
OR	odds ratio
PCR	polymerase chain reaction
STI	sexually transmitted infection
SWSBSC	Strong Women Strong Babies Strong Culture
SWW	Strong Women Workers
TAIHS	Townsville Aboriginal and Islander Health Service
US	United States of America

2 Abstract

This paper discusses evidence from the relevant health literature, successful case studies of Aboriginal and Torres Strait Islander maternal and child health programs and international Head Start initiatives. The evidence from these sources provides compelling arguments for strengthening the provision of maternal and child health components of currently funded primary health care services. There is also clear evidence that Australia lags behind other comparable countries in the provision of across-government initiatives in Head Start programs that aim to meet the early developmental needs of disadvantaged children. These programs are of particular value in addressing the disadvantage that Indigenous children face growing up in industrialised countries such as Australia, New Zealand and the United States (US). Head Start programs have run for decades in the US and for shorter periods in Canada but are generally led by the Federal Department of Health alone or in partnership with other key federal agencies.

References for all data discussed in the early sections of this paper may be found in the comprehensive literature review at section 6.

3 Summary of the literature review in relation to maternal and child health in the primary health care setting

Good access to primary health care can make a difference to the health of women of childbearing ages and women during pregnancy as well as the foetus during growth and development and the infant and young child. The relevant medical literature highlights the broad range of opportunities for intervention in the area of maternal and child health that could be best implemented in the primary health care setting. A series of four maternal and child health case studies from Indigenous health services around Australia provide evidence of the success in improving health outcomes in this area with well-planned and evaluated programs. While many historical gains in the area of maternal and child health have resulted from improved housing and environmental health as well as improved access to tertiary health services, much of the residual differences in health status may be bridged by improvements in providing better access to quality primary health care and improvements in Indigenous peoples' socioeconomic status. This paper, using the relevant health literature and four case studies, describes access to quality primary health care in relation to Indigenous maternal and child health.

What does the literature tell us about Aboriginal and Torres Strait Islander maternal and child health?

The recent report on the health of Australia's Aboriginal and Torres Strait Islander peoples for the period 1998–2000 indicates that Indigenous mothers are on average younger than non-Indigenous mothers, with 21.7% of all births being to teenagers compared with 4.5% of non-Indigenous births being to teenagers. Indigenous babies are about twice as likely to be born of low birth weight (12.8% compared with 6.5%). This has been the situation since about 1991, with no national improvements since that time.

Health profile

Low birth weight births occur as a consequence of poor foetal growth in the womb and/or premature birth. Low birth weight is a major concern because it is in itself a major risk for illness and death in early life. Low birth weight is the major determinant of infant mortality, particularly death in the neonatal period from birth to 27 days. Only 0.5% of babies born with normal weight die in the first year of life, compared with 10.2% of babies born < 2500 grams and 45.3% of babies born < 1500 grams. Put another way using US data, while low birth weight babies account for only 7% of all births they account for 60% of all deaths in the first year of life. In the Australian context, Indigenous infants born with low birth weights have been shown to be at greater risk of death in the first year of life. Perinatal mortality rates are two times higher, and infant mortality rates are two and a half times higher for Indigenous babies compared with non-Indigenous babies.

Indigenous infants and young children have higher rates of illness and hospitalisation than non-Indigenous infants and young children. In relation to hospital admissions a Western Australian study showed 68.7% of Indigenous children were admitted to hospital at least once before age two compared with 31.8% of non-Indigenous children. Thirty-one point eight percent of Indigenous children were admitted at least three times compared with 4% of non-Indigenous children. A higher burden of illness from infections, in particular respiratory infections, typifies the health profile of many Indigenous children. Rates of gastrointestinal infections, although still common, were reduced throughout the 1970s and 1980s. There is little or no information about the level of primary health care service utilisation among Indigenous infants and children relative to non-Indigenous infants and children. National levels of immunisation coverage for Indigenous

children will not be published until 2004. From hospital admission data for vaccine preventable illnesses among Indigenous children, it is reasonable to speculate that levels of vaccine coverage are inadequate to provide good group immunity among Indigenous children.

Indigenous mothers and women of childbearing age are generally less healthy than their non-Indigenous counterparts. Indigenous women have higher levels of ill health prior to becoming pregnant and have more pregnancy complications than non-Indigenous women. Of particular concern is the occurrence of chronic conditions such as anaemia, poor nutritional status, hypertension, diabetes or glucose intolerance and genital and urinary tract infections which complicate pregnancies. In addition to these health conditions, higher levels of exposure to health risks from smoking among a high proportion of women, and hazardous alcohol consumption among a smaller number of women are major concerns. There is very little information about the level of health service utilisation among Indigenous women of childbearing age generally and during pregnancy and the postnatal period compared with non-Indigenous women. At least two Australian studies of Indigenous women attending tertiary referral hospitals for obstetric care note poor antenatal care attendance as an issue and poorer birth outcomes associated with late antenatal bookings. In the Northern Territory the proportion of Indigenous women who presented for antenatal care in the first trimester of their pregnancy ranged from 14.5% to 32.8% compared with 33.3% to 76.4% for non-Indigenous women.

Health issues

This section presents some indication of the primary health care sensitive factors implicated in:

- the birth of low birth weight and preterm babies to Indigenous women and the higher risk of death in infancy;
- the higher levels of ill health among Indigenous infants and young children; and
- the higher levels of ill health and exposure to health risks among Indigenous women during their childbearing years.

Further explanation of the evidence base surrounding primary care interventions will also be presented.

1) Untreated infections.

Untreated genital and urinary tract infections among mothers are implicated in the birth of preterm and/or low birth weight babies. This is particularly relevant among Indigenous mothers, many of whom come from regions with high levels of untreated sexually transmitted infections (STIs). The diagnosis and treatment of these infections is a core responsibility of primary health care and among Indigenous populations, high infection levels may be considered an indicator of inadequate primary health care. Syphilis, gonorrhoea, group B streptococci, *Chlamydia trachomatis*, and *Bacteroides spp.* have all been shown to significantly increase the risk of preterm birth. Bacterial vaginosis is also associated with premature rupture of membranes and low birth weight births. Antibiotic treatment of these infections in women with a previous preterm birth have been shown to reduce the risk of recurrent preterm birth. Asymptomatic bacteriuria and untreated pyelonephritis are also associated with increase risk of preterm birth. A Western Australian study of Aboriginal and Torres Strait Islander women showed 51% of women who gave birth to low birth weight babies had a genitourinary tract infection compared with only 13% of other women. Introduction of the tampon test for diagnosis of STIs has increased the acceptability and uptake of diagnosis and treatment among Indigenous Australian women. Diagnosis and treatment of urinary tract infections is a relatively straight forward part of primary health care.

2) Cigarette smoking and interventions.

As many as 65% of Indigenous Australian women have been shown to smoke during and after pregnancy in two separate studies. Smoking during pregnancy increases the risk of preterm and low birth weight births, impairs development of small to medium sized airways in the foetal lung, and is a risk factor for death from sudden infant death syndrome, a major cause of death for Indigenous infants. Passive smoke exposure among infants and young children is implicated in the increased risk of respiratory infections, asthma and otitis media. The health risks of maternal smoking during pregnancy are dose related so an attempt to cut down or quit smoking can convey benefit to the mother and foetus. A Cochrane Review of 'Interventions for promoting smoking cessation during pregnancy' showed that smoking cessation programs during pregnancy appear to reduce smoking, low birth weight and preterm birth. Although Australian health care providers, including Aboriginal community-controlled health services, are well placed to inform and influence pregnant smokers to quit, many do not routinely deliver quit smoking interventions. In Australia most smokers are identified but only a minority are counselled about how to quit. Cognitive behavioural therapy for quitting during pregnancy has been established and should be used routinely. Nicotine replacement therapy should be considered in women smoking more than 10 cigarettes per day who have made a recent, unsuccessful attempt to quit and who are motivated to quit. The assessment of smoking and provision of assistance to cut down or quit is a function of primary health care service providers. Despite the high proportions of Indigenous Australian women who smoke during pregnancy there are no reports of trials to assist Indigenous women to quit or cut down their smoking during pregnancy.

3) Alcohol use in pregnancy.

Maternal alcohol consumption during pregnancy is significantly related to the incidence of foetal death, infant death and to the birth of low birth weight infants. The proportion of infants below the tenth percentile of birth weight for gestational age increases sharply with increasing alcohol intake. While most Indigenous Australians do not drink, many of those who do drink do so at levels considered a health hazard. Studies overseas have shown that brief interventions in the primary health care setting, involving advice and counselling from a doctor and education to women of childbearing age with problem alcohol use, was effective in reducing seven-day alcohol use and binge drinking over a 48 month follow-up period. Women who became pregnant in the follow-up period showed the most dramatic reductions in alcohol use. There are no Australian studies that have attempted to develop culturally specific alcohol interventions for Indigenous women of childbearing age. These interventions are most applicable in the primary health care setting where women have established relationships with care providers.

4) Antenatal knowledge and use of folate to prevent neural tube defects.

Indigenous mothers are about 40% more likely to have a baby with a neural tube defect than non-Indigenous mothers. A Cochrane Database Systematic Review shows that folate supplementation significantly reduces the incidence of neural tube defects. There are no reports about the prevalence, knowledge of, or use of perinconceptual folate supplements among Indigenous women of childbearing age or pregnant Indigenous women.

5) Pregnancy intervals and use of contraception.

Short intervals between pregnancies allow little time for mothers to replenish their bodies' nutritional stores and place added stress on women caring for more than one young child. International studies show that short intervals between pregnancies is a risk for low birth weight and preterm births. There are no Australian studies that report the values among Indigenous women in relation to family planning and no studies

reporting their access to advice about and use of contraceptives. The provision of this support, education and advice is a key component of primary health care to enable women of childbearing age to make informed decisions about the timing of their pregnancies.

6) Antenatal health care.

Obstetric complications have been shown to be a major risk for poor birth outcomes among Indigenous women. Antenatal care provides opportunity for the detection and treatment of infections during pregnancy that may pose a threat to the foetus. It is also an opportunity to detect pre-existing or pregnancy-induced hypertension which is one of the common obstetric complications. The most widely accepted schedule of antenatal visits is monthly until 28 weeks, then fortnightly until 36 weeks and then weekly until birth. While there is debate about the optimal amount of antenatal visits and the content of clinical care, caution should be exercised in applying these changes to higher risk populations such as Indigenous women. Late presentation for antenatal care has been shown to be a risk factor for poor birth outcomes among Indigenous women.

7) Postnatal care.

The capacity of a mother to nurture and care for her new baby is likely to be influenced by her health and wellbeing. There are no studies that describe the health of Indigenous women in the early postnatal period and their use of primary health care services. This information is available for non-Indigenous women who report common problems such as extreme tiredness and exhaustion (60%), backache (53%), bowel problems (37%), lack of sleep (35%), haemorrhoids (30%), perineal pain (22%), excessive or prolonged bleeding (20%), urinary incontinence (19%), mastitis (15%) and other urinary problems. These problems decreased in the first 8–24 weeks postpartum, however the prevalence of depression, frequent headaches or sexual problems did not decrease over time. Most of these postnatal health problems are amenable to treatment in the primary health care setting.

8) Breastfeeding.

Breastfeeding protects infants from respiratory, gastrointestinal and ear infections. The practice also improves neurodevelopment and reduces the risk of developing allergic diseases. Human breast milk better meets the nutritional requirements of developing infants than any other milk. While Indigenous mothers initiate breastfeeding at high rates and similar to those of non-Indigenous mothers, many cease breastfeeding prematurely for reasons that could be countered by the provision of culturally appropriate breastfeeding support and advice in the early weeks and months of breastfeeding.

9) Introduction of solids and feeding in the first year of life.

In the first year of life infants are not little versions of adults but have dietary requirements that are essential to the rate of growth and development in the first year of life. Infections predispose infants to poor growth and malnutrition, anaemia and poor growth predispose infants to infections. In many regions of Australia, Indigenous infants have been shown to have higher rates of failure to thrive and anaemia. Programs to monitor infant growth and development, treat anaemia and infections among infants and provide support and advice to parents about infant feeding is an important part of primary health care.

10) Immunisation.

National data on immunisation coverage of Indigenous children is expected to be available in 2004. The most recent *Health and Welfare of Australia's Aboriginal and Torres Strait Islander peoples* reports of

vaccine coverage for non-remote Indigenous children show that 60% of Indigenous children were known to be fully vaccinated against whooping cough and 78% against measles, mumps, rubella. Complete vaccination against diphtheria, tetanus, hepatitis B and polio were in the 60–78% range. International studies suggest that under-immunisation is a marker for insufficient use of primary and preventive care. Other studies show that many under-vaccinated children are seen an adequate number of times in health care services and suggest five main ways in which providers can raise immunisation coverage levels among their patients. These include:

- ensuring that all opportunities to vaccinate are taken;
- giving all vaccines for which patients are eligible at any visit;
- using only valid contra-indications to vaccination;
- assessing immunisation status; and
- immunising at all visits regardless of the reason the parent is seeking care and implement aggressive reminder systems to notify parents when vaccines are due.

11) Biology and chronic disease over the life course.

Health and illness in early, mid and late adulthood are a consequence of accumulated exposure to risk and protective factors throughout the course of life. This begins during pregnancy with foetal development, continues through infancy, early childhood and later adolescence. An approach to Indigenous health which focuses on adult morbidity and interventions exclusively begins too late and misses opportunities to intervene earlier in life when behaviour is more malleable and the pathology of disease is less advanced in individual bodies and across various age groups within communities (Marmot & Wilkinson 1999).

Biology before birth (Kuh & Ben-Shlomo 1997; Keating & Hertzman 1999; Marmot & Wilkinson 1999)

The nutrients that the foetus absorbs are related to aspects of the mother's physiology, her preconceptional stores, her competence to sustain foetal growth and, to a small extent, what she eats in pregnancy and whether she exercises in pregnancy. Maternal smoking, alcohol consumption and experience of infection also disrupt foetal development. There may be a reduction in the number of foetal cells, which interferes with the structure or function of selected organs or whole systems. Most postnatal growth is a consequence of the enlargement of pre-existing cells rather than the growth of additional cells.

Biology during infancy

Major risks at this time are malnutrition and infections. Both are recorded at comparatively high rates amongst Aboriginal and Torres Strait Islander children. Both relate to each other and impair bodily growth, in addition to cognitive development and educational attainment.

Barker hypothesis (Panneth & Susser 1995)

In over 50 papers the Barker group has presented evidence from British populations that low birth weight at term and, in some cases, low weight at one year of age is associated with an increased risk of hypertension, coronary heart disease, non-insulin dependant diabetes and autoimmune thyroid disease. These findings provide overwhelming evidence that poor growth in early life (in utero and in infancy) in Britain last century resulted in earlier and more severe adult chronic disease.

The falling death rates from heart disease in countries that have aggressively promoted healthier diets and lifestyles confirm the importance of paying attention to disease prevention at later stages of life. It does not detract from the seminal contributions of the Barker group to suggest that a broader paradigm is emerging that extends the concept of foetal origins of adult disease. This recognises that most human embryos have

the potential for a long and healthy life. From the moment of conception, however, adverse environmental forces limit this potential. *Intrauterine growth retardation due to poor maternal health and/or nutrition is an important factor; but so is diet at all ages, cigarette smoking, a sedentary lifestyle, the use of drugs and other substances. It is therefore imperative to take a life course approach to health promotion and disease prevention.*

The Barker group's findings have made it clear that preventive measures should begin with improving the health and wellbeing of women to prevent damage to their foetuses. This will require attention to the risk factors for low birth weight before pregnancy since health advice and nutritional supplements during pregnancy are inadequate. However, as noted above, for a long and healthy life, good nutrition and lifestyle are necessary throughout the entire life span.

4 Case studies in primary health care for maternal and child health

Strong Mothers, Strong Babies, Strong Culture

The Strong Women, Strong Babies, Strong Culture (SWSBSC) program in the Northern Territory had a specific goal to increase infant birth weights by earlier attendance for antenatal care and improved maternal weight (Mackerras 2001). The program was developed in conjunction with Aboriginal people in the Top End of the Northern Territory. Its specific aims were to:

- increase attendance for antenatal care in the first trimester to allow identification and modification of factors which might affect the health of the mother or child;
- introduce nutritional assessment and monitoring into prenatal care with evaluation of their use; and
- evaluate strategies to improve maternal nutrition by increased weight gain during pregnancy.

The implementation of the SWSBSC program began with the training of the first Strong Women Workers (SWW) in August 1993.

Formal evaluation of the impact of the SWSBSC pilot program in three communities was conducted by staff at the Menzies School of Health Research. This evaluation involved comparison of trends in the three pilot communities with secular trends for other Top End communities. Data from the Northern Territory midwives' collection and extraction of information from antenatal clinic records were used to make these comparisons between pilot communities and other Top End communities. Between 1990–91 and 1994–95, there was an increase of 171 grams in mean birth weight in the three pilot communities, with an increase of 92 grams in the mean birth weight of the non-intervention communities. The prevalence of low birth weight decreased by 8.4% in the pilot communities and by 1.5% in the non-intervention communities. The preterm birth proportion fell by 1.5% in the pilot communities and rose by 1% in the non-intervention communities. Antenatal clinical records were used to examine other program outcomes. A review of these records showed an increase in the proportion of women who attended their first antenatal visit in the first trimester of pregnancy from 16.7% to 24.4% ($p=0.03$). Despite putting on nearly 10 kg the mean weight of mothers aged 19–24 years was 59.8 kg compared with a mean of 63.4 kg among non-pregnant women of the same age in the 1995 national nutrition survey. There was a dramatic increase in the diagnosis and treatment of genital infections during the study period with the introduction of the T-test for self collection and PCR (polymerase chain reaction) analysis of specimens. In the pilot communities the mean proportion of women treated for genital infections was 0.9% compared with 37.4% in the post-phase analysis of clinical records.

Mums and Babies Program – Townsville Aboriginal and Islander Health Service

In February 2000 the Townsville Aboriginal and Islander Health Service (TAIHS) commenced a new maternal and child health program, the Mums and Babies Program (Panaretto 2003). This program grew from a concern within the Indigenous community in Townsville that pregnancy, birth and infancy health outcomes remained suboptimal. The community believed that a part of the problem lay with the antenatal services that were available and a feeling that these services should be improved to better meet the needs of Indigenous mothers and babies.

Initial funding for the Mums and Babies Program was obtained from the Rio Tinto Aboriginal Foundation and the Ian Potter Foundation for a two-year pilot program. This pilot phase enabled TAIHS to establish a dedicated team that comprised two health workers, one childcare worker, one driver and two female doctors. The team holds a clinic every morning for young families and pregnant women. The clinic is separate but adjacent to the TAIHS main medical clinic; it runs without appointments and provides a supervised playgroup environment in which children can participate while waiting for their parents and siblings. The Mums and Babies Program involves collaboration in service delivery, with a midwife/child health nurse from the Queensland Health Child Health Program, a midwife from the Townsville hospital and an outreach worker from the Queensland Health Aboriginal and Islander Health Program providing visiting services through the Mums and Babies clinic. In addition, on Monday mornings a Centrelink officer provides information about family support services that clients may be eligible to receive. Other collaborators include the Tropical Public Health Unit and Indigenous Health Unit at James Cook University, and the Townsville Division of General Practice. This integration of a range of services has enabled TAIHS to provide comprehensive primary health care, antenatal care, postnatal care, immunisations, growth monitoring, developmental screening and hearing screening in a combined program for pregnant women, families, infants and young children who attend the clinic.

Evaluation of the impact of the Program is ongoing. However, early results show that the Program began seeing 40 clients per month in February 2000 and this increased to 500 clients per month in January 2001. In the 12 months from July 2002 to July 2003 approximately 110 pregnant women attended the clinic fairly regularly at any time for antenatal care. The proportion of women having fewer than four antenatal visits (inadequate care) has fallen from 65% to 25% and the proportion of teenagers attending the clinic for care has increased from 15% to 20%. In terms of patient services provided, immunisations increased from 362 per month in 2000 to 770 per month in 2002. Maternal antenatal or postnatal care episodes increased from 402 episodes of care per month in 2000 to 817 per month in 2002. Care for sick children increased from 1095 episodes per month in 2000 to 3543 per month in 2002 and women's business from 372 episodes per month in 2000 to 1532 episodes per month in 2002. More detailed evaluation is under way, and this evaluation will enable assessment of other outcomes such as the proportion of preterm and low birth weight births. Significantly, the TAIHS believe that since the program's inception there has developed a 'culture of attending for antenatal care' among Indigenous mums.

The Mums and Babies Program core service delivery has enabled TAIHS to successfully attain funding to run related special service initiatives. The B.E.S.T Program (Breastfeeding Education Support Team) will run as a pilot for two years, training community women to act as support counsellors for women who have attended the Mums and Babies Program, and who initiate breastfeeding. An experienced lactation nutritionist from the Tropical Public Health Unit is providing the training. The aim of this program is to increase the number of Indigenous women who initiate breastfeeding and to increase the time period for which they are able to breastfeed their infants.

The Child Nutrition project was funded by the National Child Nutrition Programs and is based at TAIHS. This project involves three primary schools in Townsville with high Indigenous populations and aims to improve the nutrition of primary school children. TAIHS has also secured funding to run an intervention program directed at young at-risk families. Families with financial difficulties, substance use problems, and violence problems will be targeted and linked into appropriate support agencies.

Nganampa Health Council

Poor antenatal care was identified as a major health problem for the Anangu Pitjantjatjara Lands from the mid-1980s. In response the Nganampa Health Council developed a strategy to improve the provision of antenatal care to women in their region. It was based on the development of a care record system for antenatal patients to use in all clinics. The records could be used as a tool for health management and a source of population data for health program evaluation. The health service reviews data from this system on an annual basis to report on progress in moving towards agreed targets for the provision of antenatal care and improvement in pregnancy and neonatal health outcomes.

The initial antenatal care program targets were for pregnant women to have:

- a first presentation for antenatal care before 20 weeks;
- more than five antenatal care visits for each pregnancy;
- an ultrasound performed in all pregnancies;
- an ultrasound performed at an appropriate time for estimating gestational age; and
- appropriate investigations performed and checked in all pregnancies.

Local monitoring of antenatal data have shown a steady improvement in the proportion of women who achieve the service identified benchmarks for care. An independent study was commissioned to review antenatal service performance between 1984 and 1996 (Sloman *et al.* 1999). This report noted that perinatal mortality rates had decreased from 45.2/1000 to 8.6/1000 compared with a national average of 6.7/1000 for non-Indigenous babies. The proportion of babies born of low birth weight decreased from 14.2% to 8.1% compared with the national average for non-Indigenous babies of 6.2%. Mean birth weight increased from 3080 grams to 3183 grams compared with a national mean of 3365 grams.

In addition to the antenatal program, the Nganampa Health Council has put in place a comprehensive strategy for the detection and management of sexually transmitted infections (Department of Health and Aged Care 2001). This strategy has resulted in a reduction of the prevalence of syphilis from 20% to less than 1% between 1985 and 2000. Between 1996 and 2000 the prevalence of gonorrhoea decreased by 62% and chlamydia by 56%. The success of this sexual health strategy in reducing the burden of illness from sexually transmitted infections is likely to have contributed to better pregnancy and neonatal health outcomes.

Daruk Health Service

Daruk Health Service in Western Sydney has an antenatal clinic which provides home visits, transport to clinics, ultrasound screening, support in labour and postnatal care (Department of Health and Aged Care 2001). The antenatal clinic is staffed by a full-time Aboriginal health worker and a non-Indigenous midwife, as well as two female general practitioners. The antenatal service has increased awareness among Indigenous women of the importance of antenatal care and, since its inception, women attend for more antenatal visits and present earlier in their pregnancy for their first visit.

‘At Daruk Health Service 36% of women present within the first trimester for antenatal care compared with 21% at Nepean and 26% at Blacktown Hospitals’ antenatal clinics. The women at Daruk have an average of ten antenatal visits compared with six at Nepean and nine at Blacktown’ (Department of Health and Aged Care 2001).

5 Related international health initiatives for indigenous children

Neurodevelopment and developmental health and wellbeing

In recent years research based around neuroscience and child developmental health and wellbeing has increasingly informed us that the first eight years of a child's life is a critical period (Keating & Hertzman 1999). Programs that intervene during this period, are more successful at improving core developmental outcomes than later interventions (Karoly *et al.* 1998).

Concurrently there has been an explosion of knowledge around the impact of early developmental experiences and brain development. The concept of 'neural sculpting' describes the way in which the social and physical environments of the infant and young child organise the experiences that shape the networks and patterns of the brain. The knowledge in this area should not be over interpreted, as meaning there is no developmental flexibility after early development. It is known that there is considerable developmental flexibility and resiliency even for children who grow up in adverse circumstances. To imply there is no developmental flexibility would be to promote biological determinism and run the risk of not embracing concepts that might help shape important early interventions for Aboriginal and Torres Strait Islander children.

However, there are windows of opportunity in early life when a child's brain is exquisitely primed to receive sensory input and develop more efficiently. Lags in achieving core conceptual skills (e.g. in mathematics) may not be completely irreversible, but do make it difficult for the child to catch up at a later point of time. In a wide range of social and behavioural systems, other sensitive periods for development have been noted. The early origins of patterns of behaviour that lead to subsequent antisocial and aggressive behaviour have been documented. There is also evidence for sensitive periods in regulatory systems for emotional regulation, attention regulation and social regulation. These show continuity, from the first year of life, to how well the individual will be able to function in school related cognitive and behavioural skills when he or she enters first grade of school.

International issues (Keating & Hertzman 1999)

Related to the preceding discussion about early neurodevelopment is the recognition that modern societies have dramatically increased their capacity to generate wealth via market-based global economies. Paradoxically, there is a growing perception of major threats to the health and wellbeing of children and youth in the very societies that benefit most from this wealth. Urie Bronfenbrenner (Appendix 2 Ecology of childhood) raised these concerns in 1969 to a US congressional committee where he commented on troubling scientific evidence that pointed to a societal breakdown in the process of raising children. This breakdown was reflected in the growing rates of alienation, apathy, rebellion, delinquency and violence among youth. In the present generation, larger societies generate forces of disarray that produce growing chaos in the lives of children and youth. In the Canadian context it was noted, that during periods of profound social change such as at the present, some sectors of society are at high risk of encountering a decline of social support and hence adequate nurturing of developmental needs. The debate surrounding the struggle of Aboriginal and Torres Strait Islander families and communities to raise children with the capacity to know and sustain their rich cultural heritage, and yet have the knowledge and skills to live on more than welfare at the fringes of Australian society is current.

At an international level, one of the responses to the concerns about children and youth was the development of conversations, and research effort around answering the questions generated. Are children and youth developing in a positive way and how might we deal with the impact of rapid social and technological change on society's ability to support human development? This research will help inform us about the best ways to balance Government economic policy, with a mix of evidence-based social policy to support the developmental health and wellbeing of children and youth.

This range of issues appear true for Aboriginal and Torres Strait Islander children in the present context of Australian economic policy increasingly geared toward making the nation competitive in the global marketplace.

To further place these issues in context it is imperative to recognise that the development of health and wellbeing is also a population event. Aboriginal and Torres Strait Islander children are growing up within a population group that is at the lower end of the social scale in Australia. Health status improves with increasing socioeconomic status in every wealthy society on earth.

- Early in life there is a gradient in infant mortality and low birth weight.
- During childhood and adolescence there is a gradient in injurious deaths as well as in cognitive and socio-emotional development.
- In early adulthood the gradient is found among deaths from injuries and mental health problems.
- In late middle age early chronic disease mortality and morbidity show a gradient.
- In later life dementia and other degenerative conditions have a similar impact.

This is true of Aboriginal and Torres Strait Islander health at any level of observation.

For children the gradient effect applies not only to physical and mental health outcomes, but also to a wide range of other developmental outcomes from behavioural adjustment, to literacy, to mathematics achievement. The term 'developmental health' describes this full range of developmental outcomes.

Head Start programs in Canada (Budgell 2002)

Canada is one of a number of industrialised countries that have developed programs such as Head Start to meet the needs of disadvantaged children growing up in these new contexts. In 1995, the Government of Canada established Aboriginal Head Start (AHS) to enhance healthy child development and school readiness of Indian, Metis and Inuit children living in urban centres and northern communities. These programs began in May 1995 with a four-year pilot phase (1995–96 to 1998–99) and had ongoing funding of \$22.5 million annually. In September 2000, Canada's First Ministers established Early Childhood Development (ECD) as a new national social priority, recognising the importance of the early years in shaping long-term outcomes. The Federal Government committed to transfer \$2.2 billion over five years to provinces and territories to improve and expand their ECD programs and services. As a consequence of these general developments, extra funds were directed to enhance programs such as Aboriginal Head Start and First Nations and Inuit Child Care. The Aboriginal Head Start program was expanded to First Nation communities in October 1998. This part of the program has funding of \$25 million per year. The mandate and components of these programs are outlined on the Health Canada website (Health Canada 2002: http://www.hc-sc.gc.ca/dca-dea/programs-mes/ahs_main_e.html).

'Mandate

The primary goal of the AHS Initiative is to demonstrate that locally controlled and designed early intervention strategies can provide Aboriginal preschool children in urban and northern settings with a positive sense of themselves, a desire for learning and opportunities to develop fully and successfully as young people.

Components

Aboriginal Head Start programming is organized around the following six components:

- 1. **Culture and Language** - provides children with a positive sense of themselves as Aboriginal children and builds on the children's knowledge of their Aboriginal languages and experience of culture in their communities. More specifically, Projects will enhance the process of cultural and language revival and retention, with the ultimate goal that, where possible, children will aspire to learn their respective languages and participate in their communities' cultures after AHS.*
- 2. **Education** - supports and encourages each Aboriginal child to enjoy life long learning. More specifically, the Projects will encourage each child to take initiative in learning and provide each child with enjoyable opportunities to learn. This will be done in a manner which is appropriate to both the age and stage of development of the child. The ultimate goal is to engage children in the possibility of learning so that they carry forth the enthusiasm, self-esteem and initiative to learn in the future.*
- 3. **Health Promotion** - empowers parents, guardians, caregivers and those involved with AHS to increase control over and improve their health. More specifically, the Project will encourage practices for self care, working together to address health concerns, and the creation of formal and informal social support networks. The ultimate goal is for those involved with AHS to take actions that contribute to holistic health.*
- 4. **Nutrition** - ensures that children are provided with food which will help meet their nutritional needs, and to educate staff and parents about the relationship of nutrition to children's ability to learn, physical development and mental development. Mealtimes provide opportunities for sharing, teaching and socializing. The ultimate goal is to empower children and parents to develop or enhance nutritional eating habits that will be maintained following the children's AHS experience.*
- 5. **Social Support** - ensures that the families are made aware of resources and community services available to impact their quality of life. The Project will assist the families to access resources and community services. This may mean that the Project will work in cooperation with the service providers. The ultimate goal of this component is to empower parents to access assistance and services which support them to be active participants in their children's lives and AHS.*
- 6. **Parental Involvement** - supports the parents' and family's role as children's primary teachers. The parents and family will be acknowledged as contributors to the program through involvement with a parent body or participation in and/or contribution to classroom activities. This component provides the opportunity to empower parents to bring forth their unique abilities and further develop as role models for children and in their communities. The ultimate goal is for parents and caregivers to complete the program being more confident, and assertive and having a deeper understanding of their children than when they began the program.*

While all Aboriginal Head Start sites offer programming in each of the six component areas, each site determines for itself how to do so. Aboriginal Head Start sites are therefore all similar, but each is also unique. Each AHS project is designed by community members who assess and know their own needs. The

specific objectives of each site can vary, but they share one common vision - to provide a high quality early intervention program to Aboriginal children and their families.

Program Delivery

Aboriginal Head Start projects are made possible by funding from Health Canada under regional allocations. Regional allocations are based on the number of Aboriginal people living in urban centres and large northern communities in each region.

Aboriginal Head Start sites are located all across Canada. The program operates in locations such as Halifax, Nova Scotia and Goose Bay, Labrador in the east; Windsor, Ontario in the south; Vancouver Island and Prince Rupert, British Columbia in the west; Dawson in the Yukon Territory and Arctic Bay on Baffin Island, Nunavut.

Funding can be used to cover a variety of expenses, including salaries, training, equipment, furnishings and capital costs associated with program delivery. The financial goal is to use Health Canada funding for maximum benefit to operate high quality programs.'

Head Start programs in the United States (Head Start Bureau 2003)

Head Start began in the US in 1965 and this early childhood intervention program still exists today on a widespread basis. It had its roots in the 1960s, a decade in which the US launched a 'war on poverty' by initiating a wide variety of early intervention programs for children from low income families.

At present there are over 1300 Head Start centres located in the US with an enrolment of about 720 000 children. Considering these programs have been operating for over three decades in the US, it has been possible to measure its impact on children's lives through longitudinal studies.

A range of studies have shown that children who received early childhood intervention were:

- less likely to be placed in special-education classes;
- less likely to be retained in grade; and
- more likely to graduate from high school than those who had not received early intervention.

There were also long lasting benefits in attitudes and motivation and an association has been made with reduced delinquency, teenage pregnancy and a greater likelihood of employment.

Head Start and Early Head Start are comprehensive child development programs that serve children from birth to age five, pregnant women and their families. They are child-focused programs and have the overall goal of increasing the school readiness of young children in low-income families. The administration and details of the US Head Start programs are outlined on the national Head Start website (Head Start Bureau 2003; <http://www2.acf.dhhs.gov/programs/hsb/>).

'The Head Start program is administered by the Head Start Bureau, the Administration on Children, Youth and Families (ACYF), Administration for Children and Families (ACF), Department of Health and Human Services (DHHS). Grants are awarded by the ACF Regional Offices and the Head Start Bureau's American Indian - Alaska Native and Migrant and Seasonal Program Branches directly to local public agencies, private organizations, Indian Tribes and school systems for the purpose of operating Head Start programs at the community level.

The Head Start program has a long tradition of delivering comprehensive and high quality services designed to foster healthy development in low-income children. Head Start grantee and delegate agencies provide

a range of individualized services in the areas of education and early childhood development; medical, dental, and mental health; nutrition; and parent involvement. In addition, the entire range of Head Start services is responsive and appropriate to each child's and family's developmental, ethnic, cultural, and linguistic heritage and experience.

All Head Start programs must adhere to Program Performance Standards. The Head Start Program Performance Standards define the services that Head Start Programs are to provide to the children and families they serve. They constitute the expectations and requirements that Head Start grantees must meet. They are designed to ensure that the Head Start goals and objectives are implemented successfully, that the Head Start philosophy continues to thrive, and that all grantee and delegate agencies maintain the highest possible quality in the provision of Head Start services.'

6 Comprehensive literature review

Pregnancy and birth outcomes

A recent summary of the health of Indigenous mothers and their babies is provided for the period 1998–2000 combined in the biennial publication *The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples 2003* (Trewin & Madden 2003). Indigenous mothers are on average younger than non-Indigenous mothers with a mean age of 24.7 years compared with 29.2 years. A greater proportion of Indigenous births were to mothers aged less than 20 years than non-Indigenous births (21.7% compared with 4.5%) (Trewin & Madden 2003).

Indigenous babies for the period 1998–2000 were approximately twice as likely as non-Indigenous babies to be of low birth weight (< 2500 g). The biennial health and welfare publication shows that since 1991 there has been little change in the proportion of babies born of low birth weight to Indigenous mothers and these babies' mean birth weight (Trewin & Madden 2003). Overall 12.8% of Indigenous babies were born of low birth weight compared with 6.5% of non-Indigenous babies. Perinatal mortality rates for babies born to Indigenous women were twice as high as those for babies born to non-Indigenous women (20.1 per 1000 births compared with 9.6 per 1000 births). In the same publication, for 1999–2000 the infant mortality rate for Indigenous infants was two and a half times greater than for non-Indigenous infants (Trewin & Madden 2003).

There are many causal pathways and associated risk factors for the related birth outcomes of low birth weight and preterm birth. Some of these risks are outlined in a study of 503 live born singletons recorded as born to Indigenous mothers and routinely delivered at the Royal Darwin Hospital between January 1987 and March 1990 (Sayers & Powers 1997). Infants born to mothers with a body mass index less than 18.5 kg/m² had five times the risk of having a low birth weight. Furthermore, population attributable risk percentages suggest that 28% of low birth weight could be attributed to maternal malnutrition. Risk percentages for maternal smoking of more than half a packet of cigarettes a day were 18% for low birth weight. Risk factors for preterm birth were predominantly obstetric, with the population attributable risk percentage for pregnancy-induced hypertension being 26% and 16% for other obstetric conditions.

Schultz and others conducted a case control study to investigate the association between genital and urinary tract infections in pregnant Indigenous women, and low birth weight (Schultz *et al.* 1991). In this study 51% of women in the case group had genitourinary infections compared with 13% of women in the control group. After controlling for potential confounding factors, the women who had experienced a genitourinary tract infection in pregnancy were four times more likely to give birth to infants weighing less than 2250 g (OR 4.0, 95% CI 2.3–7.0). In this study the infections found to be significantly more common in the women in the case group were *Trichomona vaginalis*, *Gardnerella vaginalis*, *Bacteriodes* spp., or anaerobic streptococci and group B streptococcus ($p < .05$). *Escherichia coli* was the only individual urinary tract organism found more commonly among women in the case group ($p < .05$). The authors recommended a community intervention trial of screening and treatment of genitourinary infections.

In the international literature, a review of premature birth and subclinical infection suggests that up to 80% of early preterm births are associated with an intrauterine infection that precedes the rupture of membranes (Gibbs *et al.* 1992). In this review various organisms and infections are linked to the occurrence of preterm births. Untreated primary or secondary syphilis results in a 50% rate of preterm births among affected mothers (Gibbs *et al.* 1992). Untreated *Neisseria gonorrhoeae* (N gonorrhoea) has been associated with preterm births and treatment of N. gonorrhoea reduces the rates of preterm delivery and low birth weight

births compared to that of control groups. Asymptomatic group B streptococci results in preterm delivery rates of 20% versus 8.5%. Group B streptococci infections are consistently shown to be related to preterm premature rupture of membranes but not preterm labour (Gibbs *et al.* 1992). The presence of *C. trachomatis* in the cervix at the first antenatal visit is associated with spontaneous abortion, stillbirth, preterm delivery and low birth weight. There is inconsistent evidence relating *T. vaginalis* to the occurrence of low birth weight births. *Bacteriodes* spp. have been shown to be associated with preterm delivery and/or premature labour. Bacterial vaginosis, where the normal vaginal flora is replaced by high concentrations of anaerobic bacteria (*Bacteriodes* spp., *G. vaginalis* and *Mycoplasma hominis*) is associated with premature rupture of membranes, preterm labour and low birth weight births (Gibbs *et al.* 1992). Untreated pyelonephritis is associated with a 30% increase in risk of premature labour.

A meta-analysis of the relationship between asymptomatic bacteriuria and preterm delivery/low birth weight shows that women who do not have bacteriuria have a lower relative risk of low birth weight (typical relative risk 0.65; 95% CI 0.57–0.74) and of preterm birth (typical relative risk 0.50; 95% CI 0.36–0.70) (Romero *et al.* 1989). In randomised clinical trials, antibiotic treatment of asymptomatic bacteriuria significantly reduced the risk of low birth weight (typical relative risk = 0.56; 95% CI 0.43–0.73) (Romero *et al.* 1989).

The occurrence of low birth weight births is an important reflection of health risk because it is a major risk factor for death in the first year of life, particularly during the neonatal period. Data from the US show that less than 0.5% of infants with birth weights greater than 2500 g die during the first year of life, compared with 10.2% of infants with birth weights less than 2500 g and 45.3% of infants with birth weights less than 1500 grams (Luke *et al.* 1993). These data also show that the rate of low birth weight is twice as high and the rate of very low birth weight is three times as high for black infants compared with white infants. Other data from the US show that, whereas low birth weight babies only account for 7% of all births, low birth weight is associated with 60% of all infant deaths (Struk 1994). Low birth weight is the major determinant of infant mortality, particularly death in the neonatal period from birth to 27 days of life (Struk 1994). Similarly in the Australian context, a study among Indigenous women in Western Australia, has shown infants of low birth weight to be at greater risk of death in the first year of life (Read & Stanley 1983).

Health and illness among Aboriginal and Torres Strait Islander infants and young children

Aboriginal and Torres Strait Islander children in Australia have higher hospital admission rates in the first two years of life and longer duration of stay, compared with non-Indigenous children. A study in Western Australia showed that Indigenous children had an overall admission rate of 2797/1000 live births, compared with 526/1000 live births for non-Indigenous children (Read *et al.* 1994). Of the Indigenous children, 68.7% of children were admitted at least once before age two years, compared with 31.8% of the non-Indigenous children. Four percent of non-Indigenous children compared with 36% of Indigenous children were admitted at least three times. The major reasons for hospital admission for both Indigenous and non-Indigenous children were gastrointestinal diseases, upper and lower respiratory diseases, and social admissions.

Previous studies (Waddell & Dibley 1986; Gracey & Anderson 1989; Gracey & Gee 1994; Ruben & Fisher 1998) have documented the higher hospital admission rates of Indigenous infants and children in Western Australia and the Northern Territory, particularly for upper and lower respiratory, and gastrointestinal infections, with longer duration of admission for Indigenous infants and young children compared with non-Indigenous infants and young children. For the periods 1971–1980 (McNeilly *et al.* 1983) and 1980–1991 (Gracey & Gee 1994) there were substantial improvements in the rates of hospital admission of Indigenous infants

for respiratory tract infections and gastroenteritis, but the relative rates of hospitalisation of Indigenous compared with non-Indigenous infants for these and other infections remained high. Indigenous infants in the metropolitan region were hospitalised five times more frequently than non-Indigenous infants for respiratory infections, and nine to ten times more frequently for gastroenteritis. Metropolitan Indigenous infants were hospitalised four to six times more frequently for 'other infections', compared with non-Indigenous infants. In both groups the majority of other infections included 'viral infections', otitis media, urinary tract infections, conjunctivitis and skin infections, although skin infections were more prevalent among the Indigenous infants; 7% of Indigenous admissions were for whooping cough, *Haemophilus* infection, meningococcal or pneumococcal infection or congenital syphilis.

Maternal health and fertility among Aboriginal and Torres Strait Islander women

Women in their child bearing years who live in developed countries such as Australia and the United Kingdom are generally fit and have few underlying medical problems (Nelson-Piercy & Williamson 2001). This situation does not always exist, particularly for women in developing countries and disadvantaged women in developed countries. Pregnancy has an effect on many of these medical conditions and they in turn may have an effect on the progress of the pregnancy and its management. These medical conditions are reviewed and discussed in the most recent edition of Turnbull's Obstetrics (Nelson-Piercy & Williamson 2001). Some of the major medical problems which are important during pregnancy include diabetes mellitus, thyroid disease, epilepsy, asthma, systemic lupus erythematosus, antiphospholipid syndrome, liver disease and anaemia (Nelson-Piercy & Williamson 2001).

Of particular relevance are reports of medical problems and obstetric complications among Indigenous and non-Indigenous women in Western Australia, New South Wales and the Northern Territory. In Western Australia the proportion of pregnant women who have pre-existing medical conditions is detailed in the regular report, Perinatal Statistics in Western Australia (Gee 1998). The report shows that 81.8% of Western Australian women confined in 1996 did not have any pre-existing medical conditions. Asthma was the most common condition reported, with 6.9% of women having asthma, 0.7% essential hypertension, 0.5% urinary tract infections, 0.3% anaemia, 0.3% bronchial disorders, 0.2% vaginal infections and 1.3% having depressive disorders. The report did not present separate descriptions of the proportion of Indigenous mothers who had pre-existing medical conditions. In the New South Wales Mothers and Babies Report for 1999, there were similar rates of diabetes and essential hypertension reported among Aboriginal and Torres Strait Islander mothers and non-Aboriginal and Torres Strait Islander mothers and slightly lower rates of gestational diabetes and pregnancy induced hypertension (Taylor *et al.* 2001). In the Northern Territory Mothers and Babies report for 1995, 45.7% of Indigenous women compared with 16.8% of non-Indigenous women had at least one medical condition during their pregnancy. Anaemia (18.7%) and urinary tract infections (14.8%) were the two most common medical conditions experienced by Indigenous women (d'Espaignet *et al.* 1997). The same report also shows that during 1995, 24.9% of Indigenous women and 19.7% of non-Indigenous women in the Northern Territory had a pregnancy complication. Pre-eclampsia was the most common pregnancy complication reported by both Indigenous (7.2%) and non-Indigenous (5.3%) women (d'Espaignet *et al.* 1997). In the Northern Territory the proportion of Indigenous women who presented for antenatal care in the first trimester of their pregnancy ranged from 14.5% to 32.8% compared with 33.3% to 76.4% for non-Indigenous women (d'Espaignet *et al.* 1997).

In addition to the annual perinatal collections from each state and territory (sometimes referred to as the Midwives' Collections) there are a few studies documenting the proportion of Indigenous women who have medical conditions prior to and/or during their pregnancies. A retrospective, descriptive study of

Indigenous women's access to antenatal care and their pregnancy outcomes in an urban setting was conducted using an obstetric database at the King George V Memorial Hospital in Sydney (de Costa & Child 1996). This study reported that Indigenous women were younger and of higher parity than non-Indigenous women and booked for confinement later in pregnancy. The Indigenous women had more pregnancy induced hypertension (relative risk 1.66, 95% CI 1.17–2.37), urinary tract infection (relative risk 2.45, 95% CI 1.27–4.30) and need for methadone stabilisation (relative risk 5.88, 95% CI 2.99–11.57). The Indigenous women also had higher preterm delivery rates, more low birth weight babies and higher perinatal mortality rates. These poor outcomes were associated with late antenatal bookings, cigarette smoking, hypertension and urinary tract infections during pregnancy and antepartum haemorrhage. Additionally, of the Indigenous women, 4.3% had anaemia, 4.8% had a urinary tract infection, 0.5% had pre-existing renal disease, 1.6% had gestational diabetes, 2.7% had an antepartum haemorrhage, and 11.8% grew group B Streptococcus on vaginal swab.

Pregnancy intervals and use of contraception

Literature searches failed to locate any studies of pregnancy intervals or contraceptive use among Indigenous women. However, in general, short intervals between pregnancies have been shown to be associated with higher risk of adverse birth outcome. A study of the population-level impact of short (≤ 12 months) inter-pregnancy intervals on the risk for low birth weight (< 2500 g) and preterm (< 37 weeks) delivery was conducted among 4 841 418 mothers in the US from 1989 to 1991 (Khoshnood *et al.* 1998). In that study, mothers with less than six month pregnancy intervals, compared with mothers with greater than twelve month pregnancy intervals had approximately 50% to 80% increased risk of very low birth weight (< 1500 g) and a 30% to 90% increased risk of very preterm (< 32 weeks) delivery. These risks remained for the most part after controlling for maternal age, parity, education, marital status, prenatal care, smoking and previous preterm delivery. These results have been replicated elsewhere, with the additional conclusion that women, particularly those who are poor and young, should be advised of the potential harm to their infants of short inter-pregnancy intervals (Klerman *et al.* 1998).

An essential element of fertility control, including the time interval between pregnancies, is the extent to which women of child bearing age know about and have access to methods of contraception. There are no specific data which inform us about the extent to which Aboriginal and Torres Strait Islander women are able to access information and services in order to make choices about family size and inter-birth spacing. Data reported from the 1995 National Health Survey for all Australian women showed that more than 44% of all women aged 18 to 49 years were using a method of contraception (Yusuf & Siedlecky 1999). Among these users, the two most commonly reported methods were the oral contraceptive pill (60%) and condom (27%); intrauterine devices and natural methods accounted for less than 5% each. For women over 35 years of age, sterilising operations of the woman or her partner were the most frequently reported reasons for non use of contraception, while younger women reported they were trying to get pregnant or were not sexually active.

Maternal and child exposure to health risk factors

Alcohol use by mothers

A number of studies document the adverse effects of alcohol on the developing foetus. These studies emphasise that many of these adverse effects begin very early in pregnancy often before many women discover they are pregnant. Thus, interventions must focus on women in their childbearing years in addition to care during the antenatal period. The *Australian Alcohol Guidelines* published by the National Health

and Medical Research Council recommend that women drink an average of no more than two standard drinks a day, and no more than 14 standard drinks over a week; not more than four standard drinks in any one day; and have one or two alcohol free days per week (NHMRC 2001). Furthermore, they recommend that women of childbearing age and during pregnancy consider not drinking at all. Most importantly these women should never become intoxicated; and if they choose to drink over a week should have less than seven standard drinks, and no more than two standard drinks on any one day. Women should note that the risk is highest in the earlier stages of pregnancy, including the time from conception to the first missed period (NHMRC 2001).

The 1995 National Health Survey reported that Indigenous adults aged 18 years or more and living in non-remote areas were less likely than non-Indigenous adults to report consuming alcohol in the week prior to interview (Trewin 1999). Recent alcohol consumption was reported by 59% of Indigenous males, 40% of Indigenous females, 66% of non-Indigenous males and 46% of non-Indigenous females (Trewin 1999). The National Aboriginal and Torres Strait Islander Survey of 1994 reported that 59% of Indigenous males and 37% of Indigenous females aged 18 and over and living in urban areas reported that they had consumed alcohol in the week prior to interview (McLennan & Madden 1996). Although a lower proportion of Indigenous adults drink alcohol, alcohol consumption is of concern because those who drink alcohol are more likely to consume it at hazardous levels. In the 1995 National Health Survey, 9% of Indigenous female drinkers were classified as high risk drinkers and 3% of non-Indigenous drinkers were in that category.

Maternal alcohol consumption during pregnancy is significantly related to the incidence of foetal death, infant death and to the birth of low birth weight infants (Little *et al.* 1986; Faden *et al.* 1997). A study of 31 604 pregnancies which examined the relationship between maternal alcohol consumption during pregnancy and birth weight showed that the percentage of newborns below the tenth percentile of weight for gestational age increased sharply with increasing alcohol intake. Multivariate models showed reductions in infant birth weight of 14 grams in those drinking less than one drink per day to 165 grams in those drinking three to five drinks each day (Mills *et al.* 1984). A recent study of the efficacy of a brief intervention trial for the treatment of problem alcohol use in women of childbearing age involved two 15 minute physician-delivered counselling visits that included advice, education and contracting using a scripted work book (Manwell *et al.* 2000). In this study, 5979 women were screened for problem drinking and 205 were randomised into an experimental (n = 102) or control (n = 103) group. This trial found a significant treatment effect in reducing both seven-day alcohol use (p = 0.0039) and binge drinking episodes (p = 0.0021) over the 48 month follow-up period. Women in the experimental group who became pregnant during the follow-up period showed the most dramatic reduction in alcohol use. A logistic regression model based on a 20% or greater reduction in drinking found an odds ratio of 1.93 (confidence interval 1.07–3.46) in the group exposed to brief intervention.

Maternal smoking and environmental tobacco smoke exposure

Data from the 1995 National Health Survey showed that smoking is more common among Aboriginal and Torres Strait Islander adults than other Australian adults (Trewin 1999). More recently, among adults aged 18 years and over, 51% of Indigenous Australians compared with 24% of non-Indigenous Australians were current smokers (Trewin & Madden 2003). An Australian study of children aged 0 to 4 years, using National Health Survey results for the years 1989–90 showed that 45% of children lived in households with one or more smokers and 29% had a mother who smoked (Lister & Jorm 1998). In this health survey, maternal smoking was significantly associated with asthma (OR 1.52, 95% CI 1.19–1.94) and asthma wheeze (OR 1.51, 95% CI 1.26–1.80) (Lister & Jorm 1998). A study of the pregnancy outcomes of Indigenous women residing in an urban area, which was conducted at a Sydney obstetric hospital during the mid-1990s showed that

65.5% of these Indigenous women smoked during the pregnancy under study (de Costa & Child 1996). Another study of pregnancy outcomes of 273 Indigenous women in Perth conducted at about the same time showed that 65% of these women also smoked during and after their pregnancy (Eades & Read 1999).

Numerous studies have documented evidence that maternal smoking during the prenatal and postnatal periods has a range of adverse effects on the health of infants and young children. A review of the literature regarding children's exposure to environmental cigarette smoke before and after birth highlights many of the risks to the foetus, infant and young child (Overpeck & Moss 1991). Intrauterine exposure from a mother who smokes may lead to intrauterine growth retardation, low birth weight, preterm delivery and other complications of pregnancy (Simpson & Armand Smith 1986; Roquer *et al.* 1995; Kyrklund-Blomberg & Cnattinguis 1998). The reduction in birth weight is further increased with advanced maternal age and social deprivation (Bonellie 2001). Studies of environmental tobacco smoke exposure among non smoking mothers have documented increased risk of intrauterine growth restriction and low birth weight (Martinez *et al.* 1994; Dejin-Karlsson *et al.* 1998; Windham *et al.* 1999). Furthermore, environmental tobacco smoke exposure has been consistently shown to double the risk of hospitalisation for a serious respiratory infection in early life for the child of a parent who smokes. This association is strongest in children aged two years or less (Li *et al.* 1999). In utero exposure to maternal smoking has been shown to be independently associated with decreased lung function in children of school age, especially related to small airway flows (Gilliland *et al.* 2000).

The health risks of maternal smoking during pregnancy are dose related so attempts by study mothers to cut down or quit smoking during pregnancy have potential to convey health benefit to the foetus and infant (Simpson & Armand Smith 1986). Maternal smoking during pregnancy is also a risk factor for sudden infant death syndrome and was addressed in an early publication from the Bibbulung Gnarneep cohort study of urban Indigenous infants (Eades & Read 1999). A recent Cochrane Review of 'Interventions for promoting smoking cessation during pregnancy' showed that smoking cessation programs in pregnancy appear to reduce smoking, low birth weight and preterm birth (Lumley *et al.* 2003). Specifically, based on eight trials with validated smoking cessation, there was a significant reduction in smoking in the intervention groups (OR 0.53, 95% CI 0.44 to 0.63) and an absolute difference of 8.1% in women continuing to smoke. A recent clinical practice review article—*Quitting smoking in Pregnancy*—reports that the mean reduction in birth weight for babies of smoking mothers is 200 grams and that smoking doubles the risk of having a low birth weight baby and significantly increases the risk of perinatal mortality and several other adverse pregnancy outcomes (Walsh *et al.* 2001). High quality interventions to help pregnant women to quit smoking produced an absolute difference of 8.1% in validated late pregnancy quit rates, but if abstinence is not achievable, then it is likely that a 50% reduction in smoking would be the minimum necessary to benefit the health of the mother and baby. The same review shows that, although health care providers are well placed to inform and influence pregnant smokers to quit, many do not routinely deliver quit smoking interventions (Walsh *et al.* 2001). In Australia they show that most pregnant smokers are identified, but only a minority are counselled about how to quit. The review further recommends that cognitive behavioural therapy for quitting smoking in pregnancy has been established and should be used routinely (Walsh *et al.* 2001). Nicotine replacement therapy should be considered for women smoking more than ten cigarettes per day who have made a recent, unsuccessful attempt to quit and who are motivated to quit.

Antenatal cannabis use

There are few reports of the prevalence of cannabis use during pregnancy and the longer-term effects of its use on the developing foetus. An Australian longitudinal study of 1601 young adults with a mean age of 20.1 years who were surveyed in 1998 reported that 59% had at some time in their life used cannabis and,

of these, 17% had used cannabis at least weekly (Coffey *et al.* 2002). Furthermore, 7% of the sample (11% males and 4% females) met the criteria for cannabis dependence.

The impact of cannabis use during pregnancy on pregnancy outcome was explored in the Avon Longitudinal Study of Pregnancy, with over 12 000 women expecting singleton births (Fergusson *et al.* 2002). After adjustment for confounding factors, the mean birth weights for babies of women using cannabis at least once per week before and throughout pregnancy were 90 grams lighter than the offspring of other women. In the same study, cannabis use during pregnancy was unrelated to the risk of perinatal death or the need for special care.

Maternal and child exposure to health protective factors

Antenatal knowledge and use of periconceptional folate

A study of congenital malformations among Western Australian births from 1980 to 1987 suggests that babies born to Indigenous mothers were about 40% more likely to have a neural tube defect than those born to non-Indigenous mothers (prevalence ratio 1.43, 95% confidence interval 0.85–2.40) (Bower *et al.* 1989). The use of folate supplements before conception and during the first two months of pregnancy is known to reduce the incidence of neural tube defects. A recent Cochrane Database Systematic Review of relevant trials of folate supplementation, involving 6425 women showed that periconceptional folate supplementation significantly reduces the incidence of neural tube defects (relative risk 0.28, 95% confidence interval 0.13 to 0.58) (Lumley *et al.* 2000).

Throughout the early- to mid-1990s, with increasing knowledge of the importance of periconceptional folate for the prevention of neural tube defects, a health promotion research project was undertaken in Western Australia from mid-1992 until March 1995 (Bower *et al.* 1997). This study showed that in interviews conducted in March 1995, at the completion of the health promotion program, 67.5% of women of child bearing age knew of the folate-spina bifida association and 68.7% would take a folic acid supplement if planning a pregnancy. The same study reported that a concurrent 1995 survey of a sample of pregnant women showed that 43.1% of women with planned pregnancies had taken folate supplements periconceptionally, compared with 19.1% in a similar survey in 1993. There are no reports of the prevalence of knowledge or use of periconceptional folate supplements among Indigenous women of child bearing age or pregnant Indigenous women.

Antenatal health care

Aboriginal and Torres Strait Islander women have higher rates of death during pregnancy with a maternal mortality ratio of 34.8 deaths per 100 000 confinements, compared with 10.1 deaths per 100 000 confinements for all other women who gave birth during the 1994–1996 triennium (Walters *et al.* 2002). In addition, Aboriginal and Torres Strait Islander babies are at greater risk of poor birth outcomes and death during the perinatal period and infancy (Trewin & Madden 2003). Thus, there is a clear need to provide the best quality of care to Aboriginal and Torres Strait Islander women during pregnancy and childbirth.

In part, because of difficulties in selecting a sample frame and recruitment into studies, there is a dearth of literature describing the frequency of attendance for antenatal care and the health of Indigenous women during their pregnancy. A study conducted at one of the two major obstetric hospitals in Brisbane compared Indigenous and non-Indigenous women who attended for antenatal care (Najman *et al.* 1994). Of the Indigenous women:

- 28.9% were aged < 20 years;
- 30.2% had completed less than three years secondary education;
- 19.3% had an annual family income of < \$5200;
- 26.5% were single; and
- 27.9% had been in a relationship less than one year.

In addition:

- 53% of the Indigenous women smoked during pregnancy, with 16.1% smoking more than 20 cigarettes per day; and
- 18.8% of Indigenous women consumed alcohol early in their pregnancy, with 9.6% binge drinking (drinking more than five glasses of alcohol at each sitting) early in their pregnancy.

In terms of antenatal care attendance among these Indigenous women:

- 13.5% attended less than 50% of the recommended visits; and
- 10.1% attended their first antenatal visit at later than 31 weeks.

It should be noted that 14.4% of the original group of Indigenous women in this study were lost to follow-up and are not included in these attendance figures for antenatal care, and we have no report of the proportion of women who attended for delivery, without having accessed antenatal care during their pregnancy.

The provision of antenatal health care with the aim of improving the health of women during their pregnancy and of their babies has been a component of health care since the early 1900s but, in Australia, a recent review showed that there are no national consistent guidelines about the provision of antenatal care. Thus, protocols vary across jurisdictions (Hunt & Lumley 2002). Generally, the most widely accepted schedule of antenatal visits is monthly visits until 28 weeks, fortnightly visits to 36 weeks, and then weekly visits until birth (Dodd *et al.* 2002). Recent debate about the development of national protocols for antenatal care note exceptions where the clinical practice should be varied on a regional or population basis to include testing for conditions that are more prevalent among Indigenous women (Dodd *et al.* 2002) (e.g. routine antenatal screening for syphilis and glucose tolerance testing).

The issue of whether good antenatal care can improve birth outcomes has not been clearly resolved. A critical review which entailed a MEDLINE search of all relevant studies for the years 1966–1994 concluded that antenatal care has not been conclusively shown to improve birth outcomes. However, the authors suggest that policy makers should continue funding antenatal care as cost-effective reductions in low birth weight deliveries may be beyond the statistical powers of detection of current studies (Fiscella 1995). This review highlights the fact that simply counting the number of antenatal visits a woman has during her pregnancy is not an adequate measure of whether sufficient care has been provided. The number of visits is determined by several factors including the gestational age at which a woman enters care, the frequency of visits recommended by her provider, the presence of complications, the need for hospitalisation, the woman's compliance, and the gestational age at which the woman gives birth. While debate about the effectiveness of reduced schedules of antenatal visits can readily be generalised to low risk populations, care should be taken when considering the implications for the provision of antenatal care to Indigenous women who generally have poorer obstetric and perinatal outcomes. A previous study comparing 90 339 black and white women in New York showed that the black women receiving inadequate levels of antenatal care experienced substantial increased risks of low birth weight, neonatal and post-neonatal

mortality (Gortmaker 1979). These risks did not increase to the same extent for white women who received inadequate antenatal care.

Postnatal health of mothers

The capacity of a mother to nurture and care for her new baby is likely to be influenced by her health and wellbeing. There are no studies describing the health of urban Indigenous women in the early postpartum period, or during the first year of their infant's life. A population-based cohort study to determine the prevalence and persistence of health problems after childbirth was conducted in the Australian Capital Territory, and recruited 1295 women who had given birth to a live baby from March to October 1997 (Thompson *et al.* 2002). This study showed that health problems resolving between 8 and 24 weeks postpartum included exhaustion/extreme tiredness (60% at 8 weeks and 49% at 24 weeks), backache (53–45%), bowel problems (37–17%), lack of sleep/baby crying (35–15%), haemorrhoids (30–13%), perineal pain (22–4%), excessive/prolonged bleeding (20–2%), urinary incontinence (19–11%), mastitis (15–3%), and other urinary problems (5–3%). In this population no significant changes over time occurred in the prevalence of frequent headaches or migraine, sexual problems or depression over the six months. Primiparas were more likely than multiparas to report perineal pain and sexual problems. Compared with unassisted vaginal births, women who had caesarian sections were more likely to report exhaustion, lack of sleep, bowel problems, and were more likely to be readmitted to hospital in the first eight weeks.

A Statewide survey was conducted in Victoria and aimed to describe the prevalence of physical and emotional health of predominantly non-Indigenous women six to seven months after the birth of their baby (Brown & Lumley 1998). In this study of 1336 women, one or more health problems in the first six postnatal months was reported by 94% of the women. A quarter of the women had not spoken to a health professional about their own health since the birth and 49% of the women who reported health problems would have liked more help or advice. The most common problems were tiredness (69%), backache (43.5%), sexual problems (26.3%), haemorrhoids (24.6%) and perineal pain (21%). In this study 16.9% of women scored as depressed. Both these studies highlight the health problems that mothers experience in the weeks and months after the birth of their baby. The Victorian study highlights the high proportion of women in the general population who experienced physical and emotional problems after the birth of their babies and who frequently do not report these problems to health care providers.

Healthy child development

Breastfeeding

An emphasis on supporting and encouraging breastfeeding in the Australian community is the focal point of the *Infant Feeding Guidelines for Health Workers*, a NHMRC guide published in 1996 (Infant Nutrition Panel 1996). The basis of this advice are the many studies demonstrating the nutritional, health, psychological and fertility control benefits of breastfeeding over other feeding methods to mothers and their infants. The first of the *Australian Dietary Guidelines for Children and Adolescents* is the promotion of breastfeeding (Panel to Review Dietary Guidelines 1995), and the *Health Goals and Targets for Australians by the Year 2000* (Nutbeam *et al.* 1993) included the target of increasing breastfeeding rates at the time of hospital discharge to 90%, and to 60% and 50% at three and six months.

The policy statement of the Australian College of Paediatrics encourages and supports the promotion of breastfeeding because breast-fed infants have improved neurodevelopment, and a lower incidence of infections (respiratory, gastrointestinal and otitis media), allergic disease and diabetes when compared to

formula-fed infants (Simmer *et al.* 1998). Breast-fed infants also have better feed tolerance, less physiological gastroesophageal reflux and a lower incidence of necrotising enterocolitis. The policy statement further acknowledges that formula feeds are superior to cows' milk, but do not confer the same advantages as breast milk. In Australia, breast milk or formula is recommended for the first year, and at least four months of breastfeeding seems necessary for neurodevelopmental benefits. In addition, healthy breast-fed babies do not need other fluids and the introduction of weaning foods from four to six months is important developmentally and for the prevention of iron deficiency anaemia. Breastfeeding is not always easy and mothers often need assistance. The policy statement highlights that a perception of inadequate milk supply is often given as a reason for cessation of breastfeeding, even if the infant is thriving. This often occurs in the first six weeks before the infant has established feeding and sleeping patterns, and irritability is common.

Estimates of the prevalence of breastfeeding in Australia vary, and there are few studies which provide accurate breastfeeding prevalence rates among Aboriginal and Torres Strait Islander infants. Phillips and Dibley conducted a longitudinal study of infant feeding practices, for a birth cohort of 127 Indigenous infants residing in Perth, and born between November 1980 and July 1981 (Phillips & Dibley 1982). One of the major findings of this study was high rates of cessation of breastfeeding during the first two months of life, and the authors suggested that health interventions to promote breastfeeding among Perth Aboriginal and Torres Strait Islander women would be best directed to mothers during this crucial period. In this study 82% of Indigenous mothers initiated breastfeeding, but at 12 weeks only 50% were still breastfeeding. The breastfeeding rates continued to decline steeply until 28 weeks, and more slowly thereafter, with 19% of mothers still breastfeeding at 52 weeks. Interestingly, the authors suggested that up to 69% of Indigenous mothers who ceased breastfeeding in the first two months could be assisted to continue breastfeeding with appropriate health advice and support. This study also showed that for infants not being breast-fed, a high proportion were fed unmodified cows' milk. At four weeks of age, 16% of bottle-fed infants were given unmodified cows' milk. A report on infant feeding practices in Perth and Melbourne in 1993 showed that, on discharge from hospital, 84.6% of women were breastfeeding their infants, with 75% fully breastfeeding and 9.6% breast and bottle feeding (Scott *et al.* 1997). At six weeks 67.5% of women were breastfeeding, with 55.1% fully breast-fed and 12.4% breast-fed and bottle-fed. Finally, at twenty four weeks, 48.4% of women breast-fed their infants, with 34.9% fully breast-fed, and 13.5% breast- and bottle-fed. A more recent study of women in rural Queensland, reported rates of full or partial breastfeeding to be 88.5% (88.5% full breast-fed) at discharge from hospital, 66% at 1 month (53.9%), 53.2% at 3 months (45.2%), 41.3% at 6 months (31%), and 13.5% at 12 months (4%) (Boulton & Landers 1999).

As is clear from the Phillips and Dibley study (1982) among Perth Aboriginal and Torres Strait Islander mothers, the factors that influence the decisions of women to terminate breastfeeding are varied, often amenable to change and show some consistency across other Australian and international studies. A qualitative study of Indigenous women in urban Victoria found that most women wanted and expected to breastfeed (Holmes *et al.* 1997). Some women chose artificial feeding because of embarrassment, a belief that it is as good as breastfeeding, or perceptions that breastfeeding is painful and inconvenient. In this study, the most common reasons that women stopped breastfeeding were sore nipples, worries about their supply of milk and tiredness. Lack of knowledge, hospital practices, lack of support and appropriate advice, and lack of confidence and self-esteem contributed to these breastfeeding problems. Furthermore, disruption of the passing on of knowledge of healthy infant feeding practices between generations is another cultural factor affecting the practice of breastfeeding in Indigenous communities.

Introduction of solid foods to infants' diets and dietary guidelines for infant feeding

A report in *Nutrition Reviews* highlights the fact that infants and young children are not small versions of adults, but are unique and have special needs with regard to their nutritional requirements; it also outlines some of these requirements (Glinsman *et al.* 1996). During the first months of life babies require only human milk or infant formula, which provides 40–50% of calories from fat and energy to support rapid infant metabolism, growth and development. In addition, throughout the first year of life, infant nutrition requirements change and other foods need to be gradually added to their diet as they move from the early months of nursing with a milk only diet, to a transitional period. At this time parents need to slowly build dietary variety by choosing foods from each of the basic groups to offer their infant, as dictated by individual growth and development. The major force behind infant food consumption is the need for energy to support growth and basal metabolism. The single best indicator of whether these needs are being met is the appetite of the infant, and the progress in growth from weight and length measures at well baby visits. Babies need fat because they have small capacity stomachs, and thus require energy dense foods to support rapid metabolic and growth rates in the first year of life. Fat is an excellent source of calories, but also is important in the growth of the brain and nervous system. The easily digested fat available in breast milk and formula is thus important to infants in the first year of life. Restricted fat diets and low fat milks are not appropriate for infants and children under the age of two.

Fruits, vegetables and grains containing complex carbohydrates, sugars, micronutrients and dietary fibre become more important in the second year of life when growth slows and the need for energy dense foods decreases. These foods should be gradually introduced later in the first year of life, so that when infants outgrow the nutrition content of the all milk diet and need to diversify their diet they are able to accept and enjoy foods high in complex carbohydrates. Babies need sugars in moderation because, like fat, they are an efficient energy source for rapidly growing infants and their digestive tract is fully functional and able to handle dietary sugars. Human milk and infant formula provide 40% of their caloric value as carbohydrate in the form of lactose and other sugars. The review states that 'earlier beliefs that high intakes of sugars contribute to obesity and hyperactivity' have not been confirmed, and dental caries is caused primarily by inappropriate feeding practices (propping bottles) and poor dental hygiene. Any fermentable carbohydrate, including those found in human milk and infant formula, that stays in contact with the teeth and gums for a significant period of time can promote tooth decay.

Babies also need food with iron, zinc and calcium, as intakes of these minerals are sometimes low in the diets of children under two years of age. Iron deficiency anaemia is a risk factor for abnormal cognitive and social development, and iron is readily available in breast milk, iron-enriched infant formula, iron-fortified infant cereals, meats and poultry, organ meats, peas, lentils, and soybeans. Zinc deficiency increases the risk of impaired immune function and growth and is a concern because the amount of zinc available in human milk decreases with longer periods of lactation. Few infant foods are fortified with zinc and foods high in zinc (e.g. meats, organ meats, shellfish, wheat germ) are not fed to infants in great quantities. The rapid and continuous growth of infant bones in the first years of life is the reason adequate dietary sources of absorbable calcium are needed. Foods rich in calcium are breast milk or infant formula, calcium fortified infant cereals, calcium fortified soy milk and any dairy products. By the first birthday, the recommended daily intake for calcium increases by 10%, the zinc requirement doubles and the iron requirement stays the same. The importance of providing foods that contain iron, zinc, and calcium during the first two years of life, including iron-rich milk, iron-fortified cereals, dairy products, calcium-rich or fortified foods and good sources of dietary zinc such as meat and egg yolks are clear. The report concludes that parents need to know

that infants and young children have unique dietary needs, which cannot be met by applying guidelines developed for healthy adult diets.

The Australian Government conducted a review of interventions and identification of best practice currently used by community-based Aboriginal and Torres Strait Islander health service providers in promoting and supporting breastfeeding and appropriate infant nutrition (Engeler *et al.* 1997). One key initial finding of the report was that not all providers perceive breastfeeding and infant nutrition as a priority within their Aboriginal and Torres Strait Islander populations. Other services highlighted the issues of early inappropriate introduction of first foods and the use of powdered milk as opposed to infant formula when bottle feeding. The report highlighted the reliance of urban Indigenous women on breastfeeding advice from a small number of family members and health professionals.

The reliance of urban women on a small family network and/or health professionals often means the women are influenced by women who themselves did not breastfeed and health professionals who give conflicting or poor advice. (Engeler *et al.* 1997, p. 112.)

In such settings, problems with breastfeeding can escalate quickly and lead to premature cessation of breastfeeding. The report notes further that there appears to be a significant decline in breastfeeding rates in the first few months, compounded by the early and untimely introduction of solid foods and sometimes inappropriate fluids.

Immunisation practice and coverage

A report on vaccine coverage of Australian children for the years 1993–1998, was released in June 2000 (McIntyre *et al.* 2000). The BCG (Bacillus Calmette-Guerin) vaccine and the hepatitis B vaccines for Western Australian Aboriginal and Torres Strait Islander infants are additional to the Australian Standard Vaccination Schedule for 1993–1998 outlined in this report. The report outlines the establishment and use of the Australian Childhood Immunisation Register (ACIR) from 1 January 1996 to generate reports on vaccination coverage of Australian children; prior to this date intermittent Australian Bureau of Statistics surveys were used to provide vaccination coverage reports. The ACIR defines immunisation birth cohorts by date of birth in three-month groups, the first being born between 1 January 1996 and 31 March 1996. The vaccination status of each cohort is assessed at the two key milestones of 12 months and 24 months of age. Figures on vaccination coverage in the years immediately after the establishment of the ACIR are likely to be an underestimate of true rates. Vaccine coverage was calculated for eight consecutive three-month cohorts born from 1 January 1996 to 31 December 1997. For all vaccines due by one year of age, coverage estimates steadily increased from 75% for the first cohort in 1996, to 85% for the eighth cohort, assessed on 31 December 1998. The final Australian Bureau of Statistics report on childhood immunisation, showed that for children aged between three months to six years, 68.6% were fully vaccinated against diphtheria/tetanus (McLennan 1996). Other vaccines due in the first year of life had full coverage rates of 59.9% against whooping cough (pertussis), 82.6% against polio, 50.2% against *Haemophilus influenzae* B and 52% of children were reported to be fully vaccinated at age two years (includes measles, mumps and rubella vaccines). A report on vaccine coverage of Indigenous children at the national level using data from the ACIR is expected to be available from 2004 (Trewin & Madden 2003). In the most recent national report, vaccine coverage data for Indigenous children aged under seven years was available for non-remote children only. From these reports 60% of Indigenous children were known to be fully vaccinated against pertussis, and 78% against measles, mumps, rubella. Complete vaccine coverage against diphtheria, tetanus, hepatitis B and polio were in the 60–78% range (Trewin & Madden 2003).

Reasons for delay in vaccination and appropriate interventions

Some successful trials of interventions aimed at improving vaccination coverage in the Australian context have been conducted. Home vaccination services for children behind in their vaccine schedule improved vaccination coverage to 57% among intervention children, compared to 27% among control children, with an average cost per vaccinated child of \$92.52 (Bond *et al.* 1998). A study of immunisation uptake in children attending formal day care showed low income, larger family size and only ever using a doctor rather than other health care providers were associated with incomplete immunisation (Bond *et al.* 1999). In this study, the main reasons for delay in immunisation were the occurrence of minor illnesses and parental work commitments. Families expressed a preference for immunisation services at maternal and child health visits (39%), evening sessions (22%) and at day care (22%). A Tasmanian birth cohort study, conducted by Ponsonby *et al.*, showed that the proportion of infants promptly immunised decreased as birth order increased, and as the inter-pregnancy interval between study children and their immediate elder sibling decreased (Ponsonby *et al.* 1997).

A number of studies highlight the importance of health service level factors in the failure to adequately vaccinate infants and young children. Missed opportunities to vaccinate children attending health care services are often related to minor intercurrent illnesses and inaccurate immunisation status assessment by clinic staff (Wood *et al.* 1995; Holt *et al.* 1996; Watson *et al.* 1996; Santoli *et al.* 1998). Other studies suggest under-immunisation is a marker for insufficient use of primary health care and preventive care (Rodewald *et al.* 1995; Ball & Servint 1996). Authors from the National Immunisation Program in the US note that many under-vaccinated patients are seen an adequate number of times in health care services and suggest there are five main ways health care providers can raise immunisation coverage levels among their patients (Grabowsky *et al.* 1996).

1. Ensure all appropriate opportunities for vaccination are taken.
2. Give patients all vaccines for which they are eligible at any visit.
3. Use only valid contra-indications.
4. Assess immunisation status and immunise at all visits, regardless of the reason the parent is seeking care.
5. Implement aggressive reminder systems to notify parents when immunisations are due.

Opportunities exist to vaccinate children, who are often from disadvantaged communities, when they are hospitalised. Studies in a number of settings demonstrate the effectiveness of this strategy in improving immunisation coverage levels of these children prior to discharge, thus providing an adjunct to primary care level vaccination strategies (Bell *et al.* 1997; Conway 1999).

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