Computer
Assisted
Telephone
Interviewing
Technical
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Group

Population Health Monitoring and Surveillance:

Question Development Background Paper

Nutritional Food Behaviour in Australia

May 2003

CATI Technical Reference Group
National Public Health Partnership

Computer Assisted Telephone Interviewing (CATI) is a methodology widely used for surveillance of health behaviours and health outcomes in populations in Australia. The National CATI Health Survey Technical Reference Group (CATI TRG) is an advisory committee to the National Public Health Information Working Group under the National Public Health Partnership. Members of the CATI TRG include representatives from State/Territory Health Departments, the Commonwealth Department of Health and Ageing (DoHA), the Australian Bureau of the Statistics, the Australian Institute of Health and Welfare and the Public Health Information Development Unit at the University of Adelaide. Since its inception in 1999, the CATI TRG has been a forum for the development and promotion of national standards, valid methods and capacity for CATI health surveys and health surveillance.

To embark in the efforts towards 'harmonisation' of CATI health surveys in Australia, the CATI TRG has identified the need to develop question modules for behavioural risk factor and chronic disease topics based on well-developed conceptual frameworks that underpin the data requirements for health surveillance. The proposed question modules are set to undergo a rigorous process of cognitive and field-testing under the guidance of the CATI TRG and the results will be published in a question module manual as a key reference to those interested in CATI health surveys in Australia.

This paper has been prepared by the CATI TRG as part of a series, with funding predominantly from the DoHA. Its preparation has involved input from all State and Territory jurisdictions, DoHA, the Australian Bureau of Statistics, the Australian Institute of Health and Welfare and the Public Health Information Development Unit at the University of Adelaide as well as recognised content experts.

Any comments or information relevant to the subject matter of this background paper would be welcome. Correspondence should be directed to:

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Contents

1 Introduction

The purpose of this background paper is to present the conceptual framework that underpins the concepts and data requirements for the ongoing monitoring and surveillance of nutrition in Australia. This will assist in the development of nationally agreed computer assisted telephone interview (CATI) survey questions to monitor nutrition and its associated impact on individuals.

Diet is indirectly linked with many diseases, some through obesity, which is a condition in its own right. Conditions linked with nutrition and obesity includes ischaemic heart disease (also know as coronary heart disease), stroke, hypertension, some forms of cancer and Type 2 diabetes. Other diseases that have been linked with nutrition include osteoporosis, dental caries, gall bladder disease and nutritional anemia. Of these conditions, malignant neoplasms (including some diet related cancers) and ischaemic heart disease were the leading causes of death in Australia in 2000 (ABS 2001).

Dietary guidelines developed by the National Health and Medical Research Council (NHMRC) recommend a high intake of plant foods (such as cereals, fruit, vegetables, legumes and nuts), a limitation of saturated fat and a moderation of total fat intake to reduce the risk of ischaemic heart disease, several of the common cancers, overweight and obesity. Other diseases and risk factors where good nutrition may be protective include stroke, Type 2 diabetes, osteoporosis, dental caries, and high blood pressure and raised blood cholesterol (AIHW 2002).

This paper is divided into four sections. Section 2 provides a profile of nutrition. Section 3 describes data requirements and concepts to be measured. Section 4 identifies issues in measuring nutrition. This paper will provide a valuable resource to those interested in the monitoring and surveillance of nutrition.

2 Profile of nutrition

2.1 Links between nutrition and disease

The leading causes of ill health and disability in the Australian population are chronic non-communicable, preventable diseases that relate to known risk factors of smoking, nutritional food behaviours (especially through obesity), high alcohol consumption, lack of physical activity, high blood pressure and high cholesterol (DHAC 2001a).

The major causes of illness, disability and death in Australia that are thought to have nutritional risk factors for which some prevention is applicable are ischaemic heart disease, stroke, hypertension, some forms of cancer, Type 2 diabetes, osteoporosis, dental caries, gall bladder diseases and nutritional anemia. Most of these diseases relate to over-rather than under-consumption (AIHW 1994). In Australia in the year 2000, malignant neoplasms were the leading cause of death accounting for 35,628 deaths, which equates to 28 % of all deaths registered in that year. Ischaemic heart disease alone was the second leading cause of deaths, contributing 26,521 deaths or 21% of all deaths (ABS 2001). The following diseases have major nutritional risk factors.

2.1.1 Cardiovascular disease

Cardiovascular disease comprises all diseases of the heart and blood vessels including ischaemic heart disease, hypertension, atheroslerosis (hardening of the arteries), cerebrovascular diseases (including stroke), heart failure and peripheral vascular disease. There are nutrition related risk factors for cardiovascular disease. For example diet related risk factors for ischaemic heart disease are saturated fatty acid intake, *trans*-fatty acid intake, total fat intake, high alcohol intake, total abstinence from alcoholic drinks, dietary cholesterol intake and raised blood lipids (cholesterol and triglycerides). Other risk factors include hypertension, cigarette smoking, overweight or obesity, Type 2 diabetes, physical inactivity, psychological stress and genetic predisposition. Unsaturated fatty acids when substituted for saturated fatty acids in the diet and a high intake of plant foods appear to protect against ischaemic heart disease (AIHW 1994).

2.1.2 Cancers

Cancers that are known to have nutrition related risk factors include cancer of the stomach, small intestine, colon, rectum and anus, gall bladder and female breast. The main components of diet associated with risk are high fat, salt, or alcohol intakes and low fibre intake. The active components may be a result of cooking or the way the food is processed. For example, heterocyclic arylamines, generated in the browning of meat or fish, are possible carcinogens (AIHW 1994).

Epidemiological studies and international comparisons studies have revealed a number of interesting trends. Certain cancers appear to cluster together. For example, colorectal, breast, endometrium (inner mucous membrane of the uterus), ovary and prostate cancers are much more common in affluent nations. The prevalence of these cancers correlates strongly with differences in per capita fat and energy intake between countries (prevalence greater where fat and energy intakes are higher) (Weisburger 1992).

Fruits, vegetables and fibre are the major, if not exclusive, source of a number of dietary constituents implicated in protection against some cancers: dietary fibre, b-carotene and vitamin C and E. Despite the uncertainties regarding the specific role / mechanisms of these nutrients in the process of carcinogenesis, there is a large body of evidence from epidemiological studies that plant food can provide a protective effect (NHMRC 1999a).

2.1.3 Type 2 Diabetes

Type 2 diabetes is a chronic metabolic disorder for which some individuals have a genetic predisposition. The expression of the disease may be initiated by obesity, physical inactivity or stress. Many diet related risk factors commonly present in individuals with diabetes may lead to increased risk of ischaemic heart disease; for example, hypercholesterolamia, hypertriglyceridaemia and hyperinsulinaemia (Stehbens 1990 & NHMRC 1999a).

2.1.4 Osteoporosis

Osteoporosis is a condition of thinning of bone that tends to manifest at older ages and cause fractures from little or no trauma. Calcium is one of the most important nutritional factors that determine peak bone strength. Other factors such as vitamin D, genetics, estrogen levels and physical activity are also important determinants of osteoporosis (NHMRC 1995). Currently one in two menopausal women are likely to develop osteoporosis, while one in three men over the age of 60 years could experience the condition (NHMRC 1999b).

2.1.5 Dental caries

Dental caries can cause loss of teeth and pain that change eating habits and compromise nutritional status. Frequent intake of refined sugar has been strongly linked to the development of caries in older people. Other factors that contribute to dental caries include type of food, frequency of consumption, level of oral hygiene, availability of fluoride, salivary function and genetic factors (NHMRC 1999a).

2.1.6 Iron deficiency

Iron deficiency is one of the most common nutrient deficiencies in the world. Iron is needed for the development of hemoglobin in red blood cells and has a number of other functions. Iron intakes are of particular concern for infants, young children, adolescents, pregnant women, vegetarians and athletes (NHMRC 1995).

2.2 Trends in morbidity and mortality from diet related disease

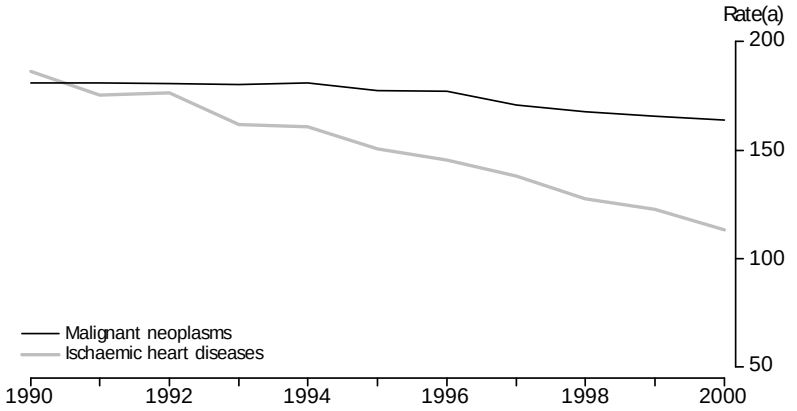
In Australia excess weight has been estimated to account for approximately 4.5 per cent of all deaths in Australia (AIHW 2001b). Obesity is associated with increased morbidity and / or mortality from ischaemic heart disease, hypertension, some forms of cancers, Type 2 diabetes and gall bladder disease. The higher the relative weight, the greater the risk of these conditions (NHMRC 1999a). The prevalence of obesity has doubled in the last 10 years affecting around one in five people. Overweight and obesity is fast becoming a problem for many Australian children, in 1995 an estimated 15 per cent of children were classified as overweight and 5 per cent were classified as obese (AIHW 2001a).

The results of the 1995 National Health Survey (NHS) indicated that one in five (21%) Australians aged 18 years and over (2.8 million people) reported having a cardiovascular

condition. The most commonly reported cardiovascular condition was hypertension, which affected 14% of the adult population. Heart disease was reported by 4% of the population. Many people with cardiovascular conditions had more than one type. For example, half of those with heart disease also had hypertension. When the 1995 NHS was compared with the 1989-90 NHS there was an increase in the prevalence of cardiovascular conditions. With the effects of the ageing population removed the standardised prevalence of cardiovascular conditions was 21% in 1995 compared with 18% in 1989-90 (ABS 1995a).

Trends over the last decade (1990 to 2000) show a decline in the two leading causes of death, malignant neoplasms and ischaemic heart disease, which account for nearly half of total deaths. Between 1990 and 2000, the age standardised death rate for malignant neoplasms decreased 9.5% while the rate for ischaemic heart disease decreased 39%. Overall, standardised death rates for many of the diet-related malignant neoplasms decreased. For example, between 1990 and 2000, the standardised rates for breast and colon cancer decreased 21% and 16% respectively (ABS 2001).

STANDARDISED DEATH RATES: malignant neoplasms and ischaemic heart diseases



(a) Per 100,000 estimated resident population.

Source: Causes of Death, Australia, 2000, ABS Cat. No. 3303.0

Cerebrovascular disease or stroke (9.6% of total deaths) was the third major underlying cause of death in 2000. Between 1990 and 2000, the standardised death rate for cerebrovascular disease decreased 30%. The rate for other diet related diseases such as diseases of the arteries, arteriols and capillaries also decreased in this period by 43%. The standardised death rate for diabetes mellitus (accounting for 2% of total deaths in 2000) fluctuated marginally, showing an overall increase for the decade of 3% (ABS 2001).

2.3 Population groups at higher risk

Some groups within the population have nutritional status or diet-related health characteristics, which are a cause for concern. Many of the origins of poor nutritional food behaviours are social and / or economic. Adequate nutrition not only depends on the availability and affordability of good quality foods but on the individual having the desire to eat healthy foods and having sufficient knowledge to make good choices from the food that is available (AIHW 1994).

2.3.1 Aboriginal and Torres Strait Islander peoples

Nutrition related diseases such as heart disease, diabetes and associated complications are some of the principal causes of the excess morbidity and mortality evident among the Aboriginal and Torres Strait Islander population. Based on 1997-99 death registrations, the three leading causes of death for Indigenous people living in Queensland, South Australia, Western Australia and Northern Territory were diseases of the circulatory system, deaths due to external causes (predominantly accidents, self harm and assault) and malignant neoplasms. Together, these accounted for 60% of all identified Indigenous deaths in these jurisdictions. The Indigenous population, had higher death rates, and were more likely to die at much younger ages from these causes, than were the general population. In 1997–99, there were approximately three times as many deaths as expected for all causes of death for both Indigenous males and females (based on all-Australian rates). The highest standardised mortality ratios for Indigenous males and females were for endocrine and metabolic diseases, where there were 7 and 9 times more deaths, respectively, than expected. Most of these deaths (88%) were due to diabetes mellitus (ABS & AIHW 2001).

There is a greater level of obesity among Aboriginal and Torres Strait Islander adults than in the general Australian population, putting them at greater risk of Type 2 diabetes, cardiovascular disease and kidney disease. It is estimated that 25 per cent of Indigenous men and 29 per cent of Indigenous women were classified as obese compared with about 19 per cent of both men and women who were non-Indigenous (AIHW 2002). Furthermore, the 1995 NHS found that in non-remote areas Indigenous people were nearly twice as likely as non-Indigenous people to be obese (ABS & AIHW 1999).

Childhood obesity is also emerging as a significant public health issue in some Indigenous communities. A cross-sectional survey conducted in urban areas of Queensland and the Torres Strait showed a prevalence of overweight among Indigenous school-aged children 2 to 3 times the rate of non-Indigenous children (SIGNAL 2001a). Additionally, Type 2 diabetes, previously uncommon in children has been diagnosed in young children of the Torres Strait region. The occurrence in children is likely to be related to childhood obesity and parental diabetes (SIGNAL 2001a). Other research indicates that poor nutrition of mothers during pregnancy and in young children contributes to an increased risk of abdominal obesity, diabetes and hypertension and cardiovascular disease in adult life (Barker & Fall 1993).

National breastfeeding data for Indigenous Australians are limited. The 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS) provided some national information, showing that women of higher socio-economic status were more likely to breastfeed and to breastfeed for a longer period of time than women from lower socioeconomic backgrounds. However, this survey also revealed that breastfeeding rates were highly variable according to location. Indigenous babies in rural areas are more likely than those in urban areas to be breastfed for longer than six months (ABS 1996).

Access to healthy food is often limited in remote and rural areas where many Indigenous people live. Income levels, loss of traditional lifestyle and access to traditional foods, limited nutritional knowledge and culturally appropriate information all influence community and individual access to healthy foods (SIGNAL 2001a). It has been found that in many remote Aboriginal and Torres Strait Islander community stores there is a limited range of foods compared with larger rural towns and urban centres. In particular, items such as dairy foods, fruit and vegetables are frequently in short supply, of poor quality and high in cost (Lee et al 1994).

2.3.2 People living in rural and remote areas

Living away from the major urban centres can mean that there is less access and a reduced range of services and facilities, higher costs, higher unemployment, a reduced range of employment opportunities and greater economic uncertainty.

The 1995 National Nutrition Survey (NNS) revealed a difference in the consumption patterns for adults living in rural and remote areas. Results showed that people living in rural and remote areas had a higher mean intake of regular breads and rolls but a lower mean intake of pasta and rice than adults living in metropolitan areas. The average intake of vegetables was highest in rural and remote areas due to their greater intake of potatoes, carrots, peas and beans. Of concern is that people in rural and remote areas were more likely to have consumed fats and oils, particularly margarine, than those in any other geographic region. In addition, people living in rural and remote areas had the highest intake of sugar (ABS 1995b).

In 1995, 53 per cent of women from rural and remote areas were overweight compared with 47 per cent of women from metropolitan areas. There was a similar but smaller pattern for men, with 65 per cent of men from rural and remote areas being classified as overweight compared with 62 per cent of men from metropolitan areas (AIHW 2002).

2.3.3 Overseas born people

Dietary differences were found in people from different regions of birth. The NNS found that adults born in the East Asian region had the highest average intake of cereal products. This was due to the high intake of rice and rice products. People who were born in European countries (including all European countries, the former USSR and the Baltic States) were more likely to have eaten fruit products than were those born elsewhere. People who were born in the United Kingdom, Ireland and New Zealand had the highest mean intake of milk products and dishes (particularly dairy milk) whereas adults born in the East Asian region had the lowest intake. In addition, people who were born in the East Asian region consumed the lowest intake of fats and oils, which was nearly half the intake of Australia born adults (ABS 1995c).

2.3.4 Infants

Exclusive breastfeeding by healthy, well-nourished women is promoted as being the best method of infant feeding for at least the first four to six months of life. Breastfeeding provides a range of benefits for the infant's growth, immunity and development (DHAC 2001b).

Although a majority of Australian women commence breastfeeding, approximately half of them introduce supplements or cease breastfeeding within three months. Donath and Amir (2000) used data from the NHS to estimate the percentage of children breastfed at discharge from hospital, at 3 months (13 weeks) of age, and at 6 months (25 weeks) of age. Infants were said to be breastfed 'exclusively' if they did not consume infant formula, cows milk, other milk substitutes or solid food on a regular basis. The percentage of infants exclusively breastfed at 3 months of age was 57% which comes close to the proposed target of 60% set out by the Commonwealth Government for the year 2000. However, the percentage of infants exclusively breastfed at 6 months was 19%, which falls short of the target of 50% set by the Government (Nutbeam et al 1993).

There is evidence that there is considerable variation between socioeconomic groups in both the acceptance and maintenance of breastfeeding, with those in higher socio-economic

groups more likely to breastfeed (AIHW 2001a). Donath and Amir (2000) found a strong relationship between breastfeeding and socioeconomic status based on the area in which the child lived. Infants from the most disadvantaged areas were significantly less likely to be breastfed at any age compared with infants from other areas.

2.3.5 Children and adolescents

Childhood is a time of rapid growth and development, and a balanced, nutritious diet is an important contributor to this growth, and to health in general. Cashel (2000) analysed data on the nutritional intake of Australian children from the 1995 NNS. Generally the quantity of nutrients consumed increased with age, and boys consumed more food than girls.

The average fat intake of Australian children aged 2-15 years was close to the recommended NHMRC dietary guidelines, while the intake of saturated fats for children was higher than recommended. Investigation also found that average calcium intakes were lower than recommended, as was the intake of iron by girls (Cashel 2000).

Although over 98% of children ate cereal foods on the day prior to the survey, girls aged 4-7 years and boys aged 8-11 years did not eat the recommended amounts of breads and cereals. In addition, less fruit and vegetables were consumed than recommended, with 30% of children aged 2-7 years eating no fruit, and a similar percentage consuming no vegetables, on the day prior to interview (Cashel 2000).

Additional analyses of data from the 1995 NNS show that between 19% and 23% of Australian children aged 2-18 years were overweight or obese, depending on age. When comparing two populations of children aged 7-15 years from 1989-90 and 1995, considerable increase in over weight and obesity occurred. In 1989-90, 11% of boys and 12% of girls were overweight or obese, while in 1995 this increased to 20% of boys and 22% of girls (Magarey et al 2001).

2.3.6 Older people

As the population continues to age, the demand for residential, respite and day-care services for older Australians will accelerate. The level of demand has caused a trend towards caring for people in their own homes and an increased burden on community services such as meals on wheels. This means that more and more older people are relying on food services for a large proportion of their nutrient intake. For those living in institutions or looked after by carers in their own homes, inability to influence those who make food choices may create a barrier to achieving a healthy diet (AIHW 1994).

2.4 Health system costs

It is not possible to cover all of the health system costs associated with diet-related disease. The health system costs for the top three diet related diseases are provided to gain an understanding of the cost of diet related disease to the Australian community. Cardiovascular disease and its risk factors, including high blood cholesterol, is the single most expensive disease group in terms of health system costs. The most recent data on health system costs show that the Australian community spent $3.9 billion in direct health system costs in 1993-94 due to this disease group (AIHW 1999).

For 1993-94, the total cost of colorectal, breast, lung and prostate cancer combined was $567 million of which approximately $59 million can be attributable to low vegetable

consumption (<4 serves / day), $29 million due to low fruit intake (<3serves / day) and $9 million to high red or processed meat intake (1+ serves / day) (Marks et al 2001b).

The direct health system costs of diabetes mellitus were estimated to be $372 million in 1993-94, of which Type 2 diabetes accounted for an estimated $217 million. Of the $217 million approximately $89 million can be attributable to overweight and obesity in the population. When complications of diabetes are taken into account, the total health system costs of diabetes is estimated to be around $681 million in 1993-94 (AIHW 1999, Marks et al 2001a).

3 Data requirements and concepts to be measured by CATI

The data requirements for the ongoing monitoring of food intake and nutrition is based on the risks to an individual's health from over consumption of certain nutrients such as fats, sodium and sugars and the risks associated with under consumption of calcium, cereals, fruits and vegetables. From the previous section, the core data requirements can be summarised as:

- Monitoring overweight and obesity;
- Monitoring the intake of foods related to diet related disease including: nutrients (fat, sodium, calcium and iron), cereals, fruits, vegetables and sugar;
- Monitoring breastfeeding and infant nutrition; and
- Monitoring dietary change and the barriers to change.

3.1 Monitoring overweight and obesity

The number of Australians who are obese has doubled in the last ten years, affecting around one in five people. In addition, more Australian children are overweight or obese than at any time in our recorded history. Obesity in particular, is a problem for many Aboriginal and Torres Strait Islander people (SIGNAL 2001c).

3.1.1 Monitoring overweight and obesity in adults: using Body Mass Index

There are two methods of measuring overweight and obesity in adults: body mass index (BMI) and waist circumference. Adult BMI is a measure of weight in relation to height that is commonly used to classify underweight, normal or healthy weight, overweight and obesity in adults (WHO 2000, AIHW 2003). BMI is calculated as weight (in kilograms) divided by height (in metres) squared. For example an adult who weighs 70kg and whose height is 1.75m will have a BMI of 22.9. BMI =70(kg) ÷1.75(m)^2 =22.9.

Table: Classification of adults according to BMI

Classification	BMI rangeRisk of comorbidities	
Not overweight or obese	<25.00	
Underweight	<18.50	Low (but risk of other clinical problems increased).
Normal range	18.50 - 24.99	Average
Overweight	≥ 25.00	
Preobese	25.00 - 29.99	Increased
Obese	≥ 30.00	
Obese class 1	30.00 - 34.99	Moderate
Obese class2	35.00 - 39.99	Severe
Obese class 3	≥ 40.00	Very severe

Source: WHO, 2000, NHDD draft version 12

Adult BMI is a measure of weight in relation to height that is commonly used to classify underweight, normal or healthy weight, overweight and obesity in adults. On a population basis there is a strong association between BMI and health risks such as coronary heart disease, non-insulin dependent diabetes mellitus and high blood pressure in adults. Therefore in population-based surveys BMI can be used:

- to indicate the prevalence of thinness and overweight and their sociodemographic distribution (problem identification);
- to evaluate health promotion and disease prevention programs (assessment of interventions);
- to monitor progress towards national public health policy;
- to ascertain determinants and consequences of thinness and overweight; and
- in nutritional and physical activity surveillance and long term planning.

In population health surveys BMI can be therefore used in nutritional surveillance (AIHW 2003). According to the NHDD draft version 12 when either self-reported height or self-reported weight is used in the calculation, BMI should be recorded as self-reported BMI. For adults, BMI tends to be underestimated when based on self-reported, rather than measured, height and weight. This is due to the fact that, on average, height tends to be overestimated and weight tends to be underestimated when self-reported by respondents (Magarey et al 2001).

3.1.2 Monitoring overweight and obesity in adults: using the Waist Circumference Risk Indicator

Body fat distribution has emerged as an important predictor of obesity related morbidity and mortality. Abdominal obesity, which is more common in men than women, has, in epidemiological studies, been closely associated with conditions such as coronary heart disease, stroke, non-insulin dependent diabetes mellitus and high blood pressure. The waist circumference risk indicator is a sex specific category of risk of metabolic complications associated with excess abdominal adiposity (in Caucasians). On a population basis there is a strong association between abdominal obesity and health risk (AIHW 2003).

Originally, waist circumference was used in the calculation of Waist to Hip Ratio (WHR), which requires the measurement of hip circumference and waist circumference as a predictor of obesity-related morbidity and mortality. More recently, waist circumference has been used in its own right as an indicator or risk factor associated with excess fat. There is evidence that waist circumference alone might be used to identify people at health risk both from being overweight and having a central fat distribution (WHO 2000).

Waist circumference is a convenient and simple measurement that is unrelated to height, correlates closely with BMI and WHR and is an approximate indicator of intra-abdominal fat mass and total body fat. Changes in waist circumference can reflect changes in risk factors for cardiovascular disease and other forms of chronic disease, even though risks seem to vary in different populations.

Table: Sex specific waist circumference and risk of metabolic complications associated with obesity in Caucasians

Risk of metabolic complications	Waist circumference (cm)	
	Men	**Women**
Not at risk	< 94	< 80
Increased	≥ 94	≥ 80
Substantially increased	≥ 102	≥ 88

Source: WHO, 2000.

Waist circumference as an indicator of risk can be used:

- to indicate the prevalence of abdominal obesity and its sociodemographic distribution (problem identification);
- to evaluate health promotion and disease prevention programs (assessment of interventions);
- to monitor progress towards national public health policy;
- to ascertain determinants and consequences of abdominal obesity; and
- in nutrition and physical activity surveillance and long term planning.

A person's waist circumference is measured half way between the inferior margin of the last rib and the crest of the ilium in the mid axillary plane. In order to ensure consistency in measurement, the measurement protocol described under Data Collection Methods (AIHW 2003) should be used.

It is important to note that there are data quality issues with self-reported height, weight and waist circumference in CATI surveys. Some respondents may underestimate or overestimate their height, weight and waist circumference. For these reasons it is important to determine whether reliable data on these measurements can be gained from CATI surveys. Some of the data quality issues can be overcome by making adjustments for margins of error.

3.1.3 Monitoring overweight and obesity in children and adolescents aged 2 to 17 years: using BMI

The measure of child or adolescent weight (body mass) relative to height is used to assess the extent of weight excess only in children and adolescents. BMI is calculated as weight (in kilograms) divided by height (in metres) squared (AIHW 2003).

However, BMI for children and adolescents aged 2 to 17 years cannot be calculated if all the components necessary for its calculation (date of birth, sex, weight and height) is unknown or has not been collected. This is because in comparison to BMI values for adults, which are age-independent and the same for both sexes, BMI values for children and adolescents, for the purposes of measuring overweight and obesity, are age and sex specific and are classified by comparing the derived BMI values against those recorded for the relevant age and sex (refer to Appendix 1 Classification of BMI of overweight and obesity for children and adolescents). For example, an 11 year old boy with a BMI of 21 would be considered overweight, or a 7 year old girl with a BMI of 17.5 would be considered not overweight or obese. Self reported or parentally reported height and weight for children and adolescents should be used cautiously - if at all.

3.1.4 Monitoring overweight and obesity in children and adolescents aged 2 to 17 years: using the Waist Circumference Risk Indicator

Among children and adolescents waist circumference measures should only be used as a measure of variation in an individual (that is, within clinical settings). As yet, no age appropriate cut-off points indicative of risk factors have been developed for use among children and adolescents.

3.1.5 Monitoring nutrient (fat, sodium, calcium and iron) intake

Fat is the most energy dense of all the nutrients. Epidemiological evidence suggests that total fat intake is associated with breast cancer and cancer of the large intestine (Weisburger 1992). Saturated fatty acids elevate plasma total and LDL-cholesterol. The plasma total cholesterol level has been shown repeatedly in prospective studies to be positively associated with the risk of ischaemic heart disease. Saturated fat intake, as a percentage of total energy, is correlated with the incidence of ischaemic heart disease (NHMRC 1999a).

The working party on sodium in the Australian Diet concluded that populations with the highest known sodium intake (greater than 300mmol/day) have a high prevalence of hypertension and high morbidity and mortality from cerebrovascular disease, while those with an intake of sodium less than 50 mmol/day have a very low prevalence of hypertension and low mortality from cerebrovascular disease (NHMRC 1992). It is difficult to ascertain exactly how much fat and sodium is in the diet because both are widely distributed in the food supply. An alternative approach may be to ask about food habits, which relate to fat and salt intake such as trimming of fat from meat, the salting of food and the use of reduced salt products and salt alternatives (AIHW 1996). There are questions surrounding the use of trimming of fat on meat as an indictor of fat intake as most meats these days are well trimmed.

Calcium has a number of roles in the body and it is recognised that lack of calcium has a key role in the development and progression of osteoporosis. Children and adolescents need an adequate amount of calcium for healthy bone development. The main source of calcium in the Australian diet is dairy foods. Dairy foods are recommended as a source of calcium for the diet because they are rich in calcium and provide the most readily absorbed source of calcium (NHMRC 1999a).

Having a diet rich in sources of iron is important in the prevention of iron deficiency. The major sources of iron in the diet are red meat and cereal. These are both direct sources of iron and they also promote iron absorption from foods with low iron content (NHMRC 1992). The major sources of calcium and iron in the diet are more limited than for most other nutrients. Possible indicators of trends in calcium and iron intake might be based on questions about the intake of the major food sources of these nutrients, i.e. for calcium: milk and milk products and for iron: meat, meat products and cereals (AIHW 1996).

Possible indicators

Fat intake:

- Proportion who rarely or never eat fat on meat; and
- Proportion who usually use reduced fat or skim milk and milk products.

Sodium intake:

- Proportion who rarely or never add salt to food after cooking; and

- Proportion who rarely or never add salt to food before or during cooking.

Calcium intake:

- Mean or median frequency of intake of milk and milk products consumed daily;
- Mean or median number of 'reference serves' of milk and milk products consumed daily; and
- Proportion who usually consume milk and/or milk products less than once a day.

Iron intake:

- Mean or median frequency of intake of core cereal foods and red meat daily; and
- Proportion who usually consume breakfast cereal and/or red meat less than once a day (AIHW 1996).

3.3 Monitoring core cereal, vegetable and fruit intake

An increase in the consumption of core cereals, fruits and vegetables has been identified as an important component of nutrition strategies, not only for the maintenance of good nutritional status but also for the prevention of the major degenerative diseases-cardiovascular disease, some cancers and Type 2 diabetes. The consumption of plenty of breads, cereals (preferably wholegrain), vegetables (including legumes) and fruits is encouraged in *Dietary Guidelines for Australians* (NHMRC 1992).

There is a growing body of evidence that consumption of vegetables (including legumes) and fruit at the recommended levels (7 serves per day) provides significant protection from 'lifestyle' diseases, (which include Type 2 diabetes, hypertension, heart disease, stroke and cancer). At present, Australians consume an average of 4-5 serves per day, with some groups consuming significantly less (SIGNAL 2001b).

According to SIGNAL (2001b) the public health nutrition policy aims to increase the average per capita consumption of vegetables and fruits to five serves of vegetables and two serves of fruit a day. This means increasing both the number of people who consume vegetables and fruit every day and the amount eaten. For the outlined reasons it is important to collect information on the frequency of intake of core cereals, vegetables and fruits. It is also important to identify the groups of people who do not consume any fruits and vegetables daily.

Possible indicators

- Mean or median frequency of intake of core cereal, vegetables and fruits daily;
- Mean or median number of serves of core cereals, vegetables, fruit consumed daily;
- Proportion who did not consume any fruit and vegetables on the day of the survey; and
- Proportion who usually do not consume any fruit and vegetables daily (AIHW 1996).

3.4 Monitoring sugar intake

According to dietary guidelines it is recommended that Australians should eat only a moderate amount of sugars. The guidelines clearly apply to foods containing added sugars,

which are an increasingly significant source of sugar, compared with the amount used in preparing foods at home. These sugars include: sugar (white, brown, raw, etc.), honey, syrups, treacles and other refined sugars such as lactose, glucose and fructose (NHMRC 1999a). Diets high in added sugar are associated with dental caries. The presence of significant amounts of sugar also dilutes the nutrient density of the diet (people fail to consume the recommended daily allowance of other vitamins and minerals) (NHMRC 1999a).

As with salt and fat intake, in order to assess sugar intake, indirect assessment based on questions regarding consumption of foods that contribute to sugar intake and / or food preparation habits needs to be undertaken. An indicator could then be calculated using the set of questions (AIHW 1996).

Possible indicators

- Proportion who never add sugar to cups of tea and coffee; and
- Daily consumption of soft drinks and confectionary.

3.5 Monitoring breastfeeding and infant feeding

Breastfeeding is recommended in infant feeding policies in Australia and internationally as it is beneficial to both the mother and the infant. Research shows that early attention to good nutrition impacts on a person's health over the whole of their life. Breastfeeding has also been shown to protect against asthma and infectious and 'lifestyle' diseases, while inappropriate introduction of solid foods can lead to either obesity or malnutrition (SIGNAL 2001b).

The dietary guidelines for children and adolescents and the NHMRC infant feeding guidelines outline key recommendations of breastfeeding including exclusive breastfeeding for the first 4-6 months of life, followed by timely complementary feeding, and continued breastfeeding to at least 12 months (NHMRC 1992, 1995). These policies and supporting evidence are currently being updated, and the key changes forecast are: extending the time of exclusive breastfeeding to 6 months of age, with an accompanying recommendation that complementary feeding commence at 6 rather than 4 months (Webb et al 2001). These follow the recent changes adopted by the World Health Organization (WHO 2001). The key breastfeeding practices outlined in the policies provide the basis for identifying aspects of most interest to monitor over time.

The term 'breastfeeding' is used to describe a wide variety of infant feeding practices. These may include: whether the infant was ever breastfed; and if so, whether early breastfeeding was exclusive, predominant or partial; and the length of time that children were breastfed at various intensities. Even the term 'ever breastfed' can have several interpretations including 'ever put to the breast, even just once', 'ever given breast milk, including expressed breast milk from a bottle', or 'regularly breastfed during the early weeks of infancy'. In addition, there is considerable variation in the meaning of various terms to describe breastfeeding intensity. For example, exclusive breastfeeding has been used to describe breastfeeding that does not include regularly giving other milks or solid foods, whereas in the international literature and most breastfeeding policies, exclusive means no other fluids (such as fruit juice, water, etc.) or solids are given to the infant (Webb et al 2001).

Consistent definitions of key breastfeeding practices are essential for meaningful reporting of indicators, comparisons between population groups and the documentation of trends. In

1991, WHO adopted standardised definitions of key breastfeeding terms and proposed these for international use (WHO 1991). These definitions underlie the NHMRC infant feeding policies, and are proposed for use in Australia, as the basis for defining and measuring the data elements of breastfeeding indicators.

Possible indicators

In order to reflect WHO recommendations, 11 indicators are proposed for measuring optimal breastfeeding (rates comparable with WHO)(Webb et al 2001)

- Per cent ever breastfed;
- Mean duration of breastfeeding among ever breastfed children;
- Median duration of breastfeeding among children less than 3 years, and among ever breastfed children;
- Per cent breastfed at each completed month of age to 6 months;
- Per cent continued breastfeeding to 12 months;
- Per cent exclusively breastfed to 4 months and 6 months;
- Per cent predominantly breastfed to 4 months and 6 months;
- Per cent fully breastfed (exclusively plus predominantly) to 4 months and 6 months;
- Per cent exclusively breastfed in the previous 24 hours among infants less than 4 months and less than 6 months;
- Per cent predominantly breastfed in the previous 24 hours among infants less than 4 months and less than 6 months; and
- Per cent receiving solid foods in the previous 24 hours among infants less than 4 months and less than 6 months.

Additionally, consultation conducted by the ABS has shown that stakeholders are also interested in collecting information on why mothers cease breastfeeding. A question included in the 2001 NHS prompts for the reason breastfeeding was stopped. Options given include teething, child bored, felt it was time to stop, resumed work, pregnant, not producing any / adequate milk, or other reasons.

Another possible indicator

- Reason for cessation of breastfeeding.

3.6 Monitoring dietary change and the barriers to change

Motivating individuals in the population to make relevant dietary changes is an important step in achieving policy objectives intended to reduce the incidence and prevalence of diet related health disorders. Under some circumstances this may necessitate the removal of structural, economic and / or social barriers to dietary change (SIGNAL 1999). Questions on motivation for dietary change have been included in a number of National and State based surveys. The NNS asked questions on whether the respondent wished to change their consumption patterns of fruits and vegetables, breads and cereals and foods high in fat. This set of questions on dietary change may be suitable for surveillance.

One of the fundamental aims of the National Food and Nutrition Policy is to increase the availability of nutritious foods, especially in remote areas, “to increase the affordability of

nutritious foods for economically disadvantaged people, and to increase the understanding of good nutritious foods" (DHH&CS 1992). Questions about factors, which make it easier or more difficult to make dietary changes, have been included in the Western Australian and Victorian Nutrition Attitudes Surveys. The NNS also included questions about the barriers to dietary change including a question on food security ("In the last 12 months, were there any times that you ran out of food and could not afford to buy more?"). Other questions about barriers to dietary change were also included.

Possible indicators

- Proportion who consider their diet to be somewhat healthier;
- Proportion who would like to make relevant changes to their diet;
- Proportion who have made relevant changes to their diet;
- Proportion who report lack of money as a barrier to dietary change; and
- Proportion who report availability as a barrier to dietary change (AIHW 1996).

4. Issues in measurement

This section discusses some methods and issues involved in measuring the data requirements for food and nutritional food behaviours surveillance. As mentioned in the previous chapters, monitoring nutrition and the consequences of poor nutrition requires information on body mass and waist hip measurements, consumption of foods from the various food groups, breastfeeding, dietary change and barriers to change. Most of the methodological issues discussed in this section are the issues that were raised in the development of the NNS and the NHS.

4.1 Methodology

4.1.1 24-hour recall

One important factor when deciding on a survey instrument is to assess the type of data that can be obtained. The advantage of the 24-hour recall method is that this method provides quantitative data, which enables derivation of, or calculation of nutrient intake. For example with the 1995 NNS, the Australia New Zealand Food Authority (ANZFA) developed a customised composition database to enable the 24-hour food records to be converted into nutrient intake. Another important aspect of food consumption is the reference period over which the information is to be recalled. A short reference period, such as the '24-hour recall' method, encourages more precise recall of consumption because it asks about the day prior to the survey, thus resulting in better recall (ABS 1995c).

The recall period can be the last 24-hours, last 3 days or a week. The question format requires the respondents to describe how much they have eaten (number of serves). One commonly associated problem with dietary surveys is under-reporting of consumption, either because of recall problems or deliberate misreporting. The 24-hour recall method relies on respondents' ability to recall the details of all foods and beverages consumed during a specific period of time (i.e. midnight to midnight). Therefore the information that is collected is subject to human variability in memory, in the ability to describe accurately the amounts of food that have been eaten and on the impact of current views about diet and disease (Rutishauser 1998). A further disadvantage of this method is that it does not represent the usual intake of individuals, as many people have considerable variation in their day-to-day food intake. However, this approach can be used to indicate the usual food and nutrient intake of a large group of people (ABS 1995c).

4.1.2 Food frequency questionnaire (FFQ)

An alternative approach to the assessment of dietary intake that was also included in the 1995 NNS is the food frequency questionnaire. Unlike the 24-hour recall method it is intended to provide information on the usual intake of food for an individual. The development of this methodology came from the recognition that short-term information about dietary intake (one or even several days) was unlikely to be useful in the context of nutritional epidemiology. The respondents are able to report the information on their usual diet even without the aid of an interviewer. To simplify the process, the questionnaire 'jogs' respondents' memory by providing a list, usually of between 50 and 200 foods and a fixed set of frequency categories from never to 1-3 times a day. The problem with this type of

questionnaire is that information on quantities of food cannot be collected. Furthermore the list of food categories provided does not describe the specific foods eaten by the respondents (in mixed dishes), the respondents will need to engage in mental arithmetic before they can arrive at an appropriate frequency category (Rutishauser 1998). Both the 24-hour recall method and the FFQ method would be difficult to conduct using CATI methodology.

4.1.3 Short dietary questions

Short dietary questions similar to the FFQ were also included in the NNS. These can provide specific, potentially valuable but limited information related to food and nutrition intake in the population. The idea behind the short questions is that they take less time to administer and they measure single or selected aspects of food habits that is more straightforward than measuring whole diets and nutrients contained in them. Short questions about food can be included in population health surveys at minimal cost and can supply valuable information provided they are sound reliable questions. They can be used at the national level and can be administered via the telephone using CATI methodology. In recent years, many State and Territory health departments have instituted regular telephone health survey programs conducted by CATI. Most of these surveys have included short dietary questions, though the questions vary between States (Marks et al 2001c). Based on this account it appears that short dietary questions would minimise respondent burden and interviewer time and be the simplest most efficient way of collecting dietary surveillance information via CATI.

4.2 Measuring serves versus frequency

In face-to-face interviews like the NNS standard measuring guides can be used to assist the respondent to estimate the amount of food and beverages actually consumed. These include metric measuring cups, measuring spoons, diagrams of shapes, a ruler and plastic measuring sticks (used to estimate the thickness of meat, poultry and cheese).

However, with the CATI instrument where visual prompts are not possible it is difficult to obtain data on the quantity (number of serves) of food. Although questions designed to assess the food intake of population groups often include estimates of quantity as well as frequency, some argue that obtaining information on both quantity and frequency increases respondent burden and introduces errors since individuals' ability to estimate proportion size accurately vary widely (AIHW 1996). Furthermore in food frequency estimates of intake little additional information appears to be gained by using individually described portion-size data (Willett 1990).

The problem with this is that for food monitoring purposes the main disadvantage of using 'frequency' rather than 'serve' data is that nutrition recommendations and targets tend to be specified in terms of 'reference serves'. The data from two surveys, the 1995 SA Omnibus Survey (frequency questions) and the NNS (reference serves questions) were compared and, on average, when fruit is eaten the amount consumed approximates two reference serves. For vegetable intake the main difference between the two instruments appears to be that the NNS instrument classifies individuals who report eating only one serving of vegetables into the same category as individuals who eat one or more vegetables only once a day. Compared with the frequency instrument it thus appears that more individuals consume significant quantities of vegetables daily (AIHW 1996, Rutishauser & Penn 1996).

The 1995 SA Omnibus Survey used questions on frequency of eating rather than on the number of 'reference serves', based on the fact that this was the simplest approach for the respondents. This decision was made after extensive testing in the US Behavioural Risk

Factor Survey, on the grounds that it avoids any problems that respondents may have with definition of serving size. The number of 'don't know' responses for any questions relating to usual food intake was less than 0.5%, indicating that this format was suitable for use in general population surveys (AIHW 1996). From the above research it appears that short food frequency questions avoid the problem with definitions of serving size and human error estimating portion size, which is even more difficult with the CATI instrument. For this reason the best method for CATI nutritional food behaviours surveys appears to be questions about usual intake using short dietary questions similar to FFQ.

4.3 Self-report and social desirability bias: attitudes versus intake

Social desirability is the tendency of an individual to convey an image in keeping with social norms and to avoid criticism in a testing situation. The response biases that result from social desirability or social approval can significantly obscure or distort the measurement of the variables of interest. Research shows that specific dietary recommendations aimed at population subgroups appear to influence dietary self-report. For example, pregnant women bias their estimates of total energy intake in a manner consistent with antenatal dietary advice. Whereas other women with generally opposite demand characteristics (i.e. where lower intakes are the ideal) show a downward bias (Hebert et al 1995).

Similarly a study that compared self-reported reduced fat and salt foods intake with sales and supply data found that reported use of reduced fat and reduced salt foods was greater than store sales and milk deliveries of these products. There are several possible reasons for these discrepancies including intentional misreporting. Most people are exposed to health initiatives, which include messages advocating the reduction of fat and salt intake and at least some respondents would know that reduced fat and salt choices are better, possibly resulting in social desirability bias. Other explanations include exaggeration of occasional purchases or misreporting as a result of confusion or ignorance of the fat content of foods purchased, rather than any intentional misrepresentation (Radimer & Harvey 1998).

In addition, comparisons of measured energy expenditure with energy intake from either weighted or estimated dietary records against energy expenditure indicated that obese people, female endurance athletes and adolescents underestimate habitual and actual energy intake. Individual underestimates of 50% were not uncommon. Furthermore even in non-obese adults, where bias is minimal there was a high proportion of underestimation of actual energy intake (Schoeller 1995). With the CATI nutritional food behaviours self-report surveys it is important to be aware of social desirability bias and the imprecision of self-report.

Appendix 1: Classification of BMI of overweight and obesity for children and adolescents (from draft version of NHDD version 12)

Classification of BMI of overweight and obesity for children and adolescents				
	BMI equivalent to 25 kg/m^2		BMI equivalent to 30 kg/m^2	
Age (years)	Males	Females	Males	Females
2	18.41	18.02	20.09	19.81
2.5	18.13	17.76	19.80	19.55
3	17.89	17.56	19.57	19.36
3.5	17.69	17.40	19.39	19.23
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65
6.5	17.71	17.53	20.23	20.08
7	17.92	17.75	20.63	20.51
7.5	18.16	18.03	21.09	21.01
8	18.44	18.35	21.60	21.57
8.5	18.76	18.69	22.17	22.18
9	19.10	19.07	22.77	22.81
9.5	19.46	19.45	23.39	23.46
10	19.84	19.86	24.00	24.11
10.5	20.20	20.29	24.57	24.77
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	26.69
17.5	24.73	24.85	29.70	29.84
18	25	25	30	30

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