

# methods in brief

A brief overview of the methods is provided in this chapter. The methods are described in full in Chapter 17.

## STUDY DESIGN

SPANS consisted of six components:

### 1 MAIN STUDENT SURVEY

The main student survey assessed:

- a demographic information
- b anthropometry (height, weight, waist circumference)
- c fundamental movement skills (FMS; sprint run, vertical jump, side gallop, leap, catch, overhand throw, kick)
- d cardiorespiratory endurance
- e self-reported information, including:
  - i physical activity participation (including travel to and from school)
  - ii participation in sedentary behaviours
  - iii food habits and eating behaviours (food intake, food preferences, influences on eating behaviours, dieting practices, body image).

### 2 BIOMARKER SUB-STUDY

This sub-study involved collection of fasting blood samples from Year 10 students attending schools in the Sydney metropolitan area and measurement of:

- a blood pressure
- b cholesterol (HDL, LDL and total)
- c glucose and insulin
- d high sensitivity C-reactive protein
- e liver function.

### 3 PHYSICAL ACTIVITY SUB-STUDY

This sub-study, completed by a second class of Year 8 and Year 10 students (third class of Year 10 students in Sydney metropolitan schools) collected the same demographic information as the main study and administered the physical activity participation questions used in the *1985 Australian Health and Fitness Survey* (Australian Council for Health, Physical Education and Recreation, 1987).

Not all measures were administered to all students. Table 2.1 shows which measures were administered to which Year groups.

Table 2.1. Measures administered to each Year group

Measure	Year K	Year 2	Year 4	Year 6	Year 8	Year 10
Demographics	✓	✓	✓	✓	✓	✓
Anthropometry	✓	✓	✓	✓	✓	✓
FMS		✓	✓	✓	✓	✓
Cardiorespiratory endurance			✓	✓	✓	✓
Self-reported information				✓	✓	✓
Physical activity sub-study					✓	✓
Biomarker sub-study						✓

Two sub-studies related to the school itself were conducted. The school staff completed one school environment survey and the school canteen manager one school canteen questionnaire in each school.

#### 4 SCHOOL ENVIRONMENT SURVEY

The school environment survey collected information on the features of the school physical environment, facilities and school policies and practices associated with physical activity participation and fundamental movement skill development.

#### 5 SCHOOL CANTEEN QUESTIONNAIRE

The school canteen questionnaire was developed by a working group of the NSW School Canteen Advisory Committee and assessed what was sold in school canteens and vending machines, school policies and procedures, and the factors that helped or hindered canteens in offering more-healthy choices. The findings are not presented in this report, but are available from the Centre for Chronic Disease Prevention and Health Advancement, NSW Health.

#### 6 RESPONSE BIAS STUDY

Many of the student response rates were well below 80%, allowing the possibility that there may have been a systematic non-response bias with regard to overweight and obesity (overweight students were less likely to participate in the study). Consequently, the investigators devised a method of characterising the non-response bias. The methods and results of the response bias study are described in Appendix K.

#### APPROVALS

Approval to conduct the survey was received from the University of Sydney’s Human Research Ethics Committee (HREC), the Strategic Research Directorate at the NSW Department of Education and Training and the NSW Catholic Education Commission.

#### FIELD STAFF

The field team consisted of four groups of four field officers: 15 primary and secondary school teachers seconded from all three education sectors plus one of the chief investigators. The team underwent eight days of training and orientation prior to data collection.

## SELECTION OF SCHOOLS AND STUDENTS

Forty-five primary and 45 secondary schools were selected at random so the number of schools selected in each education sector was proportional to the number of students enrolled in that school sector. Special schools, schools with enrolments of less than 180 students and schools in the remote regions of NSW were excluded from the sampling frame. Despite these exclusions, 96% of the secondary school population and 82% of the primary school population were included in the sampling frame.

The likelihood of a school being selected was proportional to the size of the student enrolment. Within each primary school, one class was chosen at random from each of Years K, 2, 4 and 6, and within each secondary school, two classes were chosen at random from each of Years 8 and 10 (one to participate in the main study and one to participate in the physical activity sub-study). In Sydney metropolitan secondary schools, a third Year 10 class was chosen in anticipation of lower response rates due to blood being collected among this group. Finally, three more secondary schools were recruited to increase the number of participating Year 10 students.

## DATA COLLECTION

The data were collected between 26 February and 11 May 2004. Data collection took place concurrently in primary schools and secondary schools, in schools from each education sector and in metropolitan and rural schools, in order to prevent potential bias due to seasonal effects and the effects of progression through the school term on participation rates or performance.

## DEMOGRAPHIC VARIABLES

All students were asked for information about their sex, date of birth, language spoken most at home, Aboriginal or Torres Strait Islander status, school year, suburb and postcode of residence. For students in Years K and 2, this information was extracted from school records and transcribed by field staff onto the student questionnaires. Postcode of residence was used as a proxy for socioeconomic status, based on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage (IRSD). The scores were used to rank students in tertiles of socioeconomic status. Postcode of residence was also used to determine remoteness, using the Accessibility/Remoteness Index of Australia (ARIA; Commonwealth Department of Health and Aged Care, 2001). Students living in 'highly accessible' locations were classed as 'urban' with those living in 'accessible', 'moderately accessible', and 'remote' areas classed as 'rural'. Language spoken most at home was used to categorise students into four main cultural backgrounds: English-speaking, European, Middle-Eastern and Asian.

## ANTHROPOMETRY

Field staff were trained in measuring height, weight and waist circumference using the International Society for the Advancement of Kinanthropometry (ISAK) procedures. These measurements were collected prior to the other tests to avoid fluid loss due to exertion. Height and weight were used to calculate BMI as  $\text{weight (kg)}/\text{height (m)}^2$ . Three categories of BMI were created based on the definitions of Cole et al. (2000): healthy weight, overweight and obese. However, it should be noted that the labelling of these categories differs slightly from that of Cole et al. (2000). Cole and his colleagues were not able to provide a definition of underweight, so they labelled the first category 'non-overweight' in recognition of the fact that it included BMI values that were sufficiently low to suggest poor health. This report uses the term 'healthy weight' for the same BMI category in the interests of improved readability for a wide audience of readers. However, the 'healthy weight' category may also include children and adolescents with very low BMI values.

## FUNDAMENTAL MOVEMENT SKILL ASSESSMENTS

Seven fundamental movement skills were assessed – four locomotor skills (sprint run, vertical jump, side gallop and leap) and three object-control skills (catch, overhand throw and kick) using process-oriented checklists comprising five to seven components for each skill. Each skill is composed of observable, behavioural components that together constitute a proficient or mature performance. For each skill, a score was calculated for each student based on the total number of components performed correctly. The skills selected for assessment were those closely related to activities and sports in which students were most likely to participate and also allowed direct comparison with previous studies. Students should be developmentally able to master all of these skills by the end of Year 5 (Department of Education Victoria, 1996).

The number of components for each skill was summed to give a total score for each skill. From this, two fundamental movement skill proficiency outcomes were created. First, the proportion of students who possessed all components of a skill (mastery) and, second, the proportion of students who possessed all but one component of a skill (near-mastery). For some of the sociodemographic comparisons, the mastery and near-mastery groups were combined and the new category called 'advanced skills'. The proportion of students who possessed each component of each fundamental movement skill (skill component mastery) is also reported.

## CARDIORESPIRATORY ENDURANCE

The 20-metre shuttle run test was used to assess cardiorespiratory endurance (Leger & Lambert, 1982). Scores were recorded as the level and shuttle reached in the test. This score was then converted to the number of laps completed to provide a continuous variable for analysis. Cardiorespiratory endurance was also categorised using the criterion-reference standard from *FITNESSGRAM* (Cooper Institute for Aerobic Research, 1999). The categories were unfit and fit.

## SELF-REPORTED INFORMATION PHYSICAL ACTIVITY

The *Adolescent Physical Activity Recall Questionnaire* (APARQ) (Booth, Okely, Chey & Bauman, 2002) was administered to students in Years 8 and 10, and Year 6 students completed a modified version of this instrument. APARQ had two main components: participation in organised sports, games and other activities, and participation in non-organised physical activities. Organised physical activities were defined as usually involving training and competition, having a coach, and being organised by adults. Examples included attending dance and gymnastics classes, swimming and athletic clubs, and playing football, basketball and other team sport. Non-organised physical activities were defined as those that were not structured or formal, did not involve regular training or competition, did not have a coach and were not usually organised by an adult. Examples included skateboarding and roller blading, casual ball games and surfing.

For both organised and non-organised physical activity children were asked to think about a normal week's activities during summer school terms (Terms 1 and 4) and winter school terms (Terms 2 and 3). They were asked to report every activity in which they participated (including training for organised activities), and the frequency and average duration of each activity in which they participated. For organised activities, four school-based categories were labelled to assist Year 6 students' recall and to help them understand the different types of physical activity in which they could participate. These were representative school sport (Primary Schools Sports Association, PSSA), non-representative school sport (non-PSSA), fitness (activities usually conducted as a circuit), and physical education (PE). Students could only select PSSA or non-PSSA as their school sport (that is, they could not participate in both at the same time). For non-organised physical activities, two school-based categories were labelled for Year 6 students: recess and lunch.

The following categories of physical activity participation were constructed, based on the *Physical Activity Recommendations for Children and Young People* (Department of Health and Ageing, 2004):

> **Moderate**

Students who accumulated at least seven hours of moderate-intensity physical activity over at least seven sessions during a normal week for at least 10 minutes per session.

> **Vigorous**

Students who accumulated at least 60 minutes of vigorous-intensity physical activity over at least three bouts lasting a minimum of 20 minutes each time, during a normal week.

> **Inactive**

Students not in the moderate or vigorous categories.

In line with the physical activity recommendations and to make the interpretation of the data easier, the moderate and vigorous categories were combined into one category, labelled 'active'.

## TRANSPORT TO AND FROM SCHOOL

Students were asked to report, separately, how they travelled to school and how they travelled from school in a usual week. A checklist of eight modes of transport was provided (walking, train, cycle, car, school bus, other bus, ferry and other) and students were asked which modes of transport they used, on how many days they used these types of transport (one to five), and how long they spent on a mode each time they used it. Students could report more than one mode of transport for each trip. From the raw data, the following categories were constructed, for travel to school and travel home from school separately:

> **Car travel**

Students reported travelling by car as the only mode of transport and reported travelling by car to school or from school five times per week.

> **Walking**

Students reported walking as the only mode of transport and reported doing so four to five times per week or students reported walking and travelling by car. Some students travel partially by car and partially by walking every day (reporting five car trips and five walking episodes) or walk the whole trip on some days and travel by car for the whole trip on other days (reporting a total of five car and walking trips in a week). Students who did not report in one of these two ways were excluded from further analyses.

> **Public transport**

Students reported using at least one form of public transport. Students who reported being regular users of trains, buses or both (whether or not they also travelled by car) were classified as public transport users.

> **Cycling**

Students were identified as cyclists if they only reported cycling and also reported cycling five times per week. So few students were identified as cyclists that they are not reported separately.

The proportion of boys and girls in each Year in each of the three travel categories above (car travel, walking and public transport) and these proportions by urban and rural regions, socioeconomic status, cultural background and overweight category are reported. In addition, the time spent walking over a normal week for those in the walking category and for those in the public transport category is reported.

## SEDENTARY BEHAVIOURS

Students were asked to think about a normal school week, and, from a list of 11 sedentary behaviours, write down how long they spent engaged in each behaviour, before and after school on each day of the week and on weekends. The raw data were summarised to yield the total number of minutes spent in sedentary behaviours per week.

They were also used to determine the total number of minutes spent in each of the following categories of sedentary behaviours per week:

- > **Small screen recreation**  
Watching TV, watching videos/DVDs, using the computer for fun.
- > **Education**  
Using the computer for doing homework, being tutored, Saturday school.
- > **Travel**  
Travel by car, bus, train or boat.
- > **Cultural activities**  
Reading for fun, doing crafts or hobbies, playing/practising a musical instrument.
- > **Social activities**  
Sitting around (chatting with friends, chilling), going to church.

The statement from *Australia's Physical Activity Recommendations for Children and Young People* that 'Children should not spend more than 120 minutes per day using electronic media for entertainment...' was the basis for forming the following categories:

- > **Sedentary**  
Students who accumulated 840 minutes (14 hours) or more of small screen recreation over seven sessions or more during a normal week (more than two hours per day).
- > **Non-sedentary**  
Students not in the sedentary category.

## FOOD HABITS AND EATING BEHAVIOURS

Consumption of a set of indicator foods (vegetables, fruit, soft drinks and fast food) was measured as evidence suggests that they are associated with obesity or other health outcomes such as cardiovascular disease (CVD) or cancer (Bazzano et al., 2002). Patterns of eating, including skipping meals and eating foods outside the home, were also examined, as the evidence suggests an association with overweight and obesity (Jeffery & French, 1998). Eating patterns and family, peer and media influence over eating habits were examined to determine if a

similar association was present among adolescents in this sample as has been reported in studies of US adolescents (Story, Neumark-Sztainer & French, 2002).

### The questionnaire covered:

- > **Food type frequency and amount**  
Consumption of milk, soft drink, fruit juice, fruit, vegetables, bread, pasta/rice, red meat, chicken, fish, confectionery, fried potato, salty snacks.
- > **Food and drink purchase**  
Food and drinks purchased outside the home and on the way to and from school or at school.
- > **Family food habits**  
Context of the evening meal and other meals, food purchasing and preparation, snacking between meals.
- > **Attitudes**  
Availability, convenience and enjoyment of fruit, vegetables, soft drinks, fast foods: importance of health, appearance, active and inactive recreation.
- > **Body shape**  
Satisfaction and disordered eating.

## BIOMARKER SUB-STUDY

The following biomarkers were selected:

- > Insulin and glucose as indicators of glucose metabolism and risk of diabetes.
- > Blood lipids, including HDL and LDL cholesterol and triglycerides to establish risk of cardiovascular disease.
- > Liver function tests to establish risk of fatty liver disease.
- > High sensitivity C-reactive protein, which is a novel marker and indicates inflammation and risk of future cardiac disease and diabetes.

Blood pressure was also measured.

Secondary schools in the Sydney metropolitan area were asked to participate in the biomarker sub-study at the same time as they were asked to participate in the main SPANS study. Two classes of Year 10 students in each of these schools were asked to participate, in anticipation of a low response rate.

Students were asked to fast overnight, and the blood samples were taken during the first period of the day. Students were seated quietly while awaiting measurement and each student was measured in private. Biological markers, in particular glucose metabolism, can be affected by pubertal status so students were asked to self-report their pubertal status, using Tanner scales (Tanner, 1962).

All of the blood samples were taken by a trained blood collector from a National Association of Testing Authorities (NATA)-accredited commercial pathology company. Approximately 20 ml of venous blood was taken and placed in three pathology tubes, which were transported ambient, via courier network, to a NATA-accredited pathology laboratory for analysis. Students were then offered breakfast and continued with the other components of the study.

Blood pressure was measured by a registered nurse using a mercury sphygmomanometer on the right arm with an appropriately sized cuff after the student had been seated quietly for 10 minutes. The first and fifth Korotkoff sounds were recorded as systolic and diastolic blood pressure, respectively.

## DEFINITIONS OF RISK FOR EACH BIOMARKER

### Insulin

The authors consulted with specialist paediatric endocrinologists and with the president-elect of the International Diabetes Federation (Prof Martin Silink) and identified two values of fasting insulin. The first was the value at which clinicians would be sufficiently concerned that they would pursue further investigations and consider treatment (>100 pmol/L). The second was the value associated with increased risk of cardiovascular disease.

### Alanine aminotransferase (ALT)

The cut-point for defining elevated ALT was identified through a two-stage process. First, from among the group of students in the healthy BMI category, those with high blood pressure, elevated LDL cholesterol or triglycerides were excluded. Second, the values of the 95th centile of ALT for the remaining boys and girls, separately, were identified. These values were 32U/L and 20U/L for boys and girls, respectively.

### $\gamma$ -glutamyltransferase (GGT)

GGT is elevated in almost all types of liver disease and is not as specific as ALT in suggesting fatty infiltration. A GGT value of 30 U/L or above is considered elevated among adolescents and adults (Rochling, 2001). However, this cut-point probably underestimates the prevalence of liver damage.

### High sensitivity C-reactive protein (hsC-rp)

The prevalence of students with hsC-rp above the 75th centile (2.96 mg/L) of the population reference supplied by the laboratory is reported.

### High density lipoprotein (HDL) cholesterol

The *Cholesterol in Childhood guidelines* (American Academy of Pediatrics, 1992) recommend children and youth with an HDL concentration below 1.03 mmol/L should be considered at risk. The SPANS analysis is based on this definition.

### Low density lipoprotein (LDL) cholesterol

The American Academy of Pediatrics (1992) statement on cholesterol in childhood recommends an LDL level less than 130 mg/dL (3.4 mmol/L) in adolescents from families without hypercholesterolaemia or premature cardiovascular disease.

### Triglycerides

The American Heart Association has recommended that a triglyceride concentration of <1.69 mmol/L is normal, 1.70-2.25 mmol/L borderline high, 2.25-5.63 mmol/L high and >5.65 mmol/L is very high. In the current analyses, concentrations greater than 2.25 mmol/L were categorised as high.

## BLOOD PRESSURE (BP)

Identification of hypertension requires, at least, that blood pressure be measured on three separate occasions and further assessed by a specialist physician. Consequently, as BP was measured on only one occasion, the results do not reflect the prevalence of high blood pressure. However, a definition of high blood pressure based on a single measure (details are provided in Chapter 17) was used for the purposes of comparing the demographically defined groups.

## PHYSICAL ACTIVITY SUB-SURVEY

In each secondary school, a second Year 8 and Year 10 class completed the physical activity questionnaire used in the *Australian Health and Fitness Survey 1985* (Australian Council for Health, Physical Education and Recreation, 1987). This survey was undertaken nationally in 1985 and the physical activity participation items were also administered in SPANS to allow identification of secular trends in physical activity participation over the period 1985-2004.

## SCHOOL ENVIRONMENT QUESTIONNAIRES

### PHYSICAL ACTIVITY ENVIRONMENT QUESTIONNAIRE

This questionnaire (see Appendix I) sought information on the facilities at or near the school that might be used for sports or other physical activities, the availability and frequency of use of those facilities (before school, lunchtimes, after school), the time allocated for physical education (PE) lessons and sport, the range of activities offered for PE, which members of school staff taught PE and sport, strength of support for sport and PE, barriers within the school to skill development and participation in sport and other physical activities and the extent to which different strategies were used to promote participation in physical activity among the students.

## SCHOOL CANTEEN QUESTIONNAIRE

The school canteen questionnaire (see Appendix J) was part of the NSW Healthy School Canteen Strategy, a key component of the *Prevention of Obesity in Children and Young People: NSW Government Action Plan 2003-2007*. This survey collected information on what is sold in school canteens and vending machines, food-related school policies and procedures and the factors that help or hinder canteens from offering more healthy choices.

## THE RESPONSE BIAS STUDY

The response bias study was conceived and conducted in order to determine if estimates of the prevalence of overweight and obesity, based on the SPANS data, were biased due to a systematic response bias. The methods used were validated as part of the response bias study and the results indicated that the SPANS data were not biased.

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