Adoption of the Good Sports Programme

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List of Abbreviations

ABS	Australian Bureau of Statistics
ADF	Australian Drug Foundation
AIC	Akaike's information criterion
AIHW	Australian Institute of Health and Welfare
ANOVA	analysis of variance
BAC	blood alcohol content
BEM	Behavioural Ecological Model
BIC	Bayesian information criteria
BMI	body mass index
CHD	coronary heart disease
DASS	Depression, Anxiety and Stress Scale
DoHA	Australian Government Department of Health and Ageing
DV	Dependent Variable
GFI	Graduated Frequency Index
HBM	Health Belief Model
IBM	Integrated Behavioural Model
ICC	the intraclass correlation
IOM	Institute of Medicine
LMM	Linear Mixed Model
MDMA	methylenedioxymethamphetamine
ML	maximum likelihood
MLM	multilevel modelling
MLR	multilevel logistic regression

MM	mixed model
NHMRC	National Health and Medical Research Council
NSW	New South Wales
OLS	ordinary least squares
RBT	random breath testing
RCT	randomised controlled trial
REML	restricted maximum likelihood
RSA	responsible serving of alcohol
SA	South Australia
SBC	Schwarz's Bayesian Criterion
SCAP	Sporting Clubs Alcohol Project
SCT	social cognitive theory
SE	standard errors
SES	socioeconomic status
STS	safe-transport strategy
TPB	theory of planned behaviour
TRA	theory of reasoned action
TTM	the Transtheoretical Model
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

Abstract

Approximately 26% of Australian adults are involved with community sport clubs. Although community sport clubs have the potential to improve health, current evidence reveals that they are settings for high rates of alcohol use and harm. The aim of this thesis was to examine the Good Sports programme by examining whether various indicators of adoption of the programme were associated with lower rates of risky alcohol consumption and drink-driving among community sports clubs members.

Using a three level accreditation process, the Good Sports programme assists community sports clubs to implement alcohol-related harm reduction strategies. Once a club has implemented all relevant strategies, they are classified as a 'stage-three'[1] accredited Good Sports club. In keeping with evaluation theory for large scale interventions, a series of studies (four adoption studies) were completed. All four studies found associations that aligned with the proposition that higher adoption (measured variously as time in program, or levels of club accreditation or strategy implementation) of the Good Sports programme would be associated with lower rates of risky drinking and drink-driving. Multilevel analyses were guided by model fit criteria to select an optimal selection of measures of program adoption and predictors of alcohol and driving behaviours.

Study one found that stage two club members consumed 19% less alcohol than stage one club members on the main playing day (Saturday), and that more time in the programme was associated with reduced consumption. Accreditation level also predicted a

[1] 'Stages' of accreditation are usually referred to as 'levels' of accreditation'; however, to avoid confusion with 'levels' of data, levels of accreditation will be referred to as stages throughout this thesis.

33% (95CI: 02-55) reduction in the odds of any club member being a long-term risky drinker.

Using accreditation as a continuous variable study three replicated the findings of study one. Study three identified a 20% (95CI: 5-33) reduction in odds per accreditation stage in risky consumption on the playing day; a 15% (95CI: 1-26) reduction in odds, per accreditation stage for short-term risky drinking for the week prior to the survey; and a 14% (95CI: 2-25) reduction in odds, per accreditation stage, for long-term risky drinking.

Study two found that higher stages of Good Sports implementation were associated with lower rates of drink-driving; however, study two (using the same sample and design as study one) found that the prevalence of drink-driving in stage one and stage two clubs was not significantly different. Nevertheless, members of stage two clubs with 10 drink-driving countermeasures formally implemented were less likely to drink-drive than individuals in clubs with zero (Level one clubs) or less than 10 countermeasures formally in place.

Study four (using the same sample and design as study three) found that for each season a club was in the programme there was an 8% (95CI: 1-14) reduction in the odds of drink-driving. The findings were partly inconsistent with study two which did not find time in the programme was associated with reduced odds of drink-driving.

Overall, the consistency across a range of evidence suggests that there is an association between adoption of the Good Sports programme and reduced alcohol consumption and drink-driving. The results of this thesis provide promising preliminary evidence supporting more extensive evaluation of the potential for the Good Sports programme to reduce alcohol use and long and short term harm from this drug for a significant proportion of the Australian community. A literature review, a theoretical framework, and analytical methods are also presented as independent chapters.

General Declaration

Monash University, Monash Research Graduate School

Declaration for thesis based or partially based on conjointly published or unpublished work

In accordance with Monash University Doctorate Regulation 17/Doctor of Philosophy and Master of Philosophy (MPhil) regulations, the following declarations are made:

I hereby declare that this thesis contains no material that has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes four original papers submitted for publication in peer reviewed journals. The core theme of the thesis is alcohol consumption and drink driving in community sports clubs. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the candidate, working within the schools of psychology under the supervision of Associate Professor Felicity Allen (Monash University) and Professor John Toumbourou (Deakin University).

The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research.

In the case of Chapters four, five, six and seven, my contribution to the work involved the following:

Thesis chapter	Publication title	Publication status	Nature and extent of candidate's contribution
Four	Impact of Alcohol Harm-Reduction Strategies in Community Sports Clubs: Pilot Evaluation of the Good Sports program	Published	65–70%
Five	Reducing alcohol-impaired driving in community sports clubs: Evaluating the Good Sports program	Published	65–70%
Six	Association of risky alcohol consumption and accreditation with the 'Good Sports' alcohol-management programme	Published	65–70%
Seven	Drink driving in Community Sports Clubs: Adoption of the Good Sports alcohol-Management Program	Published	65–70%

The four studies have been inserted into the thesis in published format, as is permitted by Monash University. The publications have their own numbering; however, to generate a consistent presentation within the thesis, the pages also align with the overall page numbering of the thesis as a whole. While all four articles have been accepted for publication, at the time of this thesis submission, some articles were only available in online, electronic format.

Signed:

Date: **25 March, 2012**

Ethics Approval

The research for this thesis received the approval of the Monash Standing Committee for Ethical Research on Humans (Reference Number: 2005/958EA)

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Chapter 1: Introduction

This chapter serves two purposes: first, it acts as a broad introduction to the thesis; second, it sets up the rationale for the four studies undertaken as part of this thesis. The chapter begins by describing the nature and harms of alcohol use in Australia and internationally. This is followed by an outline of the epidemiology of alcohol consumption and the associated harm of driving while alcohol impaired (drink driving). Evidence indicating that environmental influences can affect alcohol consumption and drink driving is also examined. Evidence of risky alcohol consumption occurring in community sports clubs and the need for an intervention in this setting targeting risky drinking and alcohol-impaired driving is then presented. An outline of the current evidence associated with the Good Sports program—an alcohol-management programme for community sports clubs is also presented. This is followed by a rationale for the four studies that are undertaken as part of this PhD.

In presenting evidence, a population health approach (sometimes referred to as a public health approach) has been taken. Thus, factors associated with changing the behaviour of large groups of people, as opposed to specific individuals, are the primary focus. While evidence associated with individual differences in alcohol-related behaviour is presented, this evidence predominantly concerns demographic factors; individual difference factors, such as personality, motivations etc. are not the focus. Macro influences are defined in this thesis as environmental and societal features that influence behaviour change at a population level. The justification for taking a population health approach is developed in Chapter 2.

1.1 Alcohol: A Legal and Commonly Used Drug

Alcohol is a legal mood-changing drug. It can be bought packaged at supermarkets, hotels and bottleshops; it can also be purchased by the glass at dedicated licensed drinking establishments, cafes and public gatherings, such as football and cricket matches and festivals (Hughes, Anderson, Morleo & Bellis, 2007; Norstrom, 1998). Drunk in the form of wine, beer, or spirits, alcohol is used to facilitate social intercourse, celebrate or commiserate (Babor et al., 2010). Its active ingredient ethanol is a depressant and when consumed in small doses can make an individual feel relaxed or excited; when consumed in larger amounts, alcohol can slow reflexes; thus making judgement, coordination and mobility more difficult and hazardous (Edenberg, 2007). Consumed at high levels over long periods, alcohol can undermine physical health and cause cancers and other disease (Anderson, Chisholm & Fuhr, 2009).

Approximately 2.3 billion people worldwide consume alcohol (World Health Organization [WHO], 2004). In the United States of America (USA), data on international food and drink trends show that 8.5 litres of pure alcohol is consumed per capita, per year. This is equivalent to 480 large (500 ml) cans of beer per year, per adult person (WARC, 2005). Similar consumption levels are reported in other developed countries such as Australia (8.5 litres); slightly higher levels are reported in New Zealand (10 litres), Great Britain and Northern Ireland (10.2 litres) (WARC, 2005). Alcohol has been identified as one of the major global health risk factors, as it accounts for 3.7% of all deaths (2.1 million) and 4.6% of the global burden of disease (Babor et al., 2010).

1.1.1 The effects of alcohol on the body.

Alcohol affects the body after absorption into the bloodstream (Edenberg, 2007). Usually five minutes after consumption, alcohol enters the bloodstream and starts to affect

the brain; depending on the amount consumed, some level of behavioural impairment may be observed. Thirty minutes after the last alcoholic drink has been consumed, all imbibed alcohol has reached the bloodstream. It usually takes one hour for a person to metabolise a standard drink containing 10 g of alcohol (Kalant, 1996). However, the rate of metabolism is contingent on a number of biological factors such as gender, ethnicity, liver size, body mass index (BMI), time of day and genetic differences (Samir, 2006). It has also been suggested that stress, ethnicity and fatigue may also influence blood alcohol content (BAC) levels (Watson, Watson & Batt, 1981).

Impairment caused by alcohol consumption is usually assessed by BAC. The usual methods for measuring BAC are through breathalysers or blood tests (WHO, 2007a). Breathalysers assess the amount of alcohol in a given proportion of exhaled breath; blood tests analyse the proportion of alcohol per unit of blood (usually per 100 ml of blood). Breathalysers are usually used at randomly located breath-testing stations by law enforcement agencies; blood testing is usually undertaken in clinical settings (Homel, 1993). There is a close correlation between breath and blood alcohol levels (Gibbs, 1984). Less intrusive methods are via scientific formulae, and these generally use self-reported information to calculate BAC, such as the amount of alcohol consumed (grams of alcohol or number of standard drinks), over what time, and the weight and gender of the drinker (Watson et al., 1981).

Table 1.1 outlines the effects of particular BAC levels on the body. A BAC between 0.01 and 0.05 g/100 ml is usually associated with increased heart and respiration rates, and decreased judgement and inhibitions. A BAC between 0.06 and 0.10 g/100 ml causes decreased attention and alertness, slowed reactions, impaired coordination and reduced muscle strength (Lang, 1992). Impairment increases as alcohol intake increases, thus for drivers, the risk of being involved in a traffic accident also increases. The relative

risk of a car crash increases as the BAC goes beyond 0.04 g/100 ml; at 0.10 g/100 ml the odds that a driver will be involved in a crash compared to a driver with a BAC of zero increases five times; individuals with a BAC of 0.24 g/100 ml increase their risk by 80 times, and individuals with a BAC above 0.24 g/100 ml increase their risk by approximately 140 (Hurst, Harte & Frith, 1994).

Table 1.1

The Effects of BAC Levels on Body and Performance

BAC (g/100 ml)	Effects on the Body
0.01–0.05	Increase in heart and respiration rates Decrease in various brain functions Inconsistent effects on behavioural tasks performances Decrease in judgement and inhibitions Mild sense of elation, relaxation, and pleasure
0.06–0.10	Physiological sedation of nearly all senses Decreased attention and alertness, slowed reactions, impaired coordination, and reduced muscle strength Reduced ability to make rational decisions or exercise good judgement Increase in anxiety and depression Decrease in patience
0.10–0.15	Dramatic slowing of reactions Impairment of balance and some movement Impairment of some visual functions Slurred speech Vomiting, especially if BAC is reached rapidly
0.16–0.29	Severe sensory impairment, including reduced awareness of external stimuli Severe motor impairment, e.g. frequent staggering or falling
0.30–0.39	Non-responsive stupor Loss of consciousness Anaesthesia comparable to that for surgery Death (for many)
0.40 & greater	Unconsciousness Cessation of breathing Death due to respiratory failure

Source: Lang (1992)

1.2 Consequences of Alcohol Consumption

There are long- and short-term consequences of alcohol consumption; these may be health, social or economic. Long-term health consequences include alcohol-related diseases such as cirrhosis of the liver; stroke; hypertension; cardiovascular disease; cancers of the mouth, lips, throat and oesophagus; cancer of the stomach, pancreas and liver; bowel cancer; and breast cancer (National Health and Medical Research Council [NHMRC], 2009). Short-term health consequences include fatalities, physical injury or road accidents due to impaired cognitive performance, and diminished reaction times. Social consequences may include domestic violence (WHO, 2007a), absenteeism (Klinegemann & Gmel, 2001), violence and crime (Graham & West, 2001). Approximately 70,000 Australians a year are victims of alcohol-related assaults, and 24,000 are victims of alcohol-related domestic violence (Laslett et al., 2010). A conservative estimate of the economic costs of excessive alcohol consumption to the Australian community has been in the region of $15.3 billion per year (Collins & Lapsley, 2008). Worldwide, it has been estimated that alcohol causes 3.7% of all deaths (2.1 million individuals) (WHO, 2007b).

For many people, the consumption of alcohol is used as a social lubricant or to accompany a meal, and thus alcohol consumption will probably not affect their health (WHO, 2004). However, for middle-aged and older males, it has been suggested that low levels of alcohol consumption (less than two standard drinks per day) can reduce the risk of cardiovascular and cerebrovascular disorders, and for post-menopausal women, it is said to reduce the risk of ischaemic stroke (Holman, English, Milne & Winter, 1996; Puddey, Rakic, Dimmitt & Beilin, 1999; Rehm et al., 2003). There is also evidence associating moderate consumption with protection against diabetes and gallstones (Ashley, Rehm, Bondy, Single & Rankin, 2000; Attili, Scafato, Marchioli, Marfisi & Festi, 1998). However, as the beneficial effects of alcohol are mostly associated with particular groups

of individuals (e.g. older men and women), and as alcohol consumption causes more than 60 disease conditions (Gutjahr, Gmel & Rehm, 2001), the detrimental effects of risky consumption far outweigh the alleged benefits (Rehm et al., 2004).

1.3 Patterns of Alcohol Use: Drinking Guidelines

Most countries have drinking guidelines to assist people reduce the long- and short-term consequences of alcohol consumption. Guidelines vary between countries; some describe a range (e.g. between three and four drinks per day in the United Kingdom [UK]), and some provide weekly maximums (e.g. no greater than 21 drinks per week in Denmark) (ICAP, 2010). A standardised measurement is used to assess a drink, and this usually contains a specific amount of alcohol. In Canada, for example, a standard drink contains 13.6 g of alcohol, in the USA a standard drink contains 14 g of alcohol, and in Japan a standard drink contains 19.8 g of alcohol (ICAP, 2010).

1.3.1 Australian drinking guidelines.

In 2009, the NHMRC issued a set of Australian drinking guidelines. The guidelines contain four recommendations for ‘low-risk’ drinking (see Table 1.2). Low risk is defined as drinking at a level that reduces the chance that an individual will suffer from short-term injury or long-term disease (NHMRC, 2009). The first guideline focuses on the consequences of risky drinking in the long-term; the second on the consequences of risky drinking in the short term; and the other two focus on harms of drinking for children and pregnant women. Both long- and short-term risky drinking guidelines apply equally to both men and women. The NHMRC guidelines are based on the measure of an Australian ‘standard drink’, and is defined as a beverage containing 10 g or 12.5 ml of pure alcohol (NHMRC, 2001). Other types of common drinking classifications are outlined in Table 1.2, and in the text that follows.

Table 1.2

Different Types of Drinking and the Effects of Drinking

Type of drinking	**Description and effects**
Long-term risky drinking (NHMRC guideline 1)	Greater than two standard drinks every day, is associated with cirrhosis of the liver; stroke; hypertension; cardiovascular disease; cancers of the mouth, lips, throat and oesophagus; cancer of the stomach, pancreas and liver; bowel cancer; and breast cancer (NHMRC, 2009).
Short-term risky drinking (NHMRC guideline 2)	Greater than four standard drinks in one sitting, is associated with includes physical injury, or road accidents due to impaired cognitive performance, and diminished reaction times. (NHMRC, 2009).
Alcohol Dependence (DSM-IV) (APA, 1994)	Usually regular and heavy drinking over a prolonged period. When drinking stops, withdrawal symptoms such as tremors, sweating and inability to sleep are experience; may experience seizures, tremors, and anxiety, and reduced social functioning (APA, 1994).
Alcohol use by young people under 18 and by pregnant women (NHMRC guideline 3 & 4)	Even low levels of alcohol use are harmful and are to be discouraged, as they may affect brain development of the foetus and young children. For young children may also be linked to alcohol problems later in life (NHMRC, 2009).
Intoxication	Mild: reduced inhibitions and judgement Heavy: rambling conversation; swaying; vomiting; possibly loud and boisterous; Severe: may cause unconsciousness, and may result in death (APA, 2000).

1.3.2 Long-term risky drinking.

The NHMRC long-term risk guideline states that healthy men and women are advised not to drink more than two standard drinks on any one day. According to this guideline, if an individual drinks less than two drinks per day, the probability that he or she

will suffer from long-term alcohol-related disease or injury is substantially reduced, compared to someone who drinks more than two drinks a day (NHMRC, 2009).

1.3.3 Short-term risky drinking.

The second national guideline has been developed to reduce the risk of injury on a single occasion of drinking (i.e. binge drinking) (NHMRC, 2009). It states that, for both men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion. Risk of injury includes physical injury, or road accidents due to impaired cognitive performance, and diminished reaction times. Short-term risky drinking is most often associated with intoxication. Intoxication in its mildest form produces slight changes in inhibition, reduced coordination, and decreased alertness; more extreme forms may involve slurred speech, boisterous behaviour, aggressive behaviour, inappropriate sexual behaviour, swaying, rambling conversation and difficulty concentrating (APA, 1994).

1.3.4 Binge drinking.

In the last decade, there has been a growing concern about short-term heavy drinking, for example, the type of heavy or above average consumption that often occurs at celebrations or special events on a semi-regular basis (Roche, 1999). This type of consumption is sometimes referred to as binge drinking, as it refers to the consumption of large amounts of alcohol in drinking sessions that may occur episodically on weekends and typically interspersed with days of no or low alcohol use; binge drinking is most common among young people and social drinkers (Herring, Berridge & Thom, 2008).

1.3.5 Alcohol dependence.

Binge drinking is sometimes distinguished from chronic heavy drinking that is common among those dependent on alcohol. Dependence is usually characterised by heavy

and prolonged drinking, preoccupation with alcohol, loss of control, and withdrawal symptoms such as tremors, sweating and inability to sleep when the individual stops drinking (APA, 1994). Some individuals may also experience visual hallucinations, increased anxiety, and reduced social functioning (APA, 1994).

The Australian guidelines are grounded in the notion of epidemiological risk. Risk, in epidemiology, is defined as the probability that a person will experience a particular health outcome in a given period (Rothman, Greenland & Lash, 2008). Thus, the drinking guidelines are presented in terms of risky outcomes occurring immediately after drinking (short term) and in the course of a lifetime (long term) (NHMRC, 2009). Short-term risk is calculated by adjusting for the average amount of alcohol consumed in a sitting, average number of times an individual consumes alcohol, the age and gender of an individual, and using injury and mortality data for the individual's age cohort, to assess risky levels of consumption (Rehm, Room & Taylor, 2008). Similarly, long-term risk is based on average daily volume of alcohol intake over a lifetime, and adjusted for age, gender, and relevant alcoholic related diseases (Rehm et al., 2008).

1.4 Epidemiology of Alcohol Consumption

Several factors are associated with alcohol consumption (both at-risk drinking and dependence) for individuals predominantly over the age range of 15–18 years; these include both individual and broader contextual and environmental factors. Most of the research focusing on the individual factors is epidemiological; thus, its focus is prevalence and frequency, and therefore it does not provide evidence of a direct causal link. However, epidemiological studies do show that certain variables are associated with alcohol consumption (Rothman et al., 2008). An association identified through epidemiology is strengthened if the association can be supported with a theory linking the two variables (Bailey, Vardulaki & Chandramohan, 2005).

Table 1.3 summarises large studies that identify individual-level factors associated with alcohol consumption over 18 years of age; they include large Australian and international cross-sectional studies systematic reviews and meta-analyses. These studies have been located through systematic searches of the Psychinfo, Medline, CINAHL, SPORTdiscus and ERIC databases. As systematic reviews and meta-analyses have rigorous guidelines, including search strategies, inclusion and exclusion criteria, and processes for reviewing of the evidence, they provide high quality evidence for factors associated with alcohol consumption (Peat, 2002). Table 1.3 also briefly outlines the strengths and limitations of the studies, demonstrating factors associated with alcohol consumption and drink driving (driving while impaired). Overall, in this thesis, individual factors associated with alcohol consumption include genes, age, gender, illicit drug use, mental health, socioeconomic status (SES) and marital status.

1.4.1 Genes.

The focus of the genetic research has been on hereditable causes of alcohol dependence. Some research has been done with twins. As monozygotic (identical) twins share 100% of their chromosomal genetic material, and dizygotic (fraternal) twins share 50% of their chromosomal genetic material, they are used for studies examining genetic associations (King, 2007). Meta-analyses of large-scale twin studies demonstrated that genes, and genes combined with environmental influences, can account for up to 60% of the variance in studies of alcohol dependence (Heath, 1995; Marcos, Pastor & González-Sarmiento, 2008). Thus, individuals who carry genes linked with alcohol dependence are at greater risk of being unable to control their drinking than individuals without them.

Meta-analyses also demonstrated that certain genes (e.g. ALDH2 & ADH1B) may protect against alcohol dependence (Luczak, Glatt & Wall, 2009). These genes, found more frequently in Asian groups than Caucasians, affect the liver's ability to metabolise

alcohol and result in a negative physiological effect, usually flushing, nausea and enhanced subjective feelings of intoxication (Cook et al., 2005). These unpleasant effects, occurring soon after consuming alcohol, usually deter these individuals from consuming alcohol, or from consuming large amounts of alcohol, thus reducing their overall risk of alcohol dependence.

Table 1.3

Factors Associated with Alcohol Consumption for Individuals Mostly over 18 Years of Age

Variable	Associations	Description	Strengths & limitations
Genetics	Alcohol Consumption	**Review:** Individual genes and other genes in combination with environmental factors can predispose individuals to alcohol dependence (Heath, 1995)	**Strengths**: Presents chronological development of evidence base and international evidence **Limitations:** Does not use traditional systematic approach to evaluating the evidence. Focus is on alcohol dependence
Genetics	Alcohol Consumption	**Meta-analyses** Several meta-analyses demonstrating particular genes with alcohol dependency and heritability of alcoholism (Marcos et al., 2008; Smith, Watson, Gates, Ball & Foxcroft, 2008; Walters, 2002)	**Strengths:** Large meta-analyses all finding associations with particular genes and alcohol dependence **Limitations**: Only focuses on dependence
Genetics	Alcohol Consumption	**Meta-analyses** indicate that certain genes (ALDH1B & ALDH2) may be protective of alcohol consumption (Luczak et al., 2009)	**Strengths:** Demonstrates strong case for a biological basis to an aversion to alcohol **Limitation**: ALDH1B and ALDH2 are rare genes, thus the study has limited application
Age	Alcohol Consumption	**International prevalence** data: In developed countries (e.g. Australia, Canada, USA), large proportion of young people (usually between 18–24 years) consume alcohol at risky levels, greater levels than the broader population (Jernigan, 2001).	**Strengths:** Comparison of consumption levels in 67 countries **Limitations:** inconsistent measures of alcohol consumption used, thus difficult to make accurate comparisons
Age	Alcohol Consumption	**Australian National Prevalence** data: indicate risky levels of consumption, and alcohol-related harms associated with younger individuals (Livingston & Room, 2009).	**Strengths:** Representative random sample from the Australian community (N = 29,445) **Limitations:** Cross-sectional and self-reported consumption.

Variable	Associations	Description	Strengths & limitations
Age	Alcohol Consumption & Drink Driving	**American National Youth prevalence** data: Sixty per cent of young people binge drink. Dose-response found with no of binge drinking days and risky behaviour (driving, sexual behaviour, drug use, violence, smoking) (Miller, Naimi, Brewer & Jones, 2007).	**Strength:** Large representative national sample (N = 14,414) **Limitations:** cross-sectional, self-reported consumption
Gender	Alcohol Consumption	**International prevalence** data: Higher proportion of women abstain from alcohol than men (WHO, 2007c).	**Strengths:** data collected from 76 countries **Limitations:** Different measures (e.g. last month, current abstainer), time-frames, and different sampling strategies used in each country.
Gender	Alcohol Consumption	**Australian National Prevalence** evidence suggests that males tend to consume more alcohol than females and greater alcohol-related harms associated with males (Livingston & Room, 2009).	**Strengths:** Representative random sample from the Australian community (N = 29,445) **Limitations:** risky drinking categorised into 5 or more drinks, does not examine dose-response differences between genders, which would be expected with different metabolism rates between genders
Gender	Alcohol Consumption	**American National Youth prevalence** data: young males tend to drink more than females (Miller et al., 2007).	**Strength:** Large representative national sample (N = 14,414) **Limitations:** cross-sectional, self-reported consumption
Gender	Drink driving	**Australian prevalence:** Males compared to females tend to drive while impaired (drink driving) (Harrison & Pronk, 1998).	**Strengths:** Large study (N = 1875), and only one of a couple Australian studies examining gender associations with drink driving **Limitations:** Cross-sectional, has no control group and only univariate analysis undertaken
Gender	Drink driving	**American correlation** data: Young men (16–20 years) who have consumed alcohol (BAC 0.05) 17 times more likely to be involved with alcohol-related road accident, compared to	**Strengths:** Large study using data from road side BAC testing from 48 states of the USA, and data from drivers in road accidents **Limitations:** cross-sectional data

Variable	Associations	Description	Strengths & limitations
		individuals of same age who have not consumed alcohol (Zador, Krawchuk & Voas, 2000)	
Drug and alcohol use	Alcohol consumption	**Cross-sectional** studies indicate that use of illicit drugs associated with risky alcohol consumption and alcohol-related harm (Coffin et al., 2007; Dietze, Jolley, Fry & Bammer, 2005; Kaye & Darke, 2004)	**Strengths:** Unique designs include case-crossover (Dietze, et. al., 2005) and collectively, evidence suggests an association between illicit drug use and alcohol-related harm **Limitations:** cross-sectional and retrospective
Drug and alcohol use	Drink driving and alcohol consumption	**Case-Control Canadian** data indicate illicit drug use and binge drinking associated with impaired driving (Macdonald & Dooley, 1993)	**Strengths:** Case and controls drawn from large representative sample (N = 9943), matched on gender, age, province of residence, education, income, and recent drinking behaviour **Limitations:** Limited to Canadian sample, and drink driving is self-reported, thus results may be influenced by social desirability
Mental health	Alcohol consumption	**Australian Prevalence data** indicates higher level of depression and anxiety associated with higher levels of alcohol use (Rodgers et al., 2000).	**Strengths:** Large study (N = 2275) with randomly selected participants **Limitation:** Cross-sectional and only undertaken in one city of Australia (Canberra)
Mental health	Alcohol consumption	**Meta-analysis** (35 studies): individuals who are dependent on alcohol have greater symptoms of depression compared to general population (Sullivan, Fiellin & O'Connor, 2005).	**Strengths:** Variety of studies included using rigorous inclusion criteria: observational, prevalence and RCTs **Limitations:** Studies included mainly focused on dependence and abuse, only 1 of the 35 studies examined risky drinking
Mental health	Alcohol consumption	**Meta-analysis** (9 studies) higher prevalence of alcohol disorders among those who present with depression (Jane-Llopis & Matytsina, 2006)	**Strengths:** Nine large studies from 10 countries; sample sizes ranging from N = 7076 (Netherlands) to 10,641 (Australia) **Limitations**: Only dependency studies included; studies examining risky drinking are not examined
Blue collar/low SES	Alcohol consumption	**Meta-analysis (international)** (9 studies) indicates that adolescents of low SES are more likely to engage in risky alcohol consumption (Lemstra et al., 2008).	**Strengths:** includes a variety of countries (3 American; 2 UK New Zealand; 1 Finland; 1 Italy, 1 international (34 countries). Total sample: 219, 517 **Limitations:** measures of alcohol and SES differ between studies, and results heavily influenced by the one large international study.

Variable	Associations	Description	Strengths & limitations
			Focus is only adolescents
Blue collar/low SES	Drink driving	**Prevalence Australian evidence** suggests individuals in blue-collar professions and those living in a low-economic areas or those with little education tend to drive while impaired (Harrison, 1998; Nickel, 1990; Peck, Arstien-Kerslake & Helander, 1994).	**Strengths** Harrison (1998) study (N = 1875) is one of a couple identifying SES associations with drink driving **Limitations:** Harrison (1998) has no control group and only univariate analysis undertaken. Peck et al., (1994) analysis undertaken with recidivists. drink drivers

The sections below elaborate on the information in Table 1.3.

1.4.2 Age.

Age is associated with alcohol consumption and alcohol-related harm. The pattern of association suggests a U-shaped relationship with both younger and older individuals being more sensitive to the effects of alcohol than are middle-aged people. National prevalence studies from several developed countries indicated that younger people consume more alcohol than older people (Jernigan, 2001; Livingston & Room, 2009; WHO, 2004). Consumption by younger people (12–20 years) is usually characterised by binge drinking—large amounts in shorter periods—thus, younger people are at greater risk of short-term harms such as drink driving, accidents, injury or fatalities than older people (Miller et al., 2007). Younger people also have less experience consuming alcohol, thus their physical tolerance and metabolism rate for alcohol is much lower, compared to that of older individuals (Kalant, 1996). Lower tolerance combined with little experience as drivers increases their risk of a motor accident compared to older and more experienced individuals who have consumed similar levels of alcohol (Miller et al., 2007). After a certain point, older individuals also have a heightened sensitivity to alcohol, as their bodies have decreased metabolic capacity and thus alcohol stays in their bloodstream for longer periods (Kalant, 1996). American National road fatality data drawn from 48 states indicated that older individuals (over 64 years) have an increased risk of being involved in a motor vehicle crash (Grabowski, Campbell & Morrisey, 2004).

1.4.3 Gender.

Women metabolise alcohol more slowly than men, due to women having lower proportions of lean tissue and smaller livers than men (Kalant, 1996). Thus, women must consume less alcohol than men do to stay under the legal BAC limit and reduce the odds of short-term harm. However, men tend to drink more alcohol than women do, and take more

risks after consuming alcohol, thus increasing their overall risk of long- and short-term harm (Livingston & Room, 2009; Miller et al., 2007; WHO, 2007c). Analysis of Australian epidemiological data suggested that even though women metabolise alcohol more slowly than men, when volume and frequency differences in consumption are taken into account, men and women have similar levels of risk of short- and long-term alcohol-related harm (Rehm et al., 2008).

1.4.4 Illicit drug use.

A series of cross-sectional studies indicates that individuals who use illicit drugs often do so with alcohol (Coffin et al., 2007; Dietze et al., 2005; Macdonald & Dooley, 1993). Combining alcohol with illicit drugs can increase the risk of long- and short-term harm. Alcohol is a central nervous system depressant; therefore, combining it with other depressant drugs such as heroin substantially increases the chances of a fatal overdose (Dietze et al., 2005). A meta-analysis of studies examining effects of alcohol and cocaine found that combining alcohol with cocaine can increase the chance of cardiac problems (Pennings, Leccese & de Wolff, 2002). A narrative review of cannabis and driving concluded that the use of cannabis with alcohol is associated with higher risk of motor vehicle accidents (O'Kane, Tutt & Bauer, 2002). In Australia and internationally, the use of methylenedioxymethamphetamine (MDMA or Ecstasy) is common in younger adults (e.g. the Australian Institute of Health and Welfare [AIHW], 2007; NSDUH, 2008), and a small (N = 18) double-blind randomised control trial found that combining MDMA and alcohol reduced some of the effects of alcohol, but generally increased driving impairment (Kuypers, Samyn & Ramaekers, 2006).

1.4.5 Mental health.

Alcohol consumption can cause mental health conditions, including brain damage, and three sources of evidence suggested that co-occurrence of alcohol consumption and

depression occurs more often than chance (WHO, 2004). These are: 1) prevalence studies showed that among the general population high alcohol consumption is associated with higher prevalence of depression levels (e.g. Rodgers et al., 2000); 2) a meta-analysis of studies of alcohol dependent individuals found that they have higher symptoms of depression than general population (Jane-Llopis & Matytsina, 2006); and 3) a meta-analysis demonstrating a higher prevalence of alcohol disorders among those presenting with symptoms of depression (Sullivan et al., 2005). These three sources of evidence suggested that alcohol dependence is strongly associated with depression.

While alcohol consumption is related to depression, the direction of the relationship remains uncertain. In some cases, alcohol consumption may cause depression; for others, depression may cause self-medication with alcohol. Other risk factors such as trauma may also influence both alcohol and depression. There is evidence that alcohol consumption can precede and cause depression, for example, an international study (N = 29,705) examining patterns of comorbidity between substance use and mental health conditions indicated that the majority of depressive disorders are preceded by alcohol dependence, and depression occurs at a greater rate with males than females (Merikangas et al., 1998). There is also a large body of evidence that abstinence from alcohol can alleviate the symptoms of depression (e.g. Dackis, Gold, Pottash & Sweeney, 1986; Davidson, 1995; Pettinati, Sugerman & Maurer, 1982). Alcohol consumption is associated with other mental health conditions; however, the causal link is less clear. These include anxiety disorders (Thomas, Randall & Carrigan, 2003), bipolar disorder (Goldstein, Diamantouros, Schaffer & Naranjo, 2006) and schizophrenia (Cantor-Graae, Nordström & McNeil, 2001)

1.4.6 Socio-economic status

A Meta-analysis indicates that adolescents of low SES are more likely to engage in risky alcohol consumption (Lemstra et al., 2008). Similarly, an Australian study suggests that

individuals in blue-collar professions and those living in a low-economic areas or those with little education tend to drive while impaired (Harrison, 1998; Nickel, 1990; Peck, Arstien-Kerslake & Helander, 1994).

1.5 Environmental Risk Factors Associated with Alcohol Consumption

While individual characteristics are associated with alcohol consumption, there is also evidence that environmental factors, such as policies and programmes that modify the drinking environment, can change alcohol-related behaviour. Most of these strategies have targeted populations or groups of individuals (as opposed to only high-risk drinkers), such as all consumers in licensed premises in a geographic region, and are usually implemented on a much larger scale than individually focused interventions.

The evidence for the efficacy of environmental strategies summarised below has been selected from Cochrane reviews, systematic reviews and meta-analyses. Again, this type of evidence is noted for its selection of studies with methodologies that reduce threats to causal inference, and therefore provides strong evidence for the behavioural impact of a particular policy or programme (Peat, 2002). The literature evaluating the success of environmental interventions for populations have mostly been based on research in the USA, and use the evidence-based guidelines developed by the US Department of Health and Human Services. These guidelines are titled *The guide to community preventive services: Systematic reviews and evidence-based recommendations* (often referred to as the *Guide*) (see Briss et al., 2000; Truman et al., 2000; Zaza et al., 2000). Although the *Guide* uses a similar approach to that used to evaluate evidence associated with clinical preventive services and medical care, it is specifically developed to assist evaluation of population-based interventions.

The *Guide* provides standardised strategies and a framework to assist in inclusion and exclusion criteria and assessment of study design. Designs often found in community

interventions include non-comparative designs, randomised trials, group randomised trials, prospective cohort studies, and retrospective cohort studies. The strongest designs are those with a comparative group, as this protects against improperly attributing secular changes in outcomes to the intervention. Moderate designs are retrospective or have multiple pre- or post-measurements, but no comparison group. The weakest designs are those without a pre- or post-measurement or comparison group. Study designs are further assessed by considering six threats to validity: 1) study population and intervention descriptions; 2) sampling; 3) measurement; 4) data analysis; 5) interpretation of results (including bias and confounding); and 6) other general matters. Using these categories, studies may have up to nine limitations, and are classified as follows: 0–1: good design; 2–4: fair design; 5 or more: limited design (Briss et al., 2000).

Overall, the evidence from a group of related studies is characterised as strong, sufficient or insufficient. This judgement is based on the number of available studies, the strength of the designs and execution, and the size of reported effects. Strong evidence can be based on either a small number of studies with strong execution and designs, or a larger number of replicated studies with weaker designs. The *Guide* has been used extensively to evaluate a number of community interventions focusing on alcohol consumption; some of the evidence has been assessed using traditional methods such as Cochrane reviews, systematic reviews and meta-analyses.

1.6 Evidence for Different Types of Population Interventions

In Australia, and a number of other countries, a harm-minimisation policy is used to reduce injury, disease and harm associated with the use of alcohol (Loxley et al., 2004). A harm-minimisation policy has three dimensions: reducing supply, reducing demand, and reducing harm. Reducing supply means, where possible reducing or moderating the availability of alcohol. Reducing demand means providing alternative options so that the

demand for alcohol is diminished. Reducing harm means that it is accepted that there will always be harm associated with the consumption of alcohol for some proportion of the community, and thus where possible, strategies and policies should be implemented to reduce the harm associated with alcohol use. The evidence that harm-reduction strategies that modify the environment can reduce consumption and alcohol-related harm is presented in Table 1.4, which also contains a brief outline of the strengths and limitations of these studies. These strategies, organised into harm-minimisation categories, will now be briefly described.

1.6.1 Reducing supply: availability.

Cochrane reviews, systematic reviews and meta-analyses demonstrate that reducing accessibility (pricing) and availability can reduce alcohol consumption (see Anderson, Chisholm et al., 2009; Booth et al., 2008; Fogarty, 2006; Gallet, 2007; Loxley et al., 2004). Restricting where and when alcohol may be used and obtained is particularly effective (Babor et al., 2010; Booth et al., 2008). Restrictions may apply to certain locations, such as streets, parks or hospitals (Holder, 2008), and/or the times of sale of alcohol (Duailibi et al., 2007).

1.6.2 Reducing supply: access.

Restricting access via increased pricing reduces alcohol consumption and modifies behaviour (Booth et al., 2008; Fogarty, 2006; Gallet, 2007; Hughes et al., 2011). If the price of an alcoholic beverage is increased, consumers change to a cheaper beverage within their preferred category (e.g. beer, wine or spirits) (Anderson, Chisholm et al., 2009). This finding is consistent across developed countries (Fogarty, 2006). It has therefore been proposed that, as a strategy to reduce alcohol consumption, happy hours and cheap drink promotions should be banned (Osterberg, 2001). Cochrane reviews (Ker & Chinnock, 2010) and longitudinal studies (Bryant & Williams, 2000) suggest that when bar staff are

trained in responsible serving of alcohol (RSA) practices, and these practices are supported by management and enforced, fewer patrons become intoxicated.

1.6.3 Reducing demand: laws.

Laws enforcing the minimum purchase age and use of alcohol are effective in reducing consumption and alcohol-related harm. A systematic review of 132 studies identified that changing laws so that there is a minimum purchase age of alcohol, can reduce alcohol-related harm, consumption by youth, and road traffic accidents (Shults et al., 2009; Shults et al., 2001). The impact of laws on reduced consumption and alcohol-related harm is increased by strong enforcement (Babor et al., 2010; Loxley et al., 2004).

1.6.4 Reducing harm: community mobilisation.

Other effective community-level strategies include community mobilisation and volume of advertising. Community mobilisation—a coordinated multi-strategy community approach involving key community stakeholders—reduces consumption and alcohol-related harm such as road fatalities in communities (Giesbrecht, 2003; Shults, Elder et al., 2009).

1.6.5 Reducing harm: volume of advertising.

A review of longitudinal studies has shown that high exposure to marketing strategies aimed at young people predicts increased consumption by adolescents who already consume alcohol and will increase the likelihood of adolescents starting to drink (Anderson, de Bruijn, Angus, Gordon & Hastings, 2009). However, there is insufficient evidence to suggest that counter advertising, advertising to reduce the consumption and harms associated with alcohol, is effective (Babor et al., 2010).

1.6.6 Reducing harm: drink-driving countermeasures.

Strategies targeting alcohol-impaired driving (drink driving) are also effective when implemented at a community level. Laws restricting individuals from driving a car with a BAC over a particular limit, and random breath testing (RBT) (sobriety checkpoints) are both associated with a reduced prevalence of drink driving (Shults, Elder et al., 2009; Shults et al., 2001). These strategies are particularly effective when part of broader public information (mass media) strategy (Elder et al., 2004; Giesbrecht, 2003). Similarly, for young people and novice drivers, lower BAC levels and graduated licensing (gradual increase of legal BAC levels as driving experience in years increases) are associated with a reduction in alcohol-related crashes and road injuries (Shults et al., 2001; Zwerling & Jones, 1999).

Specific strategies used in drinking establishments also are associated with reduced drink driving or harms associated with drink driving. These include incentives or promotions such as free non-alcoholic drinks and food for designated drivers (Ditter et al., 2005). A designated driver is a person who is nominated not to drink alcohol and to drive a group of alcohol drinkers home from the venue where the alcohol is being consumed (DeJong & Wallack, 1992). These strategies appeal strongly to licensed venues, as they are inexpensive and considered prosocial and widely applicable (DeJong & Wallack, 1992; Winsten, 1994). RSA training has also been shown to be effective. When bar staff are trained how to recognise intoxication and refuse service to intoxicated individuals and minors, reductions in alcohol-related crashes are observed (Shults et al., 2001).

Similar to multicomponent alcohol consumption strategies, multicomponent drink-driving strategies are more strongly associated with change when the targeted group is engaged in the implementation of the strategies (Shults, Kresnow & Lee, 2009). Strategies

not associated with change are free transport services (Ditter et al., 2005), and in the USA, programmes implemented in schools (Elder et al., 2005).

Table 1.4

Evidence of Environmental (Harm-reduction) Strategies in Reducing Alcohol-related Behaviour

Strategies	**Association**	**Evidence**	**Strengths & Limitations**
Accessibility: Defined times for selling alcohol (not selling on particular days/times or to specific groups)	Various: road accidents, violence, consumption, diseases	**Systematic review** (14 studies): Reducing availability by restrictions on hours of sale are associated with reduced consumption and alcohol-related harm (Stockwell & Chikritzhs, 2009). Also see Babor et al. (2010)	**Strength:** Covers 8 countries and critically appraises government reports **Limitation:** Different outcome measures used across studies
Availability: Price	Consumption	**Meta-analysis** (132 studies)**:** Strong evidence linking increased price consumption; stronger association with beer than wine or spirits; teens least responsive to pricing (Gallet, 2007)	**Strength**: examines a variety of beverages **Limitation**: Author notes that study has not controlled for gender, addiction or illegal consumption, which usually is not possible in this type of study.
Availability: Price	Consumption	**Meta-analysis** (91 studies) Strong evidence that pricing is associated with consumption (Wagenaar, Salois & Komro, 2009)	**Strength:** Large effect sizes reported; examines a variety of models, subgroups, and populations **Limitation**: based on English studies only. Authors note that possibility of publication bias, due to studies with significant results have higher odds of being published
Availability: Price	Consumption	**Meta-analysis** (112 studies): High consumption associated with lower price; responses to pricing does not vary between countries (N = 18) (Fogarty, 2006)	**Strength:** Novel regression technique (meta-regression) to examine whether the association between price and consumption differs between countries **Limitation**: Focused principally on Western and European countries, with only one Asian country (Japan) included

Strategies	Association	Evidence	Strengths & Limitations
Availability: Restriction in serving practices such as training of bar staff in RSA	Fatal and non-fatal injuries; consumption; knowledge	**Cochrane review** (23 studies): Suggests that RSA practices are associated with changed behaviour but must be implemented in conjunction with some type of enforcement (e.g. license inspectors) (Ker & Chinnock, 2010)	**Strength**: Examined a number of outcomes **Limitation:** Evidence not strong and higher quality evidence required (e.g. controlled trials)
Harm: advertising and promotions	TV, billboards, advertising, and promotions containing alcohol	**Systematic review** (207 studies): Associational evidence to suggest that point of purchase promotions are associated with increased consumption (Booth et al., 2008)	**Strength:** 12 studies, brings together published meta-analyses (N = 57); econometric studies (N = 132); and cohort studies (N = 65) **Limitations:** some economic studies use short periods and aggregated data; heterogeneous populations examined
Accessibility: tax and prices increases or decreases;	Consumption & substitution for another product	**Systematic review** (159 studies): increase in price is associated with reduced demand; young and binge drinkers choose cheaper drinks (Booth et al., 2008)	**Strength:** included both published and grey literature **Limitation:** some studies examined do not have control groups
Accessibility: overall consumption	Mortality & Morbidity	**Systematic review**. Alcohol consumption linked to a variety of diseases and cancers. (Booth et al., 2008	**Strength:** A wide range of disease and harms examined. Also uses an unpublished meta-analyses by Rehm **Limitation:** Authors note that there are often inconsistent definitions of abstainers applied and thus complicating analyses and results.
Laws: enforcing minimum age of purchase and use	Consumption & Harm	**Systematic review** (33 Studies) Restricting the sale to a minimum age is associated with reduced consumption and alcohol-related harm (Shults et al., 2001)	**Strength:** Time-series analyses, most (N = 29) studies have comparison groups **Limitation**: 27 of the 33 studies undertaken in the USA

Strategies	Association	Evidence	Strengths & Limitations
Laws: Lower BAC for young or inexperienced drivers	Alcohol-related road accidents	**Systematic review:** (16 studies) Lower BAC levels are associated with reduced alcohol-related crashes among young or inexperienced drivers (Shults et al., 2001).	**Strength** Identified one economic study that was included in the review. Indicates a $US11 benefit-to-cost ratio **Limitation:** inconsistent BAC laws applied in different countries and USA states
Community mobilisation: Coordinated community approach, involving community members and key stakeholders in the community	Consumption & harm	**Narrative review** (6 Studies) Resource intense, as have multiple levels of influence, but evidence suggests is associated with reduced alcohol consumption and alcohol-related harm, like traffic fatalities, when some level of enforcement is integrated (Giesbrecht, 2003)	**Strength:** Attempts to bring together evidence around using the community a major feature in an intervention **Limitation:** A collection of studies, not presented in a cohesive manner
Community mobilisation: Coordinated community approach, involving community members and key stakeholders in the community	Alcohol consumption	**Systematic Review** Multilevel programmes that engage community are associated with reduced adolescent consumption (Spoth, Greenberg & Turrisi, 2008)	**Strength:** Also outlines interventions showing promise **Limitation**: Only examines youth focused programmes
Community mobilisation: Coordinated community approach, involving community members and key stakeholders in the community	Drink driving	**Systematic Review**: Multilevel programmes that aim to mobilise communities, are associated with reduced consumption, and target community norms are effective in reducing drink driving (Shults, Elder et al., 2009).	**Strength:** Uses a comprehensive approach to assess influences and suggests a conceptual model as to how factors influence drink driving **Limitation**: Based on American studies
Volume of Advertising: Specific marketing campaigns explicitly aimed at young people	Consumption & uptake, awareness	**Systematic review** (13 longitudinal studies): Suggest that exposure to media and commercial communications on alcohol is associated with the likelihood that adolescents will start to drink alcohol, and with increased drinking among those who already drink (Anderson, Avalon de Bruijn et al., 2009)	**Strength:** Uses strength of association, theory, consistency of findings, and dose-response effects to draw overall conclusion **Limitations:** Heterogeneous samples; different variables used to assess influences and outcomes—awareness, consumption etc.
Counter advertising: Advertising to decrease appeal	Consumption	**Narrative review:** suggests that usually there is insufficient budget and reach with counter	**Strength:** First piece of work to document that counter advertising with advertising is

Strategies	Association	Evidence	Strengths & Limitations
and usage		advertising, compared to the budget and scope of advertising used to promote alcohol consumption (Babor et al., 2010)	likely to be ineffective **Limitation**: little evidence in this area
Environmental factors (e.g. lighting, ventilation, noise, etc.)	Alcohol consumption	**Systematic Review** (34 studies) indicates that factors amenable to regulation such as permissive environment, discounted drinks, crowding and loud music are associated with increased consumption (Hughes et al., 2011)	**Strengths:** Comprehensive list of factors examined (N = 47) **Limitations:** Mostly European countries and a large number of studies over 10 years old

1.7 Alcohol Consumption in Community Sports Clubs

The above sections provide details of the patterns of alcohol use that are associated with harm, individual-level factors associated with alcohol use and population-level interventions. The present thesis focuses on community sports clubs. The sections that follow examine alcohol use and interventions in community sports clubs and relates this information to the Good Sports programme.

Alcohol consumption occurs in a variety of settings, including the home (Leonard, 2001; Norstrom, 1998), licensed venues (Hughes et al., 2007), and the workplace (Pidd et al., 2006). As already identified, sometimes consumption is used as part of social intercourse or enjoyed at home or with friends over a meal (NHMRC, 2009); at other times, alcohol can be consumed in settings where it places individuals at risk of short-term and long-term harm. International evidence indicates that the community sports club is a setting associated with high levels of risky alcohol consumption (Black, Lawson & Fleishman, 1999; Duff, Scealy & Rowland, 2005; Mendoza & O'Riordan, 1995; Snow & Munro, 2000, 2006).

For example, in England, a national household survey indicated that heavier alcohol consumption was associated with playing sport or belonging to a sports club (Poortinga, 2007). In New Zealand, rugby players reported higher levels of harmful alcohol consumption than community members (O'Brien, Blackie & Hunter, 2005; Quarrie et al., 1996), and American college athletes reported higher levels of harmful consumption than other students (Brenner & Swanik, 2007; Ford, 2007), and that playing sport was associated with alcohol misuse. In a large Australian study of Australian rules football, rugby union, rugby league, cricket, tennis and surf lifesaving Clubs, Duff et al. (2005) found 34% of club members reported consuming five or more standard drinks on each club

visit, prevalence estimates that were markedly higher than those in the general community at that time (10%) (AIHW, 2005).

The association between participation in community sport and alcohol consumption is supported by evidence that suggested that the consumption of alcohol is a strong and established part of sporting culture (Crawford et al., 2001; Nelson & Wechsler, 2001). In Australia, Duff et al. (2005) found that approximately 75% of sport participants reported that drinking alcohol is important for club camaraderie, an important tradition at their club, and an important way of celebrating after a game. Similarly, ritualised club behaviours associated with alcohol consumption such as long drinking sessions, drinking competitions, and end-of-season trips that focus on excessive consumption (Black et al., 1999; Duff et al., 2005; Mendoza & O'Riordan, 1995; Snow & Munro, 2000, 2006) have been reported. With the high levels of risky consumption in sports clubs, it is reasonable to conclude that this may influence individuals' health and behaviour, their communities, and extract significant resources from their country's economy and health system.

1.8 Alcohol Interventions in Community Sports Clubs

A 2009 Cochrane review showed that there have been no randomised control trials, quasi-randomised trials, or controlled before and after trials examining policy and environmental interventions in sports clubs for any health behaviour (Priest, Armstrong, Doyle & Waters, 2008). To find any studies added to the published literature, since this review, Boolean search strategies using the terms sport, alcohol, community and policy were undertaken in the following databases: PsychINFO, SPORTdiscus, Sociological abstracts, MEDLINE, CINAHL and ERIC. No controlled or uncontrolled studies examining policy or environmental interventions could be identified. However, three studies examining interventions targeting individual characteristics were found.

All three studies were undertaken by the same collaborators. The target group was adolescents, and the intervention focused on tailoring individual prevention messages to each individual via a nursing consultation (N = 465). The aim of all three programmes was to promote physical activity and reduce alcohol use. The first study used a quasi-experimental design and found that brief, tailored interventions were effective in increasing physical activity and reducing alcohol use (Werch et al., 2003). The other two studies (N = 217 & 248) were impact studies for two variations of the same programme (Mathews, Werch, Michniewicz & Bian, 2007). One programme used a CD-ROM to provide information to adolescents, the other used health booklet. Both studies found that adolescents were amenable to receiving health information about physical activity and alcohol consumption, but females more keenly than males.

1.9 The Good Sports Programme

In response to the evidence of harmful alcohol consumption occurring in Australian community sports clubs, and a need for an intervention in community sports clubs, the Australian Drug Foundation (ADF) developed the Good Sports programme. The aim of the Good Sports programme is to reduce harmful alcohol consumption and alcohol-related behaviour in community sports clubs by implementing harm-reduction strategies through a three-level accreditation programme. Box 1.1 below outlines the strategies associated with each level of the Good Sports programme.

The Good Sports programme is provided free of charge. With the aid of a dedicated project officer, clubs are assisted to implement multiple strategies to reduce the supply, demand and harm of alcohol. Once clubs have implemented all relevant strategies they are

classified as a 'stage-three'[1] accredited Good Sports club (see Duff & Munro, 2007; Munro, 2000). Overall, the objectives of the Good Sports programme are as follows:

- to ensure that sports clubs that sell or serve alcohol do so according to the relevant liquor licensing laws and regulations
- to implement a set of criteria and policies regarding the use and promotion of alcohol
- to prevent the occurrence of alcohol-related problems arising out of the unsafe and irresponsible use of alcohol at sports clubs

[1] 'Stages' of accreditation are usually referred to as 'levels' of accreditation'; however, to avoid confusion with 'levels' of data, levels of accreditation will be referred to as stages throughout this thesis.

Box 1.1

The Accreditation Stages of the Good Sports Programme

Stage one

- Clubs comply with state's liquor licensing laws.
- At least one bar staff member on duty is trained in RSA.
- Liquor is only served within specified hours.
- People under 18 do not serve and are not served alcohol.
- Drunk and intoxicated people are not served or allowed to enter the premises.

Stage two

- Provision of low and non-alcoholic drinks
- All bar staff members on duty are trained in RSA.
- Bar staff do not consume alcohol on duty.
- Club maintains an incident register.
- Tap water is provided free of charge.
- Substantial food options are made available when the bar is open for more than 90 minutes.
- Clubs implement a safe-transport strategy (STS), for example, a designated driver programme, taxi vouchers or key register.
- Clubs do not conduct any of the following: happy hours, cheap drink promotions, drinking competitions, drink vouchers, all-you-can-drink functions or alcohol-only awards or raffle prizes.
- All indoor areas are smoke-free and club does not sell cigarettes.

Stage three

Club has a Good Sports written policy that addresses the following:

- bar management
- responsible serving of alcohol
- underage drinking
- alcohol alternatives
- food options
- safe transport
- smoke-free environment
- club trips
- non-compliance
- promotion of policy and policy review

The intended outcomes of the programme are as follows:

- less risky drinking in the short- and long-term by club members
- less drink driving (driving while adversely affected by alcohol)

In 2011, there were 3,960 registered Good Sports clubs in Australia. As the programme was first implemented in Victoria, the majority of clubs in the programme are from this state. Nevertheless, South Australia (SA) is adopting the programme with considerable enthusiasm and Tasmania and New South Wales (NSW) are rapidly recruiting clubs into the programme.

Table 1.5 indicates the distribution of clubs throughout Australia at the start of 2011. The Good Sports national office has estimated that approximately 1,128,600 participating sports club members are currently exposed to the programme.

Table 1.5

Number of Good Sports Clubs in Australia

State	**N**
Victoria	1715
Tasmania	145
SA	409
NSW	1209
Queensland	456
Western Australia	0
Australian Capital Territory	10
Northern Territory	16
Total	3960

In 2011, 28 types of sports clubs were participating in the Good Sports programme. These include the traditional Australian sports, such as football, cricket, rugby, and tennis; however, there are also rowing, archery, bowling, bocce, surf lifesaving, and horse riding

clubs registered in the programme. Table 1.6 identifies the 12 priority sports that the Good Sports programme is targeting; the majority are Australian Rules football and cricket clubs.

Table 1.6

Type and Number of Sports Clubs Registered with the Good Sports Programme

Sport	**N**
Basketball	43
Bowls	243
Cricket	631
Football	822
Golf	87
Netball	79
Rugby league	316
Rugby union	137
Soccer	355
Sports Club	92
Surf Life Saving	116
Tennis	152
Other	707

Currently, football (N = 822) and cricket (N = 631) are the most common sports involved with the Good Sports programmes. Among the clubs included in the 'other' category are polo, hockey, fishing and dart clubs.

1.10 Evaluating the Good Sports Programme

It has been suggested that a series of research phases should be followed when evaluating large-scale health-promotion interventions (Flay, 1986). This approach is recommended because it gradually builds an evidence base, where each successive stage justifies further investment towards gathering stronger evidence, and thus guards against over-investing in a flawed or poorly designed programme. This approach is especially important when programmes are costly and logistically complex to implement. Flay (1986)

suggests eight phases for the development of health-promotion programmes. These phases are outlined in Table 1.7.

Flay's (1986) approach begins with basic descriptive work that identifies the problems associated with a particular health behaviour (phase i). This is followed by hypothesis development, pilot studies and prototype studies (phases ii–iv). After hypotheses have been developed and tested, Flay suggests greater investment in efficacy, treatment and implementation trials (phases v–vii) are justified. Efficacy trials are of the implementation of the programme under ideal conditions. Effectiveness trials are undertaken with interventions that have been demonstrated to be efficacious under ideal conditions, and are now being examined as to whether they are effective under real-world conditions. Demonstration studies are the final phase (phase viii) of research, and this is where the programme is then rolled-out to broader populations (Flay, 1986).

Table 1.7

Flay's (1986) Recommended Phases for the Development of Health-promotion Programmes

Phase	**Description**	**Methods**
Basic research (phase i)	Disciplinary based research to identify mechanisms (e.g. epidemiology; etiology; psychology, education etc.)	Usually defined by discipline
Hypothesis development (phase ii)	Development of hypotheses about new approaches to health promotion	Review; synthesis of basic research, exploratory research
Pilot research (phase iii)	Preliminary tests of new approaches using basic research results to achieve specific health-promotion goals	Pilot testing to assess innovative manipulations
Prototype studies (phase iv)	Studies examining refined programme, based on information gathered from earlier studies	Experimental or quasi-experimental tests of complete programmes
Efficacy trials (phase v)	Trials used to determine the efficacy of the programme, suggested to be effective from earlier phases	Pure experimental trials with random assignment of aggregated units to conditions, with sufficient numbers for effects to be detected
Treatment Effectiveness Trials (phase vi)	Trials to determine the effectiveness and acceptability of efficacious programmes on a broader population	Large-scale experimental or quasi-experimental trials in real-world settings. Delivery of the intervention is optimised and standardised
Implementation Effectiveness Trials (phase vii)	Trials to determine the effectiveness of an efficacious programme under real-world conditions	Large-scale experimental or quasi-experimental trials in real-world settings. Delivery of intervention can vary naturally or involve planned comparisons
Demonstration Studies (phase viii)	Studies to determine the effects of an efficacious programme on public health when implemented in whole systems (schools, cities, states, nations)	Naturalistic or quasi-experimental programme evaluation; natural variation in delivery

Flay's (1986) phases of research provides a thorough outline of the development and evaluation of health-promotion programmes. However, more recently, it has been shown that using traditional experimental designs in the latter phases (phases iv–viii) of

programme evaluation may limit the implementation of an intervention when it is being delivered to populations or communities (Sanson-Fisher, Bonevski, Green & D'Este, 2007). For example, it may not always be practical or ethical to withhold an intervention from whole communities. Alternative designs have been suggested to assess the impact of large-scale health-promotion interventions. In conjunction with these designs, it has been recommended that more sophisticated analysis methods, such as multilevel modelling (MLM), be employed to develop strong research evidence (Heller & Page, 2002). Kirkwood, Cousens, Victoria and de Zoysa (1997) suggested three alternative designs to evaluate the impact of large-scale health-promotion programmes: pre- and post-intervention comparison; intervention *versus* control comparison; and post-intervention adopters *versus* non-adopters comparisons.

The pre- and post-intervention comparison design compares rates of the outcome in several populations of interest before the intervention is delivered, with the rates for the same populations after the intervention is delivered. This design requires a baseline, and thus can include options such as the A–B (non-intervention (A), followed by the intervention (B)), and the multiple baseline design. Controlling for risk factors in the analysis will assist in attributing the intervention to the change in the outcome behaviour. The A–B design, while providing evidence for behaviour change, cannot rule out secular influence on the targeted behaviour. However, the influence of secular trends can be reduced by having several A–B groups as in a multiple baseline design. This design collects a baseline for several groups, and then staggers the implementation of the intervention. Below is an example of data collection for three groups using a multiple baseline design:

Group 1: A–B–B–B

Group 2: A–A–B–B

Group 3: A–A–A–B

The intervention *versus* control design is the core element of the randomised controlled trial (RCT). This design can be an RCT if it is practical and logistically possible; however, with large-scale interventions this is often not feasible. It has therefore been suggested that this design could also include non-randomised, matched, unmatched, double-blind or open designs. However, again, this is not often practical when implementing an intervention at a community level. Thus, when these features cannot be introduced, the need to control for confounding variables is critical (Kirkwood et al., 1997).

The adopter *versus* non-adopters design compares groups that have adopted an intervention, with those that have not (Kirkwood et al., 1997). This design compares groups after the intervention has occurred, and the magnitude of the impact is assessed by comparing adopters with the non-adopters. The design can also be called a risk-factor study, as it assesses the reduced risk of adopting the programme, compared to not adopting the programme. In analysing the data, controlling for confounding factors is important in attributing the effect of the adoption of the intervention to any change in behaviour. Controlling for confounders is important, as there may be substantial differences between those who adopt the programme, and those who do not.

1.11 Current Evidence for the Good Sports Programme

In keeping with Flay's (1986) recommended phases for building evidence, the evidence associated with the impact of the Good Sports has been accumulating and is summarised in Table 1.8. The first study was the Sporting Clubs Alcohol Project (SCAP).

This study examined whether a programme aimed at harmful alcohol-related behaviours in sports clubs would be viable and accepted in community sports clubs (ADF, 1998). Sporting clubs were found to be amenable to the implementation of alcohol-management strategies. The second study was the first formal study to gather evidence of harmful alcohol consumption and behaviours in community sports clubs (Snow, Maher & Sanford, 2001; Snow & Munro, 2000). After this, a pilot study was undertaken in Victoria testing the programme, and a process evaluation completed (Duff, 2002). The Good Sports programme was then rolled-out in Victoria and, as funding was secured, into other states (Tasmania, NSW and SA). Process evaluations were also undertaken in each of these states (Boot & Duff, 2003; Duff, Goren & Scealy, 2003). An external process evaluation was also undertaken by Latrobe University (Latrobe University, 2003).

Table 1.8

Timeline of Significant Developments and Evaluations of the Good Sports Programme

Year	Milestone	Research Phase
1997	SCAP	Phase i: Basic research
1999	Gippsland Football League Study; Alcohol use in Metropolitan Sporting Clubs Study	Phase ii: Basic Research identifying alcohol problems in community sports clubs
2000	Pilot of the Good Sports programme in Victoria and model evaluation	Phase iii: Pilot research
2001	Good Sports programme is rolled-out in Victoria	N/A
2002	Process evaluation of the rollout of the programme in Victoria; The Good Sports programme is piloted in NSW;	Phase iii: Pilot research
2003	Pilot undertaken in Tasmania	Phase iii: pilot research
2004	Good Sports rolled-out in Tasmania Pilot and rollout of the programme in SA	Phase iii: pilot research
2005	Good Sports established in NSW National survey of alcohol consumption in sports clubs.	N/A Phase i: undertaken at a national level
2006	Good Sports established in QLD Good Sports programme piloted in WA and ACT	N/A
2007	Adoption study one (level-one- and level-two-accredited clubs) undertaken *	Phase iv: prototype study
2008	Adoption study two (non–Good Sports, level-one, level-two and level-three clubs) undertaken*	Phase iv: prototype study

*studies undertaken as part of this PhD
ACT = Australian Capital Territory; QLD = Queensland; WA = Western Australia

In keeping with the national growth of the programme, a national survey of attitudes and behaviours around alcohol was undertaken in 2005 (Duff et al., 2005). This supported the evidence for the need for a national rollout of the programme. Moreover, as part of building up the strength and quality of the evidence, and the need to demonstrate the requirement for investment in a stronger evaluation of the Good Sports programme, four adoption studies were undertaken. These studies were completed as part of this PhD.

1.12 Aim of This PhD

The aim of this PhD was to undertake a series of four adoption studies as a means of examining the impact of the Good Sports programme on alcohol consumption and drink driving. These studies were classified as adoption studies, as data were collected after clubs had reached certain levels of accreditation and these data were compared with data collected from either clubs at other levels of accreditation or clubs that have not adopted the programme. Overall, these studies tested whether accreditation and length of time in the Good Sports programme was associated with lower rates of alcohol consumption and drink driving, after controlling for potential confounders.

1.12.1 Study one.

The first study examined whether accreditation and length of time implementing alcohol-related harm-reduction strategies in community sports clubs through the Good Sports programme were associated with lower rates of alcohol consumption. Study one did this by comparing consumption between accreditation stages and by also comparing alcohol consumption of members participating in the Good Sports programme, with consumption levels in the Australian community.

1.12.2 Study two.

Using the same dataset as study one, the second study tested whether the adoption of drink driving countermeasures in community sports clubs was associated with lower rates of drink driving. Clubs accredited at stage two with drink-driving countermeasures formally implemented were compared with stage-one-accredited clubs that had no drink-driving countermeasures formally implemented as part of the Good Sports programme. Prevalence levels of drink driving in the community were also compared, and the association with the number of safe-transport strategies implemented was also examined.

1.12.3 Study three.

Using a different data set, to study one and study two, study three compared levels of alcohol use among members of clubs that have adopted the Good Sports programme (all three stages) with consumption of individuals in clubs that have not adopted the programme. The hypothesis that there would be a dose-response relationship for alcohol consumption, individuals in non–Good Sports clubs would consume the most alcohol, and that there would be lower consumption by individuals for each level of accreditation was examined. The length of time a club participated in the Good Sports programme and its association with risky drinking was also examined.

1.12.4 Study four.

Using the same dataset as in study three, study four examined the hypothesis that individuals belonging to clubs participating in the Good Sports programme (all three stages) would be at lower risk of drink driving compared to individuals in non-participating clubs. In assessing this hypothesis, three dose-response associations were examined. First, whether an increased level of accreditation was associated with reduced risk of drink driving. Second, whether increased time in the programme was associated with reduced risk of drink driving. Third, whether the number of safe-transport strategies implemented was associated with a reduced risk of drink driving.

Before reporting the findings of these four studies, the next chapter (Chapter 2) will examine how health behaviour theories can be used to design interventions in community sports clubs. This will be followed by Chapter 3, which will describe the statistical analysis used in the four studies (MLM).

Chapter 2: Theory

2.1 Introduction

This chapter identifies relevant theory and identifies a planning model that is appropriate to guide the evaluation of the Good Sports programme. It begins with a description of the dominant theories commonly used in the health-promotion and health psychology literature. This is followed by an analysis of the limitations of these theories when attempting to understand or change behaviours. Specific attention is given to how environmental influences receive limited acknowledgement in these theories. Rose's (1992) strategy of preventive medicine and the extended mind theory are discussed as a way of supporting the need for greater emphasis on environmental influences. The new public health, a population health approach, is presented as an alternative way to understanding and influencing health behaviours. More specifically, an ecological approach to prevention is proposed as a comprehensive model for understanding these behaviours. Finally, using the PRECEDE/PROCEED planning framework, the ecological approach is used to explore how modifying environmental factors can be used to influence alcohol-related behaviour in community sports clubs to reduce risky drinking, and drink driving.

2.2 Theories of Behaviour Change

A review of health behaviour theories found over 50 theories cited in the health-promotion and behaviour literature (Glanz, Rimmer & Viswanath, 2008). However, while a diverse array of theories are used in health research, four theories have dominated the field over the last two decades (Glanz et al., 2008). These are:

1. the Health Belief Model (HBM)

2. the theory of reasoned action (TRA) and its companion, the theory of planned behaviour (TPB)
3. the Transtheoretical Model (TTM), or stages of change
4. social cognitive theory (SCT)

All four theories can be broadly described as social cognitive theories, which focus on individual cognitions used to make sense and respond to the world (Connor & Norman, 2005). Behaviour in these theories is understood to be a product of rational decision-making, a procedure based upon deliberative and systematic processing of information. Sometimes this process is called self-regulation because its focus is on how an individual manages mental processes to achieve an outcome or behaviour (Fiske & Taylor, 1991). This way of understanding behaviour is said to be a product of the tradition of clinical psychology and medicine, which argues that behaviours are principally modified by changing the individual (Scrambler, 2008).

2.3 The Health Belief Model

The HBM has been used both to explain behavioural change in response to health behaviour interventions, and to elucidate how the new health behaviours are maintained. The model was developed in the 1950s by the US Public Health service as a means to clarify why some individuals did not participate in screening programmes (Hochbaum, 1958; Rosenstock, 1974). The model suggests that individuals will act to avert a potential health hazard (e.g. cancer) if they perceive they are susceptible to it and that there are benefits in them taking an action (Champion & Skinner, 2008). The HBM has been used to help understand the uptake of health behaviours such as mammography screening (Champion, Ray, Heilman & Springston, 2000), colorectal cancer screening (Rawl, Champion, Menon & Foster, 2000), and HIV/AIDS detection and prevention (Booth, Zhang & Kwiatkowski, 1995).

As outlined in 2.1, the key constructs in the theory are perceived susceptibility and severity, perceived benefits, perceived barriers and perceived self-efficacy. As the model has developed, additional constructs have been incorporated to improve the model's predictive capacity; these include cues to action and perceived behavioural control(Champion & Skinner, 2008). As the constructs of the theory suggest, the model proposes that behaviour change is contingent on awareness raising and education of individuals, and the notion that knowledge and understanding are critical for behaviour change.

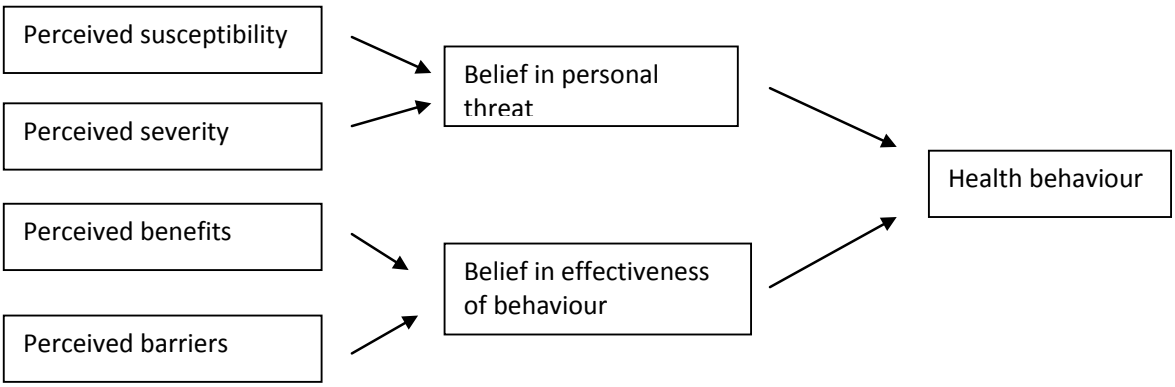


Figure 2.1. Health belief model.

The HBM has been one of the most widely used conceptual frameworks in health behaviour (Abraham & Sheeran, 2005). Janz and Becker (1984) reviewed the HBM and identified 46 studies using it. Eighteen were prospective and 28 were retrospective; behaviours examined included actions to avoid illness or injury (e.g. flu vaccinations and disease screening programmes); actions taken after a diagnosis (e.g. adherence to medication regimes, such as insulin and hypertension medicine); and clinic utilisation (e.g. use of paediatric clinics). The authors concluded that because a high proportion of studies found the four core constructs to be significant predictors, there was substantial support for

the model. Overall, barriers were found to be 86% predictive of health behaviours, susceptibility 81% predictive, benefits 78% predictive and severity 65% predictive.

However, more recently, evidence has emerged that the HBM's constructs are applied inconsistently. In 1992, Harrison, Mullen and Green (1992) undertook a meta-analysis of the HBM, and identified 61 studies that claimed to be measuring HBM constructs. Only 16 could be included in the analysis, as the remaining 55 did not include the four core constructs (perceived susceptibility and severity, perceived benefits, perceived barriers and perceived self-efficacy). Out of the 55 excluded, 27 studies had been reported in the Janz and Becker (1984) review. Overall, the inconsistent application of the HBM makes it difficult to assess the accuracy and effectiveness of the theory to predict and modify health behaviours.

Studies included in Harrison et al.'s (1992) meta-analysis focused mostly on physical and medical behaviours such as flu vaccinations, breast examination and diabetes. Harrison et al. (1992) found no research into alcohol-related behaviours. However, the included studies demonstrated that the four core constructs of the HBM are significantly correlated with health behaviours, but their explanatory power was nevertheless very low. The constructs only accounted for 1–10% of the overall variance in the health behaviours examined.

2.4 The Theory of Reasoned Action and Theory of Planned Behaviour

The TRA and the TPB (Ajzen, 1991; Fishbein & Ajzen, 1975) were attempts to understand the relationships between attitudes and behaviour. The TPB is a refinement of the TRA. In the TPB, it is asserted that the most important predictor of behaviour is intention to act. Intention to perform a particular behaviour is influenced by three factors:

1. the attitude of the individual towards the behaviour

2. the individual's subjective norms
3. the individual's perceived control over the situation (see Figure 2.2)

According to the TPB, a person's attitude is determined by beliefs about the benefits of performing a behaviour. Subjective norms are influenced by individual beliefs that certain behaviour is approved by significant individuals (e.g. a doctor). Perceived control is associated with individual belief about personal control and power to change the targeted behaviour. The theory of TRA does not include a separate construct for perceived control over the situation.

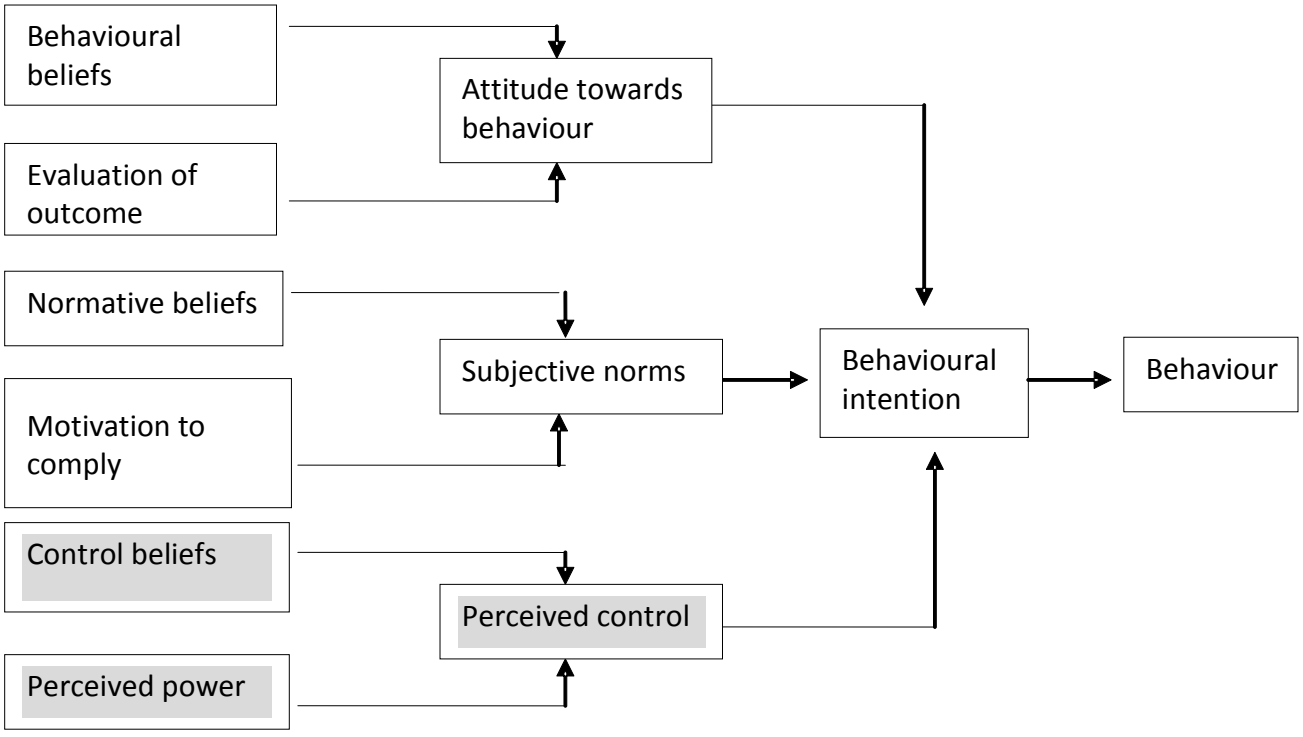


Figure 2.2. Theory of planned behaviour (shaded area not part of theory of reasoned action).

The TRA/TPB has been used to develop numerous health behaviour interventions. Behaviours examined using these theories include smoking, drug and alcohol use, exercise, oral hygiene, and sexual behaviour. Overall, these studies report strong correlations between the various constructs. In a systematic review of 16 studies by Ajzen (1991), an average correlation of 0.71 was reported for correlations between intentions, norms and perceived control. Similar findings have been reported by Armitage and Conner (2001) in their review of154 studies.

However, Godin and Kok's (1996) systematic review of 56 studies found that, like the HBM, the theory is often poorly operationalised. Godin and Kok (1996) found only 26 studies provided information on how the model's three basic constructs (attitude, norms and perceived control) predicted intention, and how subsequently intention predicted behaviour. Further, Godin and Kok (1996) found that only approximately 33% of the variation in health behaviours could be explained by intention. Marcoux and Shope (1997) used the TPB to predict adolescent alcohol use (N = 3946) and reported that the intention only explained 26% of the variation in use of alcohol, 38% in frequency of use of alcohol, and 30% in the variance in misuse. However, the core constructs (attitudes, subjective norms and perceived behavioural control) explained up to 76% of the variation in intention to use.

Acknowledging the limitations of TPB, work has been done to develop the theory further (see Fishbein, Triandia, Kanger & Becker, 2001; Montano & Kasprzyk, 2008). A model aimed at addressing the limitations of TRA/TPB and incorporate the strengths of other theories is portrayed in Figure 2.3. Developed by Kasprzyk, Montano and Fishbein (1998), the model is titled the 'integrated behavioural model' (IBM). The institute of Medicine (IOM), in the report 'Speaking of health', recommends that the IBM be specifically used to develop and communicate strategies to change health (Institute of

Medicine, 2002). However, while there is a strong endorsement for the IBM, there is still some disagreement about how exactly the additional variables interact (see Fishbein et al., 2001).

The IBM seems to have made some substantial advances. With the addition of the four factors influencing behaviour, the model is attempting to accommodate factors that moderate behaviour, including factors extrinsic to the individual. Moderating factors include: an individual having sufficient skills and knowledge to perform a behaviour and habits that can often be unconscious, automated or conditioned responses. Factors external to the individual, and even possibly beyond the control of the individual, include salience or prevalence of the targeted behaviour and environmental constraints.

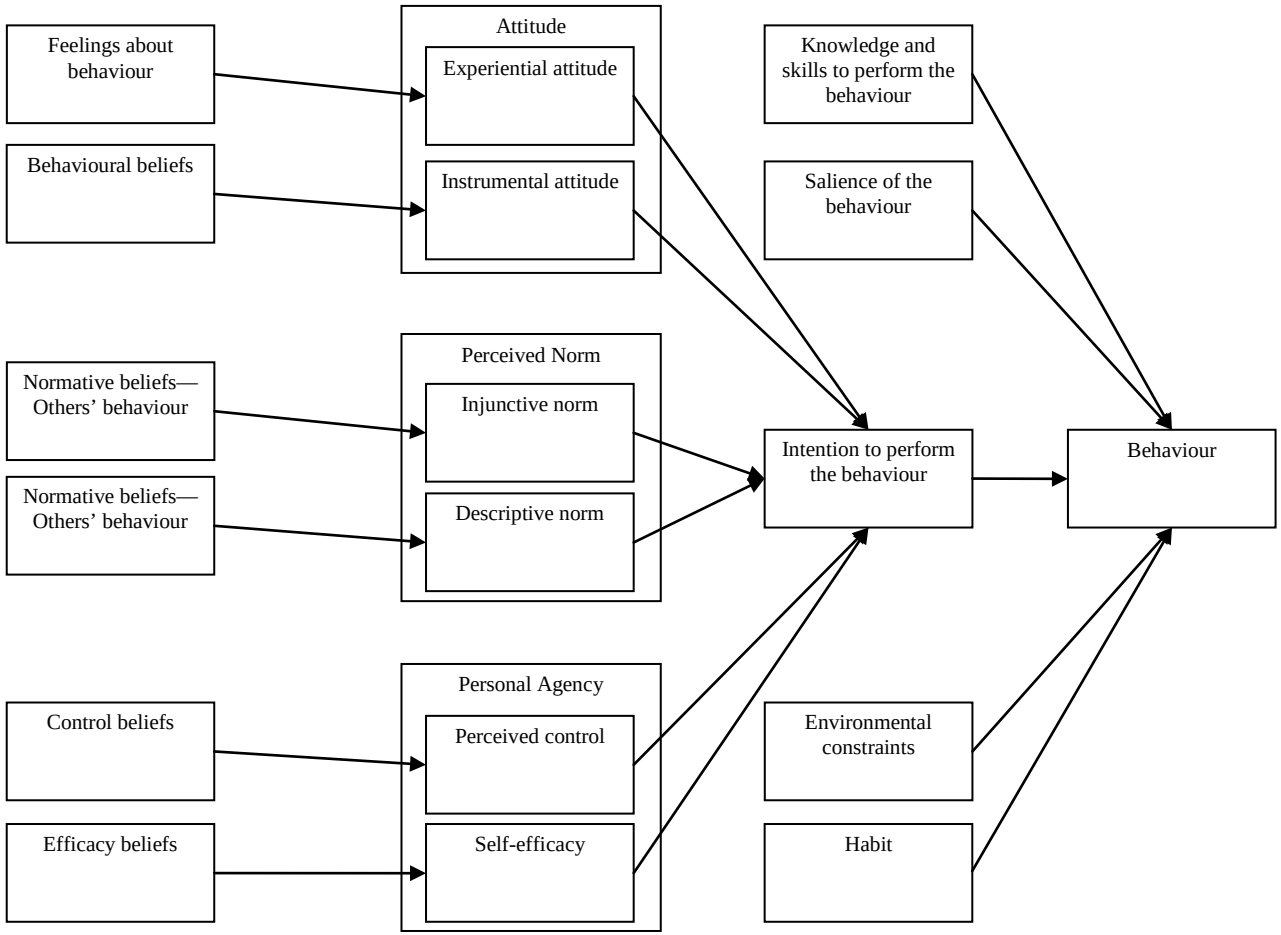


Figure 2.3. The Integrated Behaviour Model for the theory of planned behaviour.

The variables ‘attitude’, ‘norms’ and ‘perceived control’, which form part of the original TPB, have also have been broken down into sub-constructs in the IBM. Attitude has been broken down into experiential and instrumental attitudes. Variables influencing these sub-constructs have also been included (e.g. behavioural beliefs affect instrumental attitudes, and control beliefs affect perceived control). The IBM holds promise, as the new variables may make it easier to tailor interventions. The variables moderating behaviour may help explain why intention in the TRA/TPB only explains approximately one-third of the variance in behaviour.

There seems to be limited testing of the IBM. Kasprzyk et al. (1998), using a time-series analysis (N = 993 (T1); N = 686 (T2)) of condom use with HIV risk groups, examined how perceived control moderated behaviour. They found that attitudes, norms and agency were predictive of intention. However, they did not examine how the environment or skills might influence or moderate behaviour. Their study appears to be an early iteration of the IBM and does not closely align with the later versions of the model, as presented in Figure 2.3. Thus, their findings do not really advance the testing of the model. Painter et al. (2010) examined the influence of agency and norms on the intention to revive influenza vaccinations (N = 337), and found these variables were predictive of intention. However, his study only operationalised three constructs (injunctive social norms, descriptive social norms and control beliefs). According to the IBM (see *Figure 2.3.*) these constructs influence intention and not behaviour. Painter et al (2010) did not explore the newer factors, such as skills and environmental constraints. Thus, like Kasprzyk et al.’s (1998) study, it adds little to the testing of the model. In summary, the IBM appears promising, but the theory still essentially remains untested.

2.5 The Transtheoretical Model

The TTM emerged from a comparative analysis of leading theories of psychotherapy and behaviour change, and integrates more than 300 theories of psychotherapy—hence the name transtheoretical (Prochaska, 1984). The TTM presents behaviour change as a long-term process. Further, it suggests that individuals must go through a series of motivational and behavioural stages before they have changed their behaviour permanently. These processes are not always linear and sequential—individuals may regress to earlier stages and repeat stages.

Broadly, the theory has been described as an integration of several cognitive and behavioural theories, which can be organised into four broad categories:

1. Stages of change (phases outlining motivation or intention to change)
2. Decisional balance (weighing up the benefits and costs of changing)
3. Self-efficacy (confidence to carry out the behaviour under a range of circumstances)
4. Processes of change (Consciousness raising, conditioning and reinforcing processes) (Prochaska, Redding & Evers, 2008)

The stages of change component of the theory describes five motivational phases (precontemplation, contemplation, preparation, action, maintenance and termination); these phases are levels of motivation that an individual must progress through to achieve behaviour change. Decisional balance is the process of weighing up pros and cons of changing a particular behaviour—the pros are the benefits of changing; and the cons are costs of changing. Self-efficacy is the process of developing confidence to deal with the desired behaviour change and the confidence to deal with temptations to avoid behaviour change.

Processes of change are covert and overt behaviours that people must develop to achieve behaviour change. There are 10 processes: five cognitive or affective and five behavioural. Cognitive or affective processes include consciousness raising, dramatic relief, self-revaluation and environmental re-evaluation. Behavioural processes include seeking social support, counter-conditioning, reinforcement management, stimulus control and social liberation.

The TTM is more of a theory that explains why behaviour changes occur than a theory that describes how to change or influence behaviour. A significant strength of the TTM is that it presents behaviour as a temporally sequenced process, not a discrete event. Like the HBM, the TTM assumes that behaviour change is understood as the product of defined processes within individual control, and that progress through the stages depends on awareness raising. Similar to the HBM, the TTM is rarely tested in its entirety, probably because of the array of complex constructs included in the theory (Thirlaway & Upton, 2009). Nevertheless, this deficit makes it difficult to assess the accuracy of using the TTM to predict or change behaviour.

Practitioners and researchers often refer to the TTM, as the stages of change model; this suggests that the theory is not well understood, as it does not acknowledge other influential components (such as decisional balance theory, self-efficacy and processes of change) of the model (Sutton, 2005). This confusion is also reflected in mixed findings in relation to the theory and study designs. For example, Rosen (2000), in a meta-analyses (47 studies) of cross-sectional studies examining a variety of health behaviours (e.g. smoking, exercise and diet), could not clearly identify stages with distinct cognitive processes. Similarly, Herzog and Blagg (2007), using a cross-sectional study of 242 individuals, looked at the motivational characteristics of contemplators and precontemplators of smokers and could not find any differing characteristics between the

two groups. However, a meta-analysis (91 studies) by Marshall and Biddle (2001) found distinct differences in the decisional balance and process constructs between the stages outlined in the model for behaviours focusing on physical activity.

Despite the mixed support for cognitive processes being associated with various stages of behaviour change, cross-sectional studies are laden with temporal complexities. Complexities arise because cross-sectional studies cannot demonstrate whether the move to a stage was the product of cognitive changes, or whether the cognitive change was due to the transition to a stage. The cross-sectional studies that do demonstrate differences between groups only demonstrate an association, not causation. Stronger evidence is required to demonstrate causal links, such as that provided by longitudinal or experimental studies.

There is longitudinal evidence that individuals do change in motivation across time, but whether these changes can be modelled as distinct phases is contested. Sutton (2005) showed that individuals categorised as contemplators at baseline were most likely to be in action at follow-up, compared to those who were in precontemplation. However, it has been suggested that these are differences between categories on a continuum. For example, if we divide age into categories (units of 10 years) and compare physical activity, mobility will start to decrease in the older categories. However, because age has been categorised and subsequently analysed this way, it does not mean mobility begins to decline at that exact point. Thus, it has been suggested that the changes should be indicators on a motivation continuum and not distinct stages of change (Bandura, 1998; Thirlaway & Upton, 2009).

Experimental evidence also does not generally support the stages of TTM. A systematic review by Rimesma, et al (2003) examined 23 randomised control trials (RCTs) for smoking cessation and found little support for the effectiveness of TTM stage-based

interventions. Another systematic review, by the same authors examined a variety of health behaviours (e.g. smoking, alcohol consumption, and diet) from 37 RCTs; they found limited evidence supporting the efficacy of TTM stage-based interventions for these behaviours (Bridle et al, 2005). Similarly, a systematic review by Van Sluis, Van Poppel and Van Mechelen (2004), examined lifestyle interventions applied in primary care settings, and found similar results. However, using more lenient inclusion criteria (e.g. inclusion of case control studies), a narrative review by Spencer, Pagell, Hallion, and Adams (2002) examined 164 smoking studies, and concluded that there was some evidence, but was not conclusive, for the efficacy of TTM stage- based interventions.

Prevention trials targeting populations based on the TTM have also failed to produce promising results. For example, Aveyard et al. (1999) undertook a cluster randomised trial with 52 schools (8352 students), and found that smoking cessation and prevention messages based on the TTM for schoolchildren between the ages of 12 and 14 were ineffective. Hollis et al. (1999) reported an RCT using a brief computer-assisted intervention with a similar age group and found that the intervention was ineffective in preventing smoking. In summary, while the TTM theory may be popular among practitioners, it is not supported by strong evidence.

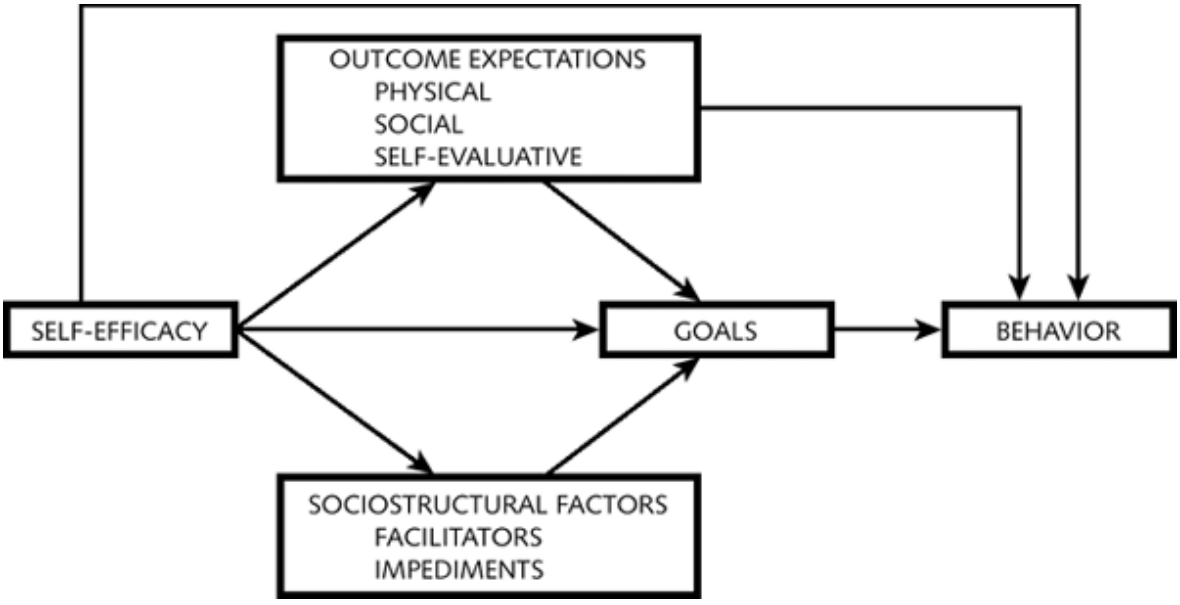
2.6 Social Cognitive Theory

Developed by Bandura (1986), SCT attempts to integrate concepts outlined in the dominant health theories, especially those included in the HBM and the TPB. Bandura (1998) argued that the HBM and the TPB have overlapping constructs, and thus there was a need for a more comprehensive and efficient theory. SCT posits that human behaviour is the product of the interrelationship between personal sense of control to take action (self-efficacy), a personal sense of control over the environment (socio-cultural factors) and beliefs about consequences of actions (outcome expectations) (see Figure 2.4). This

interrelationship between individuals and their environments is called reciprocal determinism (Baker & Yardley, 2002; Bandura, 1997). SCT has been applied to a number of behaviours, such as mental and physical health, emotional disorders and health psychology.

While SCT acknowledges the role of environmental influences in behaviour, it is essentially a theory that focuses on people's potential ability to alter their environments. According to SCT, behaviour change is possible when individuals have a personal sense of control over their environments. If people have a sense of control, they feel more inclined to change their behaviour and are more committed to any decision about behaviour change. Thus, self-efficacy and outcome expectations are the core constructs of the theory (Bandura, 1997). Self-efficacy is an individual's belief in his or her capacity to manage challenging situations, such as changing an unhealthy behaviour. It can also be described as cognitions that determine whether behaviours will be initiated and how long the behaviour will be sustained in the face of impediments and failure. Self-efficacy can be developed in a number of ways:

1. through practice and subsequent mastery of a behaviour
2. vicarious experience, after watching someone else perform the behaviour
3. verbal persuasion or emotional arousal that inclines a person to feel able to master a behaviour or situation



Source: Bandura (2009)

Figure 2.4. Social cognitive theory.

Outcome expectations pertain to the perceived consequences of an individual's behaviour. Bandura organises outcome expectations into three dimensions:

1. personal (self) evaluations such as being proud or ashamed
2. social approval or disapproval
3. physical experiences, such as discomfort, withdrawal symptoms or pain, after a behaviour has changed

As self-efficacy and outcome expectations are understood to play influential roles in adopting new behaviours, they are seen as direct predictors of behaviours (see *Figure 2.4*). Goals are self-incentives set by the individual to perform a behaviour, and they can be distal or proximal. Bandura (1998) suggests that individuals set goals when they believe the goal brings more advantages than disadvantages. This is why outcome expectations are said to affect goal setting. If the positive outcomes outweigh the negative outcomes, individuals are more likely to set goals to change their behaviour. Similarly, the degree of

self-efficacy individuals have will determine how high they set their goals. Individuals with high self-efficacy will set more challenging and ambitious goals, compared to individuals with low self-efficacy (Bandura, 1998). As Figure 2.4 indicates, self-efficacy is critical in ensuring that goals translate into behaviour. Goals will not translate into behaviour unless an individual has sufficient self-efficacy (Bandura, 1997).

Socio-cultural factors refer to things in the environment that facilitate or impede choices; they are also referred to as barriers or opportunities. They can include living conditions, health infrastructure and the political and social environment. If a political and social environment supports a behaviour, there is an increased chance the behaviour will occur. According to Bandura (1997), if there are too many barriers or if the opportunity to perform is rare, it is unlikely the behaviour will be performed. In such a situation, a high level of self-efficacy will be required to perform the desired behaviour.

Support for SCT as a theory that predicts and explains behaviour is moderate. A search of the literature reveals that hundreds of studies have used SCT as their guiding theory. Unfortunately, like the other health theories described above, SCT is often poorly operationalised. This is unsurprising because SCT has a vast array of constructs, and measuring all of these constructs would be logistically complex. Luszcynska and Schwarzer (2005) summarised 46 key studies that have examined predictors of SCT, finding that most studies focused on the two core constructs—self-efficacy and outcome expectancies—with a handful examining goals and/or impediments. In all of these studies, self-efficacy was a strong predictor of goals and behaviour, while outcome expectancies and goals did not always predict behaviour change.

However, a small study has tested all of the SCT constructs. Using structural equation modelling, Ronivak, Anderson, Winnet and Stephens (2002) examined physical activity among 277 university students. they found that SCT constructs explained 55% of

the variation in physical activity, with self-efficacy the strongest predictor. However, some of the operationalisation of SCT constructs in this study seem to have been developed idiosyncratically by the authors. In particular, the way the final Structural Equation Model is presented is inconsistent with the way Bandura (1986, 1997) argued that the constructs are associated.

SCT has been used to develop and evaluate some large-scale health-promotion interventions. The Minnesota Heart Health Programme (Perry, Kelder & Klepp, 1994) youth component used peer modelling and school environmental change over four years. These changes were implemented at a school and community level. Compared to the control group, and after adjusting for nesting and confounders, two years after the intervention, twelfth-grade students were 40% less likely to smoke, more likely to eat heart-healthy foods and more likely to engage for longer periods in physical activity. Similarly, the North Karelia Project in Finland used peer modelling and mass-media campaigns to reduce smoking behaviour, encourage weight loss and control hypertension (Puska et al., 1985). Over 20 years, this programme has demonstrated a 70% reduction in cardiovascular disease, a 65% reduction in lung cancer and a six-to-seven year increase in life expectancy in men and women, respectively. These studies are promising and have achieved extremely positive outcomes. However, they have not implemented all the constructs of SCT, and thus cannot fully validate the theory.

2.7 Beyond the Dominant Psychological Theories

Social cognition has been used to develop, guide and evaluate numerous health behaviours and interventions (see Glanz et al., 2008). However, while they have initiated discussion and research into health behaviours, clearly these theories can be improved. A substantial limitation is that predictions from these theories generally explain less than 30% of the variation in health behaviours. These models clearly need to incorporate and

test other influencing factors if they are to advance our understanding of health behaviours. The IBM and SCT hold the greatest promise because they have built on the learning of earlier theories and because their focus has moved beyond variables intrinsically associated with individuals and incorporates environmental (socio-structural) factors. While there is a need to focus on individual factors, a strong body of evidence suggests the need to include environmental and social influences in theories of health behaviour. This evidence will now be discussed.

Emphasis on individual characteristics as the primary levers for behaviour change has long been a feature of psychology (Bandura, 1982; Schneider, 1991; Turk & Slavoy, 1986). This approach is grounded in the biomedical model of health. It is also a perspective that is based in the clockwork definition of medicine (Baum, 2008) and germ theory (Najman, 1980). Traditionally, the clockwork model views the body as having components: the health of an individual is determined by how efficiently the clock works. If there are faults in the clock, it is the role of the health practitioner to restore the individual to good health by rectifying the overall mechanism (Underwood & Owen, 1986). From a medical point of view, these could be biological parts, such as lungs, heart and the immune system. From a psychological and behavioural perspective, these mechanisms may be self-efficacy, perceived control (e.g. TPB), knowledge (e.g. HBM), skills (e.g. SCT) and capacity to change (e.g. TTM). The clockwork model has been highly effective in managing physical malfunctions in the body. For example, if a person's lungs or heart valves are in poor condition, the appropriate surgery can be successfully undertaken to restore the component to optimum condition and thus the person to full health (Baum, 2008).

Germ theory is the product of the science of bacteriology, developed principally by Pasteur and Koch (Najman, 1980). Pasteur argued that specific organisms caused particular

diseases and symptoms in individuals. Building on this idea, Koch developed techniques to identify bacteria, and subsequently, methods to eradicate these bacteria. Koch's approach to cure was first to identify the specific bacterium causing the disease, and then to destroy the bacteria with the appropriate medicine or immunisations. This method, now widely adopted, has been highly effective in curing and preventing a variety of bacteria- and virus-based diseases, including polio, chicken pox, tetanus, diphtheria, malaria, hepatitis B and the flu. It has guided the development of what is now known as the epidemiological triad (germ, host and environment) (Lin, Smith & Fawkes, 2007). The epidemiological triad suggests that while a bacterium may be present in an individual, it may not always cause disease. Bacteria or viruses need a sympathetic environment and a susceptible host; without these three factors, the person will not develop the disease.

While epidemiology and germ theory have been effective in managing, preventing and curing communicable diseases and promoting the healthy environments typical of developed countries, whether the same approach is completely transferable to the discipline of psychology has been questioned. Particular concern around the applicability of this thinking to health and lifestyle behaviours, such as eating, drinking, smoking, illicit and legal drug use and exercise, has been raised (Thirlaway & Upton, 2009). Nevertheless, it has been suggested that the environment, which was constrained to the biological body in the medical model, be expanded to include the physical, social, economic and political environments (McMahon, 1970; Susser, 1973). Sometimes these influences are described as distal influences or risk and protective factors (Hawkins, Catalano & Miller, 1992). Proximal factors are closely associated with the individual and could include factors that are described in the dominant psychological theories, such as self-efficacy or perception. Distal factors are usually not intrinsically associated with the individual and may include

living conditions, access to resources, social infrastructure and community cohesion (Susser, 1973).

There is substantial evidence that environmental factors influence individual health and health behaviours. Chapter 1 identified environmental factors, such as availability, price, access, laws and advertising, that affect alcohol consumption across the world. These studies demonstrated that if the environment is modified, alcohol consumption is reduced. These influencing factors can be categorised as distal factors, as they are removed from the individual and implemented at a structural or policy level. For example, enforcing a minimum age of alcohol purchase and having defined times to sell alcohol are strategies that need to be initiated at a legislative level and then implemented at an institutional level; they do not specifically target individuals or their psychological constructs.

Similarly, longitudinal determinant research has demonstrated that features of the social environment are associated with health behaviours and quality of life. Persuasive evidence is presented by Marmot (2009, 1995), who has examined social and economic conditions associated with health over an individual's life course. His evidence is summarised in the two key texts: *Structural determinants of health* (M. Marmot & Wilkinson, 1999) and *The status syndrome* (M. Marmot, 2005). His research covers a period of more than 30 years and includes data from both developed and undeveloped countries. Marmot (2005) has identified that SES, which includes access to adequate income, access to social and community resources and engagement in community, is a strong determinant of an individual's health. Marmot (2005) does not argue that these factors are direct causes of poor health, but that these factors influence health. For example, low parental income may lead to minimal education, resulting in poor understanding of healthy eating habits; this leads to poor health.

Spooner, Hall and Lynskey (2001) reviewed the international literature and identified environmental influences that affect drug (illicit and licit) and alcohol behaviour of young people. They found that factors such as environmental and urban planning, access to public transport, and alternative social and recreational opportunities determined drug and alcohol use for young people. They also showed that education, social deprivation and community social cohesion acted as determinants.

2.8 Rose's Strategy of Preventive Medicine

Compelling evidence supporting the health benefits of targeting environmental influences has been presented by Rose (1992) who makes a number of strong claims, and has argued for these in his book *The strategy of preventive medicine.* First, Rose argues that focusing on individuals at highest risk is inefficient when working with populations. He first articulated this argument when trying to reduce systolic blood pressure of an English population. However, he has reported similar findings for other health behaviours and outcomes such as gambling and alcohol consumption.

While those with prior hospitalisation were at the greatest risk of coronary heart disease (CHD), most people who developed CHD were categorised as moderate-to-low risk. Rose (1992) argued that as there are more people in the low-to-moderate risk range (usually most of the population), the overall pool of individuals is greater, and therefore this yields a greater number of cases (such as CHD) than individuals in the highest risk group (usually the minority). Rose (1992) argued that this is why targeting those at greatest risk is inefficient when the aim is to reduce the prevalence of a disease with risk factors distributed across the population. He has made the same argument for behaviours such as gambling, alcohol consumption and salt intake.

Rose (1992) argued that the most efficient way to reduce the number of high-risk individuals in a population is to reduce the average level of risk for that population. This, he maintained, was best achieved by targeting the environment, as this affected the whole population. As Figure 2.5 indicates, targeting the environment means the whole population distribution curve of risk shifts to lower levels. Further, in doing this, the prevalence rate for that population is reduced, thus reducing the overall risk and reducing the number of high-risk individuals.

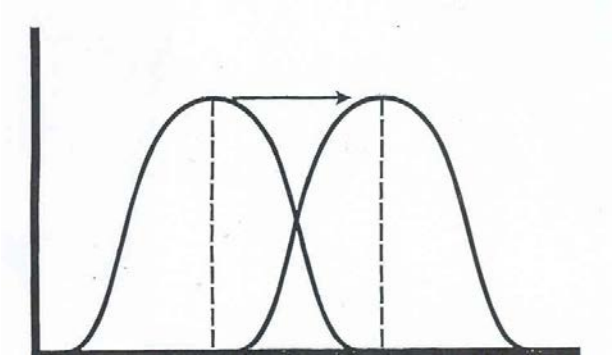


Figure 2.5. Environmental strategies (shift the curve).

Rose (1992) supported this model of change with data from large international studies. Using the Intersalt study, a study of 10,000 individuals from 32 countries, he demonstrated that mean systolic blood pressure varied substantially between countries (Rose, 1992). His interpretation was that individual variations can be found in every country (e.g. genetic, personality and motivational factors); however, significant inter-country differences could not be adequately explained by these individual variations. Rose (1992) argued that the best explanation for country-to-country variation in systolic blood pressure was group differences; essentially, the social, political and economic

characteristics of each country. Thus, for Rose (1992), the most effective way of changing the health of populations was to modify these forces.

Rose (1992) demonstrated that the mean value of systolic blood pressure for a community predicted the proportion of the population that would be high-risk individuals. To avoid an autocorrelation error, he averaged the systolic blood pressure of populations in the Intersalt study with extremely high-risk individuals excluded; he then demonstrated that the average level of systolic blood pressure was significantly correlated with the number of high-risk individuals. These findings supported the argument that high-risk individuals were products of a broader social context. He suggested their health behaviours were influenced by the norms, opportunities and structural characteristics of their societies, and this is why an average characteristic predicts the number of high-risk individuals. Thus, to reduce the number of high-risk individuals in a population, the average level of a population characteristic must be reduced, and this, he suggested, is best achieved by modifying the structural characteristics of a society. Rose (1992) has reported similar findings for other health behaviours and outcomes such as gambling and alcohol consumption.

Rose's (1992) insights have had substantial implications for public health and population health, and these have been translated into two prevention axioms (Rose, 1992):

1. A large number of people exposed to a low risk will generate more cases of diseases than a small number of individuals exposed to a high risk.
2. A preventive measure that brings large benefits to a community offers little to each participating individual.

The second axiom is usually referred to as the prevention paradox (Kreitman, 1986). It is acknowledged that, as the intervention targets the whole population, there will still be a substantial proportion of individuals that will not benefit from the intervention. However,

Rose (1992) argued that this is the trade-off and the paradox for population and prevention approaches.

2.9 The Extended Mind

The contribution of the physical and social environments to individual behaviour has gained increasing support in philosophical domains (see Menary, 2010). The extended mind theory, originally proposed by Clark and Chalmers (2010), suggests that the separation of the body, mind and the environment is not as clear as traditionally believed. Clark and Chalmers (2010) argued that because external objects cue individuals to perform behaviours—that is they help in cognitive processes—the mind and the environment form a system. They argued that the mind extends to the environment because components of the environment function in the same way that internal components of the mind do.

Clark and Chalmers (2010) used two fictitious people to clarify their argument: Otto and Inga. Otto and Inga are both travelling to the museum. Otto has Alzheimer's disease and therefore his memory is limited; whereas Inga has a normally functioning memory. To reach the museum, Otto has written the directions and location of the museum in his notebook; Inga uses her memory to get to the museum. Both have a belief about the location of the museum; however, Otto consults his notebook to get there, while Inga consults her memory. The fundamental difference between the two is that Inga's memory is processed by her brain, while Otto's memory is served by his notebook. Otto's notebook acts like memory, as it is instantly accessible and can cue behaviours endorsed by him.

Similar examples of objects in the environment that form an individual's system of functioning may be information platforms such as ipads and palm pilots (Clark, 2010). These are objects that are integrated into an individual's life that store specific information (e.g. addresses, phone numbers and email); they extend a person's mind by storing

information that an individual cannot retain. Individuals know that if they need particular information they can access this equipment. Similarly, a social environment that overtly promotes a particular health behaviour (e.g. to eat low calorie food, to reduce alcohol consumption or not to drink and drive) over time becomes incorporated into individuals' social systems and integrated into their cognitive processes.

Aspects of extended mind theory resemble Pavlovian (1927) and Skinnerian (1938) principles of behaviour. Both emphasise that the environment can be used to cue and reinforce behaviour. However, extended mind theory goes a step further and incorporates the environment into the cognitive system. Extended mind theory describes the environment as a tool integrated into a person's life, a tool that helps individuals to make and maintain choices. Extended mind theory supports the IBM (see Figure 2.3), which suggests that the environment moderates intention. It is also consistent with SCT, which suggests the environment influences behaviour. While the notion of the extended mind is relatively new, it provides additional support for giving the environment greater consideration when trying to understand and change behaviour.

2.10 The New Public Health

While targeting the direct influence of environmental variables on behaviour has not been prominent in psychological theory and research, the approach is not new. A paradigm describing itself as the new public health (Ashton & Seymour, 1988; Baum, 2008) has for over 20 years suggested that social and environmental influences need to be accorded greater prominence in shaping behaviour. This approach has been popular among governments and funding organisations who wish to change behaviour of large groups. Thus, sometimes the new public health paradigm has also been described as a population health approach. (Baum, 2008)

Internationally, population approaches have attracted significant interest because they are more efficient since they often influence a greater number of people compared to strategies that target individuals (Baum, 2008; Lin et al., 2007). Individually focused interventions usually target high-risk individuals, attempting to get these people to practise lower risk behaviours. However, this is often ineffective for a number of reasons. As one example, as the behaviour of one high-risk person is modified, another person may be entering the setting who may be already at high risk (M. Marmot & Winklestein, 1975). Further, as the majority of the population is not usually affected by an individual intervention, the approach has limited application when a whole population needs to change or modify its behaviour (Cohen, Scribner & Farley, 2000). While the need to focus on specific elements of the individual cannot be ignored, and will always be required, the resources needed to change these dimensions at a population level will always be substantial and probably unsustainable.

One of the first international documents to acknowledge the link between the environment and health is the ‘Ottawa Charter for Health Promotion’. The charter was launched at the ‘First International Conference of Health Promotion’ and was an international call for action (WHO, 1986). The charter stated that health—and therefore quality of life—is a product of how people live, and that individuals and communities do not always control their living conditions. The charter suggested that the objective of health promoters and programme developers should be to create conditions that empower people to increase control over their lives and to improve their health and quality of life.

The Ottawa Charter built on ideas of Antonvosky (1979, 1987) who suggested that salutogenic environments promoted healthy choices and healthy behaviour (Eriksson & Lindstrom, 2008). For Antonovsky (1996), a salutogenic environment was a setting where individuals have some control over determinants of their health. Antonovsky’s idea of

environments influencing behaviour has been applied to obesity and alcohol, whereby environments that promote unhealthy or high-calorific eating are described as obesogenic (Day & Pearce, 2011; Guerrieri, Nederkoorn & Jansen, 2008), and environments that encourage unhealthy or irregular consumption of alcohol are described as alcogenic (Huckle, Huakau, Sweetsur, Huisman & Casswell, 2008).

2.11 An Ecological Approach to Understanding Health Behaviours

While the new public health paradigm (Ashton & Seymour, 1988; Baum, 2008) emphasises broader environmental influences, it does not discount the need for or relevance of a primary care health system or interventions specifically targeting individuals. Rather, these interventions are seen as important elements in the overall process of improving the health of populations (Baum, 2008). In doing this, the new public health approach supports a model that is described as ecological (McKinlay,1995); it recognises that environmental interventions have the most capacity to influence populations; however, other levels of influence can add to the impact of a population-targeted intervention. An ecological model of health behaviour implies that multiple factors influence health and the most effective interventions influence behaviour at a variety of levels (Salis & Owen, 1997). Ecological models are based on four core principles:

1. **Multiple factors influence behaviour:** Individual, interpersonal, organisational and policy-level factors all have some influence on behaviour.
2. **Influences interact across levels:** Influences can cut across levels, for example, different policies may affect groups (i.e. high risk or low SES) and individuals differently (i.e. those with high motivation).
3. **Multilevel interventions are the most effective when changing behaviour:** One strategy is unlikely to have a sustainable impact; however, if strategies

and influences designed to change behaviour are influenced from a number of levels, they are more likely to have greater impact and to be sustained.

4. **Ecological interventions are most effective when they are behaviour specific:** Behaviour change occurs when the targeted behaviour is directly related to the strategies implemented. Policies that are generic or aimed at general behaviour are not likely to be effective.

While relatively new in its application in health psychology, ecological theory is a product of several historical trends. Ecology is a specific stream of the biological sciences, grounded in Darwin's (1859) theory of evolution. The discipline is based on the principle that all living organisms constantly interact with and adapt to the environment and each other (Begon, Townsend & Harper, 2006). Scientific work in ecology began in 1902 when botanists and zoologists documented the interdependence of plant and animal species living in the same environment (Wicker, 1979).

Some psychologists have applied ecological principles and methods to human behaviour. One of the earliest contributors was Lewin (1951) who suggested that the first step in understanding the behaviour of individuals and groups was to examine the opportunities and constraints of their environments. Another conceptual framework in ecological psychology is the work of Brofenbrenner (1979), who viewed behaviour as affected by and affecting multiple levels of influence. He conceptualised the environment as a four-tiered system: microsystem, mesosystem, exosystem and macrosystem. The microsystem comprises systems or influences closest to the individual, such as family and school; the mesosystem is the system that allows different microsystems to interact (e.g. parents with school); the exosystem consists of external environments that influence individuals, such as the workplace or community settings; and the macrosystem is the broader social and cultural context in which an individual lives.

McKinlay (1995) developed an ecological model for health promotion that organises the levels of influence on human behaviour into three fundamental categories: downstream, midstream and upstream (see Table 2.1). Downstream interventions occur at the individual level; these can include individual interventions such as counselling. They usually target individuals who are currently displaying a particular behaviour.

Midstream interventions target populations. The primary goal of midstream interventions is to change and prevent health-damaging behaviour through environments such as schools and communities (Orleans, Gruman, Ulmer, Emont & Hollendonner, 1999). Interventions at this level could include school drug education (e.g. skills training in resistance and coping strategies). It can also include restrictions such as not permitting smoking or only serving low-alcoholic drinks in a particular setting.

Upstream interventions occur at the macro level, usually at the state or national level, and mostly involve policy change and implementation. The aim of upstream interventions is to strengthen social norms that support healthy behaviour and to redirect unhealthy social counterforces (Orleans et al., 1999). Such interventions could include public education, media campaigns and social marketing. Upstream interventions can include economic incentives or deterrents such as excise taxes or reimbursement for prevention counselling in a health plan. It can also include reduced access to a product such as cigarettes to people under the age of 18.

For McKinlay (1995), interventions can occur independently on each of the three levels described in his model (downstream, midstream and upstream). However, an ecological intervention is essentially characterised by its attempt to intervene at all levels, usually simultaneously. Proponents of the new public health approach to health promotion would acknowledge the need for all three tiers of McKinlay's (1995) model, but would

further emphasise that until recently, limited attention has been given to the upstream categories (Baum, 2008).

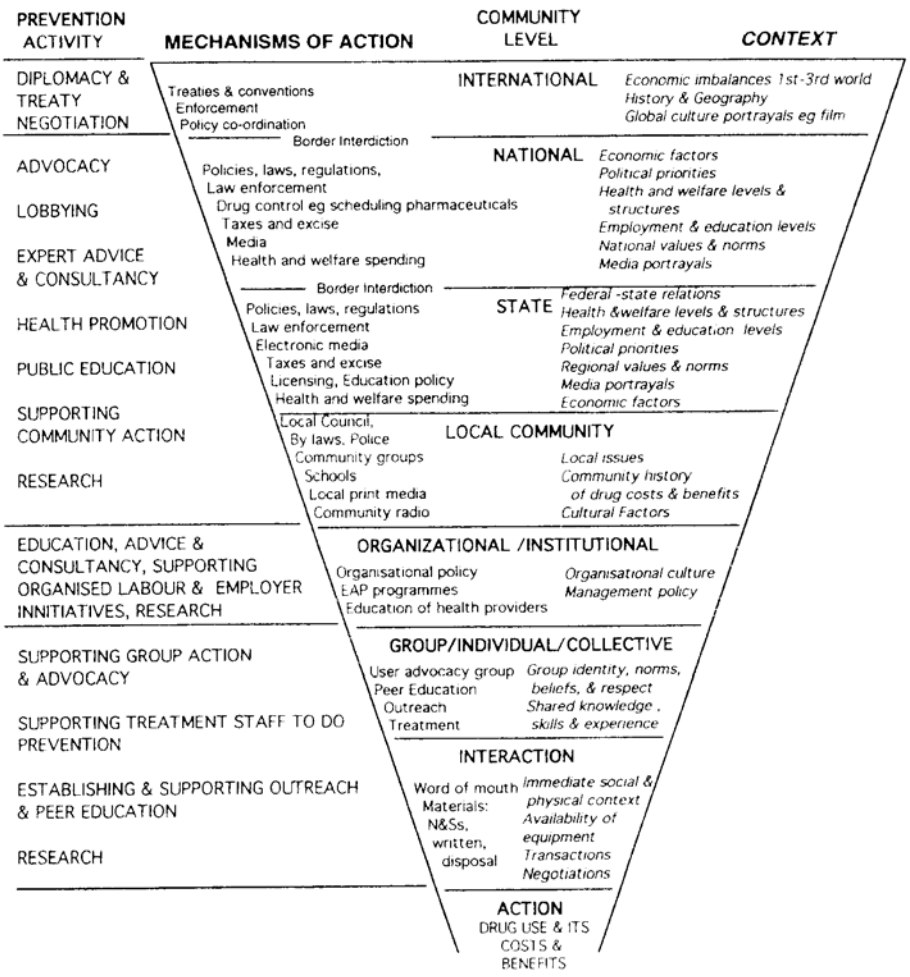
Table 2.1

Various Levels of Intervention for Prevention and Health Promotion Based on McKinlay's Model

Type of intervention	**Examples of interventions**
1. Downstream interventions Interventions that target the individual, usually those at risk	Individual counselling Group counselling Education Self-help programmes Pharmacological treatments
2. Midstream interventions Interventions that target populations, usually using organisational structures or the natural environment	Worksite and community-based health-promotion programmes School-based activities Community-based activities targeting at-risk populations
3. Upstream interventions Interventions that aim to strengthen social norms that promote healthy behaviour, and to also redirect countervailing social forces	National and state-wide media and social marketing campaigns Economic incentives & disincentives Policies restricting access Policies affecting marketing and sales Policies restricting advertising and promotion

Source: McKinlay (1995)

Lenton (1996) developed a model identifying influences on drug and alcohol-related behaviour. However, he took a more global approach by using national and international categories, though he also included interpersonal (interaction) dimensions in his model.



Source: Lenton (1996)

Figure 2.6. Lenton's influences on drug and alcohol-related behaviour.

The strengths of the ecological approach are its acknowledgment and focus on multiple levels of influence on behaviour. As Lenton's (1996) model outlined, this provides several options for influence for programme designers (Glanz et al., 2008). Moreover, when interventions are implemented at levels beyond the individual, they affect more people (Cohen et al., 2000), thus providing maximum opportunity to reduce the prevalence of disease or unhealthy behaviours.

However, ecological theories have been criticised on the basis that they show intellectual laziness, as they simply assert that all factors influence behaviour in some way; this broad approach has been described as not sufficiently advancing the field of health promotion or health behaviour (Heather, 2001). This lack of specificity also makes it difficult to design interventions (Bartholomew, Parcel, Kok & Gottlieb, 2006). A related weakness is a lack of information about how more distal factors (e.g. community, policy and environmental) influence behaviour or interact across the levels (Green, Richard & Potvin, 1996). This issue has been addressed by the development of a number of planning frameworks that help programme planners and implementers to identify the most effective leverage point (see Section 2.13).

Ecological interventions are also more difficult to evaluate than those that target downstream influences because distal (upstream) factors are not always amenable to an experimental design (Murray, 1998). Given they are usually delivered to large numbers of individuals, they can also be extremely costly to implement (see Holder, Saltz, Grube, Voas et al., 1997). The interactions across the various levels of influence and the clustering of data also mean traditional analytic techniques are not appropriate (Blakely & Subramanian, 2006; Rabe-Hesketh & Skrondal, 2008). Moreover, if ecological interventions are to succeed (without mandatory legislation), influences categorised in the top tiers depend on community engagement and high levels of social capital (Casswell, 2000; Holder, Saltz, Grube, Voas et al., 1997; Holder, Saltz, Grube, Treno et al., 1997)). Practitioners argued that a programme will not succeed without the backing of its community; nor will it succeed without the capacity or resources to implement the programme (Green & Kreuter, 2005).

2.12 Developing an Understanding of the Mechanisms Associated with Environmental Influences

Over the last 12 years, substantial developments have been made in understanding the mechanics and processes by which multilevel ecological interventions work (Glanz & Bishop, 2010; Hovell, Elder, Blanchard & Sallis, 1986; McAlister, Perry & Parcel, 2008; Oakes & Kaufman, 2006; Spiegler & Guevremont, 1998). One of the most detailed explanations of these mechanisms is outlined by Hovell, Wahlgren and Gehrman (2002); they described their model as the Behavioural Ecological Model (BEM). Consistent with Pavlov's (1927) and Skinner's (1938) theories, they suggested that behaviour change is based on cues and stimuli; however, they also propose other developed concepts such as cultural practices, metacontingent function relations and group and cooperative contingencies.

In the BEM, cultural practices are defined as specific behaviours that reinforce the behaviours of others; they are social processes that maintain a custom (Hovell et al., 2002). An example relevant to alcohol behaviour in a community sports club occurs when a club provides cheap alcohol; this makes consumption more accessible, and thus reinforces the behaviour (alcohol consumption) when a person attends the club. The club may be selling alcohol to raise revenue; however, repeated and continuous consumption by individuals due to accessibility reinforces to the club that the selling of alcohol is popular among club members.

One organisational practice reinforces other practices and behaviour; over time, the behaviours then become the norm. Metacontingent functional relations are the relationship between cultural practices and overall group behaviour (M. F. Hovell et al., 2002). If most sports club members behave in a particular way (a meta influence), this becomes the

standard of behaviour for the club. Overall, group behaviour can also lead a deviant minority to change their behaviour, or may push them to another setting to consume alcohol, such as their home or a licensed venue.

Metacontingent functional relations can also beget social reinforcing influences (M. F. Hovell et al., 2002). For example, if a club takes up a programme to manage the sale and consumption of alcohol responsibly, this programme establishes standards of behaviour. Over time, these practices promote a new culture and encourage individuals to model a particular type of behaviour. Thus, after the programme has been implemented for an extended period, it may be common for other members to ask intoxicated individuals to leave or to discourage individuals from playing drinking games. This example is analogous to the influences associated with smoking, whereby legislation, taxes on cigarettes and restrictions on where people can sell and smoke cigarettes make it easier for people (even complete strangers) to ask people not to smoke in particular places.

A critical element of BEM is the idea that for the environment to influence behaviour, the contingencies and reinforcers need to be widely and densely distributed; the greater the distribution, the more people will come in contact with them (M. F. Hovell et al., 2002). For example, it has been demonstrated that when individuals are aware of speed and red-light cameras they adjust their behaviour; however, as they also know these traffic devices are not located at every intersection, they will speed or accelerate through changing lights, especially when they are running late. If these traffic devices were located at every intersection, it is unlikely that individuals would speed, even if they were running late (M. F. Hovell et al., 2002). Similarly, if consistently implemented strategies to reduce risky drinking were in place in community clubs, the programme would be more likely to be effective than if it were only implemented on the game day or at special club events (presentation or fundraising nights). This principle is consistent with ecological theory,

which suggests that the most effective programmes are those that have multiple leverage points.

2.13 Organising the Evidence and Theory to Develop an Intervention in Sports Clubs

Complexity is the price of embracing an ecological approach. Often, there are more options for intervention than can be practically managed. Moreover, it is not always possible, nor efficient, to deliver interventions at all the levels described in an ecological model. In light of these constraints, it has been suggested that the strongest and most efficient interventions critically review the evidence, thus identifying the best leverage points for behaviour change (Bartholomew et al., 2006). In addition, strong interventions always implement multiple leverage points and do not rely on one strategy (McLeroy, Bibeau, Steckler & Glanz, 1988).

Several planning frameworks have been developed to organise the evidence into a coherent and sound intervention. Frameworks that feature prominently in the health literature include the PRECEDE/PROCEED model (Green & Kreuter, 2005), the Capacity Building Framework (Norton, Mcleroy, Burdine, Felix & Dorsey, 2002; NSW Health, 2001), and RE-AIM (Glasgow, Vogt & Boles, 1999). By far the most popular framework is PRECEDE/PROCEED, with over 900 examples of its application in the research literature (Gielen, McDonald, Gary & Bone, 2008; Green et al., 1996). Programmes using this framework include interventions in specific geographic regions, occupational settings, educational settings and healthcare settings (Green & Kreuter, 2005). The framework suggests that once evidence of successful leverage points has been found, they should be organised into three influential domains: predisposing, reinforcing and enabling (Green &

Kreuter, 2005). These domains are effectively a systematic way of organising McKinlay's (1995) three levels of intervening.

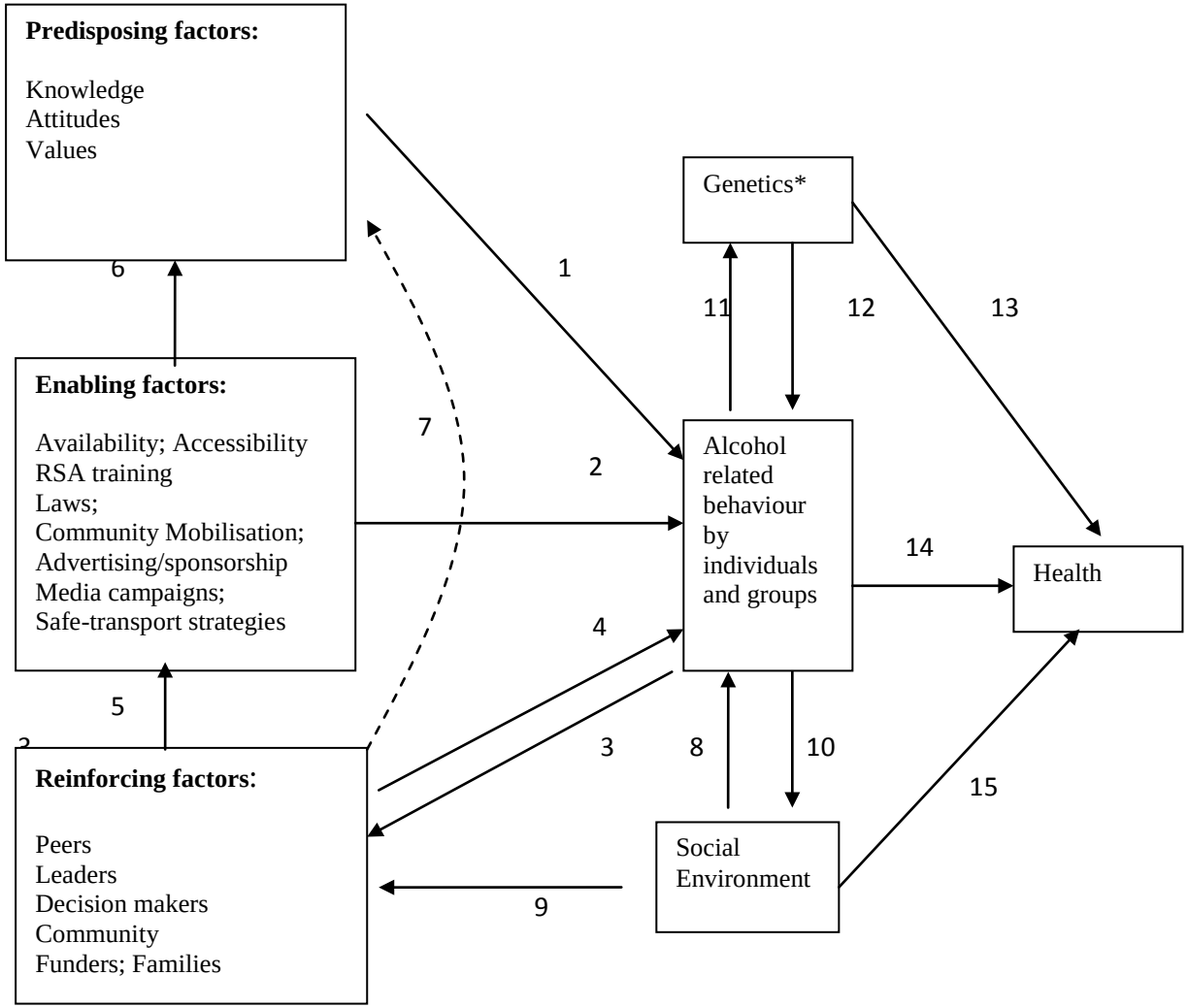
Predisposing factors principally focus on influences that either hinder or motivate an individual or individuals to change behaviour. They can also be described as factors that an individual or a group bring to a behavioural choice that may pull the person towards or away from specific behaviours (Green & Kreuter, 2005). Theoretically, predisposing factors can also include risk factors, such as smoking or depression, or demographic factors (Green et al., 1996), and understanding the relationship of risk factors with targeted behaviour is important, as it helps practitioners tailor appropriate interventions. However, as PRECEDE/PROCEED is a planning model, it only incorporates elements that can be practically implemented to influence behaviour. Demographic factors, such as age and gender, will influence an intervention's outcome; however, they are not factors that can be manipulated as part of the intervention, and so are not included as predisposing factors.

Enabling factors are environmental elements that facilitate health behaviours by individuals or groups (Green & Kreuter, 2005). Enabling factors can include social forces and systems, such as making healthy choices and behaviour more accessible or more affordable. In the context of a sporting club, enabling factors could be making light-alcohol beer cheaper than full-strength beer and providing safe-transport strategies (e.g. a designated driver service). Other enabling factors would be training of bar staff in RSA, and actively promoting and abiding by these practices, such as not serving intoxicated individuals.

Reinforcing factors are usually social or environmental feedback cues that influence repetition of a behaviour (Green & Kreuter, 2005). Social feedback could be recognition by peers or leaders. In a sports club setting, this could be feedback from the local council about the positive and well-behaved members. Environmental feedback could

be a club less characterised by drunkenness and violence. Reinforcing factors are critical, as they formalise and validate new behaviour and systemic change; they also help promote new norms of expected behaviour (Green & Kreuter, 2005).

The way the three domains—predisposing, reinforcing and enabling—interact and influence alcohol-related behaviour is outlined in *Figure 2.7.* It also portrays how the Good Sports programme sets out to achieve these outcomes, using the PRECEDE/PROCEDE planning framework.



*While genes (shaded area) is part of the PRECEDE/PROCEED model, it is not included in the Good Sports Intervention

Figure 2.7. The PRECEDE/PROCEED Planning Model as applied to the Good Sports programme.

While PRECEDE/PROCEED is fundamentally a planning model, how the various factors interrelate can be depicted using an example of behaviour in the community sport context. The following is an example for a community sports club (the numbers correspond to those in Figure 2.7). (1) A young male likes to socialise by drinking at his community sports club on the weekend (predisposing factors). (2) The club has a dedicated programme to reduce risky alcohol consumption, hence resources are available in the environment to help him make choices that will promote better health (enabling factors). These resources could include the provision of food to slow the metabolism and consumption of alcohol, the provision of cheaper low-alcohol drinks and having bar staff trained in RSA practices.

(3) As the club has implemented a programme and is promoting it, making healthier choices would be followed by some type of reaction. (4) This could include peers emulating this behaviour; it could also be that the club feels like a safe and inviting place to socialise; the club could also be the local council family-friendly place. These reactions reinforce the behaviour and choices made by the young man. (5) Once behaviour is reinforced, he will then look for continued support to repeat that behaviour. (6) The continued provision of these resources makes these resources heightened cues for the behaviour to recur. This will inevitably have some impact on the predisposing factors—the motivation to continue to socialise at the club.

(7) Reinforcement makes it more likely that the same decision will recur. Thus, the arrow numbered seven (broken line) is where the cycle repeats itself and how a programme builds up momentum. The environment that promoted a particular behaviour now becomes a predisposing factor. That is to say, these elements increasingly become the dominant factors that pull the person away from unhealthy alcohol-related choices at the club. The club now provides an environment that enables making healthier choices about alcohol easier compared to alcohol-related choices that are harmful to health. (8) Over time, as the

club continues to resource responsible sale and consumption of alcohol, the club promotes certain norms. These norms also affect an individual's alcohol consumption. (9) Over time, these norms become the expected behaviour and are promoted overtly by the club.

(11, 12 and 13) While genetics have some influence on individual alcohol-related behaviour, this element is usually beyond the scope of most health promoters and practitioners; nevertheless, it is still acknowledged in the planning model. (14 and 15) Overall, reduction in risky alcohol consumption has an impact on health and quality of life.

When examined closely, various individual theories can be seen in the different components of the PRECEDE/PROCEED planning model. For example, the TPB suggests that intention and attitudes predict behaviour. This can be seen to be part of the model that links predisposing factors with individual behaviour (line 1). Attitudes in the PRECEDE/PROCEED model predict behaviour, but in this model, attitude change is not considered sufficient to change or maintain behaviour change.

Similarly, environmental cues that promote behaviour, reinforcement from peers and an individual's motivation, attitude and knowledge are comparable to the three components of influence in Bandura's (1986) SCT. If reinforcement, as described in the PRECEDE/PROCEED model, is to be effective, individuals need to believe the health-promotion message and cues that are being promoted and encouraged; otherwise, they may move to another setting where these messages are not promoted. This notion is in keeping with the HBM. In the PRECEDE/PROCEED planning model, it is recognised that behaviour change is not a discrete event, only over time will individuals and groups change their behaviours. Further, behaviour change is seen as contingent on continued cues, and over time, a gradual increase in overt knowledge of expected behaviour will develop. These ideas are consistent with transtheoretical theory (Prochaska, Redding & Evers, 2008).

Overall, the PRECEDE/PROCEED planning framing incorporates a number of individual influencing variables identified in the four major health theories (e.g. attitude and knowledge). The planning framework also has strong similarities with the major theories, particularly the Integrated Model of Behaviour and social cognitive theories, with their emphasis on the role of the environment on behaviour. The model provides a clear and logical planning model to evaluate a programme like the Good Sports programme. This framework will now be used to guide the evaluation and interpretation of the Good Sports programme reported in the four articles of this thesis.

2.14 Conclusion

In this chapter, key theories used in health promotion and health psychology were identified. It has also been argued that the dominant health-promotion theories are limited. Specific attention was given to how environmental influences received insufficient attention in these models. The new public health model and more specifically, an ecological approach have been proposed as the more efficient and effective way of understanding health behaviour, and particularly, a way of addressing alcohol-related problems in community sports clubs. In trying to situate the Good Sports programme in an ecological framework, the PRECEDE/PROCEED planning model has been used. It has also been shown that the PRECEDE/PROCEED planning model incorporates a number of individual theories, and is probably the most efficient model to evaluate and implement a behaviour change programme in community sports clubs. The public health movement represents a ‘heroic age’ in medical intervention. It seems that the discipline of psychology, if it is to advance theory and intervention development, needs a comparable heroic age in which it embraces, accepts and tests the role of environmental influences on behaviour.

As the interactions across the various levels of influence in an ecological or environmental intervention, and the clustering of data, means traditional statistical analytical techniques are inadequate (Blakely & Subramanian, 2006; Rabe-Hesketh & Skrondal, 2008), the next chapter describes the statistical technique used to analyse the data in all of the four studies included in this thesis: MLM.

Chapter 3: Statistical Analysis for Clustered Data

The first chapter of this thesis outlined the long- and short-term harms associated with alcohol consumption; it also identified that community sports clubs are a setting where high levels of alcohol consumption occurs. Chapter 2 specifically identified and critically appraised theories used to explain health behaviours. In doing this, it also identified that interventions with multiple leverage points were most likely to be the ones that would be the most effective and efficient when targeting populations. However, it was also noted that traditional statistical techniques were not appropriate for the analysis of data associated with these types of interventions. MLM is the recommend technique to analyse these types of data. This chapter provides an explanation of the statistical analytical method—MLM—used in the four scientific articles included in this PhD that examine the impact of the Good Sports programme.

MLM is a form of regression used when the data are characterised by clustering, and has a hierarchical structure, such as children in schools, schools in regions and regions in states. The chapter begins by specifying when MLM should be employed. This is followed by an explanation of the identifying features of an MLM, by comparing it with traditional ordinary least squares (OLS) multiple regression. Examples of output produced by statistical software packages, statistical tests that are generally used to assess multilevel models and strategies that are recommended in building a multilevel model are also given.

3.1 Traditional Types of Statistical Analysis

Traditionally, when examining differences between groups of individuals (e.g. a treatment and control group) on a variable of interest, independent samples t-tests and analysis of variance (ANOVA) tests are commonly used (Gravetter & Wallanau, 2007). Certain assumptions must be met before these statistical techniques can be employed. These assumptions are listed below:

1. **Measurement:** The dependent variable is measured on a continuous scale
2. **Random sampling:** The participants in the study are randomly selected from the population
3. **Independence of observations:** The observations and measurements are independent from one another—the response by one individual must not influence the response of another individual
4. **Normal distribution:** The populations from which the data are gathered has a normal distribution
5. **Homogeneity of variance:** That the variance in the dependent variable is similar for both groups being compared (Tabachnick & Fidell, 2005)

With most social research, these assumptions are not too difficult to fulfil (Snijders & Bosker, 1999). However, in many cases, usually for logistical reasons, assumption two (random sampling) is sometimes not practically possible. Thus, often social research is comprises convenience samples or quasi-experimental study designs (De Vaus, 2002). Theoretically, randomly selecting participants ensures that there are no biases (confounding effects) in the groups being compared (e.g. one group has younger participants) (Mitchell & Jolley, 2004). Usually, when the random sampling assumption has not been met, control variables, sometimes referred to as covariates, may be introduced into the analysis (Cook & Campbell, 1979). Based on previous research and/or a

theoretical rationale, these variables are introduced to control for confounding effects, while examining the relationship between the independent variable and the dependent variable.

If control variables are introduced, multiple regression is often employed to detect between-group differences in a dependent variable. Multiple regression tests whether a linear relationship exists between three or more variables (predictor and at least one dependent variable), while controlling for other confounding variables (covariates) (Shadish, Cook & Campbell, 2002). As with ANOVA and t-test, multiple regression has certain criteria that must be met before the technique can be validly applied. The following are the assumptions that must be met before a multiple regression can be undertaken:

1. **Measurement**: The dependent variable is measured on a continuous scale
2. **Independence of observations:** The observations and measurements are independent from one another; that is, the response by one individual must not influence the response of other individuals
3. **Normality**: All variables used in the regression should be normally distributed
4. **Linearity**: The relationship between any two variables used in the regression should be approximately linear
5. **Homoscedasticity:** For each dependent variable, the variability in the dependent variable should be similar for each value of the independent variable
6. **Multicollinearity:** The correlation between the independent variables should be less than 0.9
7. **Outliers:** There should not be any anomalous extremely high or extremely low scores
8. Residuals

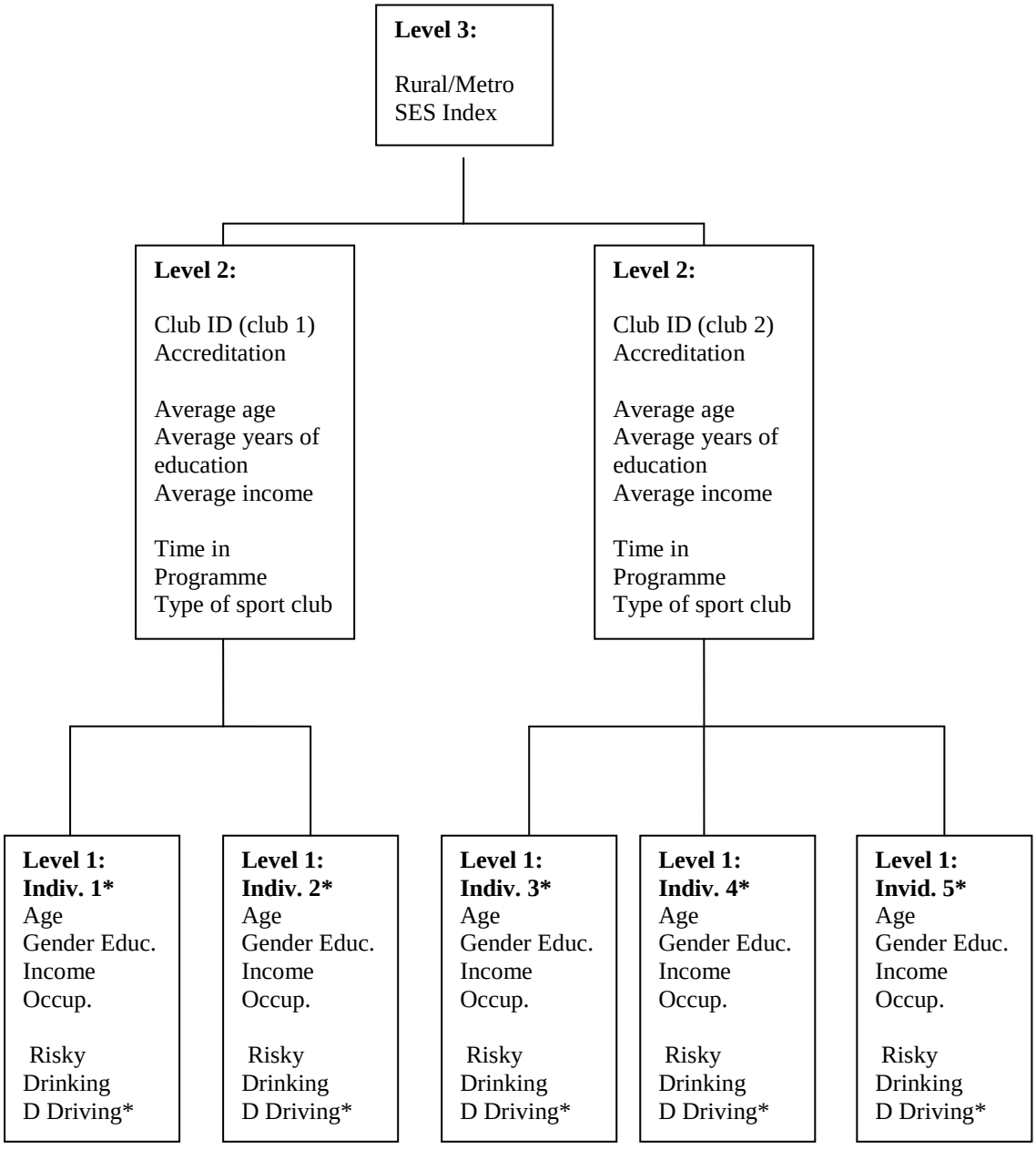
a. **Normality**: residuals should be normally distributed about the predicted DV scores;
b. **Linearity**: The residuals should have a straight line relationship with the predicted DV scores; and
c. **Homoscedastatisticty**: The variance of the residuals about the predicted scores should be the same for all predicted scores (Tabachnik & Fidel, 2005)

3.2 Nested/Clustered Data

Most traditional social research can accommodate the assumptions required for multiple regression. However, when the data have been collected using stratification sampling techniques, or the data can be organised into clusters, the requirements to satisfy assumptions two (independence of observations), five (homoscedasticity) and eight (residuals) become problematic (Snijders & Bosker, 1999). Clustered data are usually characterised by the capacity to organise groups of the data into higher order groups.

Examples of clustered data include students that can be grouped (clustered) into the same classroom and/or school, individuals who are seeing the same therapist or attending the same hospital, children from the same family, and individuals who belong to the same sports club. Sometimes clusters can be further categorised into higher level clusters, such as schools in regions, families in villages and suburbs within states. When data are organised into clusters, the individual level is described as level one, the clusters of individuals into a group as level two and the grouping of level-two groups as level three (Rabe-Hesketh & Skrondal, 2008). For example, the data in the studies included in this thesis can be organised into the following clusters: individuals and individual-level variables are clustered in sports clubs; and sports clubs can be further organised into rural

or metropolitan regions. Figure 3.1 indicates how the variables in the four studies included in this PhD could be classified.



* D Driving = drink driving (alcohol-impaired driving); indiv= individual

Figure 3.1. Hierarchy of clusters for data used in four studies, shown for three clubs.

Stratification sampling techniques often use clusters to identify and obtain individual-level data (Snijders & Bosker, 1999). For example, if schoolchildren are the population of interest, sampling may be performed through randomly sampling schools. If employees in a certain types of organisation are to be studied, random sampling of the organisations and then approaching individuals in the selected organisation would be one method of collecting data. In the case of data gathered for this thesis, individuals in sports clubs were the subject of interest. Sports clubs were selected to participate in the study then individuals in the selected clubs were asked to participate in the research. Repeated measures, such as observations made on different occasions on the same individual or group, are also understood to be a form of clustered data (Rabe-Hesketh & Skrondal, 2008). Clustered data is also referred to as nested data, and clustered longitudinal studies are sometimes referred to as growth models (Bickel, 2007).

3.3 Problems Usually Associated with Clustered Data

3.3.1 Aggregation.

A common procedure in social research data with more than one level is to aggregate lower level data to a higher level. For example, individual-level data in study one, such as individual alcohol consumption, could be aggregated to a club level. This would create a variable that represents the average alcohol consumption of respondents in a club; every individual in the club would have the same value for this variable. There is nothing statistically incorrect about aggregation if the researcher is interested in outcomes at the aggregated level. However, if the aggregated variable is treated as if it had the characteristics of a lower level variable, significant interpretative and statistical errors can occur (Snijders & Bosker, 1999; Tabachnick & Fidell, 2005).

When higher level data are used to draw conclusions about lower level variables, it is referred to as the ecological fallacy (Robinson, 1950). The ecological fallacy would occur for studies included in this thesis if the variable ‘average club consumption’ was used to draw conclusions about individual behaviour, as opposed to drawing conclusions at a club level. This would happen if the aggregated variable was used as the dependent variable, or by interpreting the newly created variable as a characteristic of individuals. Using these methods to draw conclusions about individual behaviour is problematic for two reasons. First, using aggregated data to draw conclusions about individual behaviour shifts the meaning of the aggregated variable to another level. The variable ‘average alcohol consumption’ is an index of alcohol-related behaviour in a club; it is not a measure of individual behaviour. Using the aggregated variable of alcohol consumption to explain individual alcohol consumption is analogous to using a cricket club’s batting average to explain an individual player’s batting average.

3.3.2 Violation of independence.

When data fall into clusters, and/or stratification has been used to collect the data, the assumption pertaining to the independence of observations has not been met, and therefore traditional statistical techniques cannot be used (Tabachnick & Fidell, 2005). The independence assumption is violated because individuals from the same group will probably be exposed to similar influences, thus their responses to the variables being examined will probably be similar. For example, children from the same class will experience similar influences from their teacher and/or school; counselling clients seeing the same therapist will experience similar psychological or intervention-style influences; and sports club members will experience similar social and environmental influences when attending the same sports club. Given the likelihood of experiencing similar influences, individual responses in clustered data are usually correlated (Murray, 1998). Moreover,

because individual responses in clusters are correlated, it follows that the residuals (error) for individuals in clusters are also correlated (Bickel, 2007). It will be demonstrated below (see the intraclass correlation [ICC] under tools and statistical tests below) that the ICC is a measure of the degree to which individual responses and errors in a cluster are correlated.

Clustered data violate the independence assumption; thus, corrective techniques that adjust for these violations must be employed in any analysis of clustered data. If correctives are not made to the analysis, standard errors (SE) will be underestimated (incorrectly smaller); this is sometimes referred to as a negative bias. As probability estimates (*p* values) are calculated using the SE, misleading tests of significance will be produced (Bowerman & O'Connell, 1993). While theoretically, the need to correct for problems associated with clustered data has been understood from as early as 1861, key software advancements that allowed for this type of analysis were only developed in the last 15 years, and only in the last 10 years have researchers started to publish studies that have employed this technique (West, Welch & Galecki, 2007).

3.4 Mixed/Multilevel Models

Mixed models, sometimes referred to as multilevel models, are a form of regression that corrects for the violation of the independence assumption associated with regression (Bickel, 2007). Like multiple regression (and logistic regression), MLM consists of a dependent variable with a predictor variable and covariates. When the outcome variable is continuous, the mixed model is sometimes referred to as a Linear Mixed Model (LMM). The software packages SAS, SPSS, R, Stata and HLM can all undertake LMM analysis. With the exception of SPSS, all of these packages can also undertake mixed-model analysis with dichotomous dependent variables.

Multilevel techniques can also be employed to undertake factor analysis (multilevel factor analysis) and analysis with two or more dependent variables— multilevel structural equation modelling (Heck & Thomas, 2000). Multilevel techniques can also be used to do meta-analyses, where the goal is to compare several studies from the literature that are analysing the same outcome (Hox, 2002).

3.4.1 Linear mixed models.

There are several characteristics that distinguish a linear mixed model (LMM) regression equation from a traditional multiple regression equation. Estimates of the intercept and coefficients for predictors and covariates for traditional multiple regression are averages for the whole dataset. In contrast, mixed model regression allows an estimate of the regression intercept and regression coefficients for predictors and covariates to be calculated for each cluster, or another higher order variable (Rabe-Hesketh & Skrondal, 2008). After these values have been estimated, an average cluster intercept and average cluster coefficient value are calculated. Fundamentally, LMM analysis allows intercepts and slopes to vary in respect to any higher order variable.

For example, using LMM techniques to analyse data for alcohol consumption (level-one variable) in sports clubs, the intercept and coefficients could be permitted to vary on a club-by-club basis (level-two variable). Allowing variables to vary by a higher order variable is effectively a way of explaining differences between clubs. When a variable is specified to vary in respect to a higher order variable, it is classified as a random variable. When a variable is specified as not varying in respect to a higher order variable, it is classified as a fixed variable (West et al., 2007).

The terms ‘fixed’ and ‘random’ are also used for parameter estimates in the LMM regression equation. The average parameter estimate for a random variable is referred to as a ‘fixed estimate’ or ‘fixed effect’ (Bickel, 2007). The fixed estimate is the weighted

average across the groups, with the larger clusters contributing more to the overall average than the smaller clusters. In contrast, a random effect is the standard deviation of the fixed effect of a random variable; it is the average cluster deviation from the fixed effect (Snijders & Bosker, 1999). Like conventional measures of standard deviation, squaring the random effects is a measure of the variance (Rabe-Hesketh & Skrondal, 2008).

The final regression equation for a multilevel regression comprises only the fixed effects. For example, the relationship between gender and alcohol consumption (after controlling for age) in sports clubs may be of interest. However, if for theoretical reasons, the intercept and the coefficient for gender were permitted to vary by cluster (sports club), the intercept and gender would be categorised as random variables. As age has not been permitted to vary by cluster, age would be categorised as a fixed variable. The equation representing this multilevel regression looks very similar to a traditional OLS multiple regression equation, and would be written as indicated in Equation 1. At this stage, the only difference between Equation 1 and a traditional multiple regression equation is that the estimates for the intercept and the slope coefficient for gender have been estimated in respect to each sports club, as opposed to an estimate for the whole sample.

$$Alcohol\ consumption = \beta_0 + \beta_j(Gender1) + \gamma_2(Age1) + e_i \qquad Equation\ 1$$

The coefficient values in Equation 1 are referred to as fixed effects. As the intercept (β) and coefficient for gender (β_j) are permitted to vary by cluster, these represent average values over the clusters. In contrast, the coefficient for age (γ_2), which has not been permitted to vary in respect to sports clubs, is calculated for the whole sample. All software packages also give a random effect estimate for each random variable. Thus, for Equation 3, a random effect estimate would be produced for the intercept and variable gender. Tables 3.1 and 3.2 are examples of fixed estimates for the fixed and random

variables, and the random effect estimates for multilevel regression equation for alcohol consumption, as produced by SPSS.

Table 3.1

SPSS Output for Fixed Estimates for Fixed and Random Variables

						95% Confidence interval	
Parameter	**Estimate**	**Std error**	**Df**	**t**	**Sig.**	**Upper Bound**	**Lower Bound**
Intercept	5.74465	0.483856	1602.966	11.873	0.000	4.795593	6.693708
Age	–0.029102	0.009149	1633.002	–3.181	0.001	–0.047047	–0.011156
Gender	–0.768987	0.304295	666.064	–2.527	0.012	–1.36648	–0.171494

Dependent Variable: Number of standard drinks on Saturday (playing day)

Table 3.2

SPSS Output for Random Effects

						95% Confidence interval	
Parameter		**Estimate**	**Std error**	**Wald Z**	**Sig.**	**Lower bound**	**Upper bound**
Residual		20.641669	0.748457	27.579	0.000	19.225633	22.162001
gender (subject = club)	Variance	1.15461	0.299625	3.854	0.000	0.694298	1.920103

Dependent Variable: Number of standard drinks on Saturday

Table 3.1 indicates that the value for the intercept (β_0) is approximately 5.7 and the values for the coefficients for the variables age and gender are –0.03 and –0.77, respectively. The values in the column ‘sig.’ are all below 0.05, thus indicating that the fixed estimates are all significant. The row labelled ‘residual’ in Table 3.2 indicates the variance of the intercept, and the second row indicates the variance of the random variable gender. The ‘(subject = Club)’ indicates that the intercept has been allowed to vary by each club (Club). The values in the column ‘sig.’ are again all below 0.05, thus indicating that the variance of the intercept is significantly different between clubs, and the variance for

the coefficient gender is also significantly different between clubs. As will be demonstrated below, the aim of adding other same-level covariates to the model is to reduce the variance *within* groups, and the aim of adding higher level variables is to reduce *between-group* variance (Bickel, 2007).

The term ‘mixed model’ comes from the notion that there is a mixed combination of fixed and random variables in the regression equation. As mixed models have varying slopes and intercepts, they are sometimes referred to as random coefficient models (Longford, 1993). Moreover, because they use higher order variables to help explain variance in random slopes and intercepts, they are also referred to as hierarchical linear models (Raudenbush & Bryk, 2002), slopes as outcomes (Kreft & De Leeuw, 1996) or multilevel models (Bickel, 2007).

3.4.2 Logistical mixed models.

Multilevel logistic regression (MLR) models use the same terminology to describe random variables, fixed variables and random effects in the regression equation (Rabe-Hesketh & Skrondal, 2008). The output for an MLR model is also very similar to an LMM regression. Equation 2 is an example of a logistic mixed-model regression equation that uses risky drinking as the dichotomous dependent variable—does an individual drink at risky levels (yes or no)? The independent variable is the age of the individual. The intercept has been defined as a random variable in respect to club, and age has been defined as a fixed variable. Consistent with traditional logistic regression equations, there is no error term in the level-one equation.

$$Risky\ drinking = \beta_0 + \beta_1\ (Age1) \qquad \textit{Equation 2}$$

Sometimes logistical regression equations are also written in the following way :

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_{1j}(age)_{ij} + u_{0j} \qquad \textit{Equation 3}$$

Where $\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)$ = the log odds that the outcome variable = 1. In this equation the outcome variable is that the individual is a risky drinker.

Table 3.3 is an example of the output for the fixed effects for Equation 2, for a logistical model, as produced by Stata, Version 11. Similarly, Table 3.4 is an example of the output of the random effects for Equation 4.

Table 3.3

Stata 11 Output for Fixed Effects of Multilevel Logistic Regression

riskyshort	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
q6age	**-.0151833**	**.0052084**	**-2.92**	**0.004**	**-.0253915**	**-.004975**
_cons	**-1.144605**	**.2102286**	**-5.44**	**0.000**	**-1.556645**	**-.7325641**

Table 3.4

Stata 11 Output of Random Effects

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
club_id: Identity var(_cons)	**.5138356**	**.1537312**	**.2858635**	**.9236123**

LR test vs. logistic regression: chibar2(01) = **37.48** Prob>=chibar2 = **0.0000**

Table 3.3 indicates that the fixed estimate for the intercept (_cons) is –1.14. As the intercept has been defined as random, this is the average intercept value over all the clubs.

The fixed estimate for the coefficient age is –0.015. As age was defined as a fixed variable, this coefficient is the average for the whole sample. Both the intercept and age coefficient are significant as indicated by the P > |Z| column. Table 3.4 indicates that the average variance of the intercept between clubs is 0.51.

3.5 Overview of Mathematical Theory Behind Multilevel Models

There are at least two levels of data and therefore, at least two regression equations used to calculate a mixed model regression. There are also certain subscript conventions that aid in building and describing a multilevel model. Using individual alcohol consumption as the dependent variable and specifying that individual alcohol consumption would vary by club, the following is an explanation of how the mixed model regression equations have been built for the analysis in the studies reported in the next four chapters of this thesis.

3.5.1 Subscript and equation conventions.

Multilevel models are a procedure that uses intercepts and slopes as outcomes (Dependent Variables—DVs) (Kreft & De Leeuw, 1996). This is another way of saying that MLM is simply regression with a variety of levels. Intercepts and slopes from the first level of analysis serve as DVs for the second level of analysis, and the intercepts and slopes for the second level of analysis serve as DVs for the third level of analysis (Bickel, 2007).

The level-one equation usually contains conventional level-one (individual-level) measures such as age, gender and SES. The number of second-level equations depends on how many random components there are in the first level equation. Explanatory factors (predictors) in second-level equations are usually second-level fixed-effect variables. Similarly, if there is a third level, the number of third-level equations depends on the

number of random variables in the second-level equation and the predictors in the third-level equation are third-level variables (Bickel, 2007). After all the equations for all the levels have been specified, they are combined by substitution to form the multilevel model. It is this model (equation) that software packages calculate the coefficients for, and this model is used for interpretation. These values are reported in the output of the fixed effects (see Tables 3.1 and 3.3).

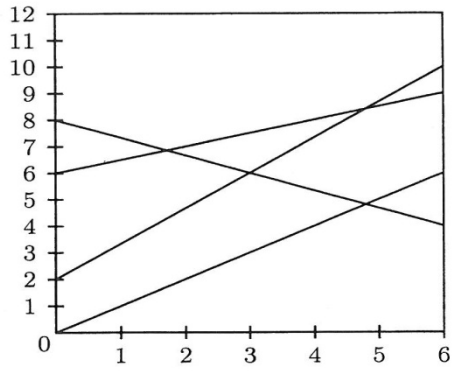
In developing the multilevel regression model, there are certain symbols and subscript conventions that are used to aid in the description and building of multilevel regression model. The beta (β) symbol is usually used to represent random coefficients and the gamma symbol (γ) is used to represent fixed coefficients. There are also certain subscript notations that help identify whether the coefficient represents an intercept or a slope. While subscript notation is relatively similar across two-level multilevel models, subscript notation varies substantially across the description of three-level models (see Luke, 2004; Raudenbush & Bryk, 2002; Singer & Willett, 2003; Snijders & Bosker, 1999). A practical example demonstrating these conventions will help clarify these concepts, with a two-level model and three-level model, using conventions employed by Bickel (2007).

3.5.2 Equation notation for a two-level model.

As this thesis examines alcohol consumption in the sports setting, a typical starting point in exploring this type of behaviour would investigate the relationship between alcohol consumption and age. A traditional regression equation examining the relationship between age and alcohol consumption for the i^{th} individual is described in Equation 4 and has an intercept (a), a slope (b_I) for the predictor, age and an error term (e).

$$Alcohol\ consumption_I = a + b_I(age) + e_I \qquad \textit{Equation 4}$$

If clustering in the data is acknowledged, the intercept and slope is permitted to vary in respect to these clusters. As consumption in sports clubs is the focus of interest here, either the intercept and slope, or both, could be allowed to vary by club (J). A hypothetical pictorial example of regression lines with a varying slope and intercept for four sports clubs is represented below.



Source: Snijders and Bosker (1999)

Figure 3.2. Four regression lines each with a different intercept and slope.

Allowing variables in a regression equation to vary modifies the way the regression equation is written. Equation 5 demonstrates how an equation with a random intercept and random slope can be written.

$$Alcohol\ consumption_{IJ} = \beta_{0J} + \beta_{1J}(Age1) + (\mu_{0J} + \mu_{1J}(Age1) + e_{IJ}) \qquad Equation\ 5$$

Equation 5 has a very similar format to a traditional regression equation; that is, there is an intercept, slope and error term. However, the symbols for the intercept and the slope coefficients change to beta symbols (β), thus depicting they are random. The dependent variable has the subscript i indicating that it represents the i_{th} individual in the j_{th} club. The variable age has the number one added to indicate that it is a level-one variable. The error term has also become more complex.

The first subscript for the random coefficients indicates whether it is associated with an intercept or slope. Conventionally, this type of equation has the first subscript associated with an intercept as zero, and the first subscript associated with the first random slope as 1, and the first subscript for the second random slope is two, etc. The second subscript for these random coefficients indicates that it is part of cluster J. Thus, in Equation 5, β_{0J} indicates that this is the random coefficient for an intercept from cluster J, and β_{1J} indicates that this is the first coefficient for a random slope in cluster J. If there was a second covariate the subscript for the coefficient would be 2j (e.g. β_{2j}), indicating it is the second coefficient for a random slope in cluster j.

The error term still represents the level-one residual (e_{IJ}), but now it also represents variability in the random slope (μ_{0J}) and the random intercept (μ_{1J}(Age1)). The conventions of having the first subscript for an intercept as zero, and the first subscript for a random slope apply to the error term—the 0 used as the first subscript in μ_{0J} indicates that it is associated with the intercept; similarly, the 1 used as the first subscript in μ_{1J} indicates that it is associated with the slope of the first covariate.

Having identified that the intercept and slope vary in respect to clubs, an explanation of why the intercept and slope vary may be attempted. This is done by developing separate regression equations for each random variable. By drawing on theory and previous research, possible explanations for these variations may be explored. For example, is the variation in the random variables a function of second- or third-level variables? Conventionally, second-level variables are used to explain variation in random level-one variables, and third-level variables are used to explain variation in random second-level variables (Bickel, 2007; Snijders & Bosker, 1999). Drawing on theory that suggests that context influences behaviour (McLeroy et al., 1988), the variation in the intercept could be explained as a function of the proportion of risky drinkers in the clubs.

Similarly, the variation in the slope (Age1) may be seen as a function of the average age of club members. These functions are represented in Equation 6 and Equation 7.

$$\beta_{0J} = \gamma_{00} + \gamma_{01}Risky2 + \mu_{0J} \quad \textit{Equation 6}$$

$$\beta_{1J} = \gamma_{10} + \gamma_{11}Age2 + \mu_{1J} \quad \textit{Equation 7}$$

Second-level equations also take on a traditional regression format—they have an intercept, predictor and error term. However, now the number 2 after the predictors (e.g. Risky2 and Age2) indicate that these variables are second-level variables. The coefficients are now written as gammas (γ), as they are fixed, and the subscripts associated with these coefficients indicate the role these coefficients play in the multilevel model. Broadly, the subscript notation for coefficients in level-two equations is consistent with the level-one equations—the first subscript for the intercept is zero, and the first subscript for an intercept is one. However, this convention applies to the general equation, not the intercept and slope coefficients for the specific equations. For example, in Equation 6, the first subscript for each gamma coefficient is zero; this is because this equation represents a random intercept. Similarly, the first subscript for each gamma coefficient in Equation 7 is one, as this equation represents a random slope.

At this point, it should be noted that if theory and/or evidence suggests that more than one predictor could be used to explain the variation in a random variable, these could also be included in the second-level equation. For example, it could be argued that the variation in the intercept is a function of the proportion of risky drinkers in the club, and a function of the average education of club members. The regression equation for the random intercept that included these variables is outlined in Equation 8.

$$\beta_{0J} = \gamma_{00} + \gamma_{01}Risky2 + \gamma_{02}Education2 + \mu_{0J} \quad \textit{Equation 8}$$

Having permitted the intercept and slope to vary, the model at this point is defined as a random coefficient regression equation (Bickel, 2007). The multilevel model is created by substituting the level-two equations into the level-one equation.

For example, '$\gamma_{00} + \gamma_{01}$Risky2 + μ_{0J}' is substituted for β_{0J} in the level-one equation. Similarly, '$\gamma_{10} + \gamma_{11}$Age2 + μ_{1J}' is substituted for β_{1J} in the level-one equation. The steps in constructing a multilevel model regression equation are depicted in Box 3.1.

Box 3.1

Steps in Constructing a Two-level Multilevel Regression Model

Level-one model:

Alcohol consumption $_{IJ} = \beta_{0J} + \beta_{1J}$(Age1) + e_{IJ}

Level-two model:

$\beta_{0J} = \gamma_{00} + \gamma_{01}$Risky2 + μ_{0J}
$B_{1J} = \gamma_{10} + \gamma_{11}$Age2 + μ_{1J}

Substitution of level-two equations into the level-one equation:

Alcohol consumption $_{IJ} = (\gamma_{00} + \gamma_{01}$Risky2 + $\mu_{0J}) +$ Age1*($\gamma_{10} + \gamma_{11}$Age2 + μ_{1J}) + e_{IJ}

Multilevel model with brackets expanded and error terms put together:

Alcohol consumption $_{IJ} = \gamma_{00} + \gamma_{01}$Risky2 + γ_{10}Age1+ γ_{11}Age2*Age1+ (Age1*$\mu_{1J} + \mu_{0J}$ + e_{IJ})

The final multilevel equation, as well as having main effect dependent variables (e.g. γ_{01}Risky2, γ_{10}Age1), also has a cross-level interaction term (γ_{11}Age2*Age1). As Box 3.1 demonstrates, whenever a higher order variable is used to explain variability in a

random slope, a cross-level interaction term emerges (Bickel, 2007). A cross-level interaction is not created when using a higher order variable to explain a random intercept.

It is important to realise at this stage that when a variable is defined as varying in respect to another variable, as in the intercept varying in respect to club, the variable 'club' does not appear in the regression equation. The variable 'club' is only used to calculate the intercept estimate as an average over all the clubs.

3.5.3 Three-level multilevel models.

Having built a two-level multilevel regression model, it is possible and logical to build a three-level model. For example, data examining student behaviour could explore whether students' behaviour varied by school, and whether schools varied by regions. Similarly, data exploring voting behaviour could investigate whether individual behaviour varied by regions, and whether regions vary by state. Alcohol consumption in sports clubs varies by club, and then further varies by regions. Due to space limitations, this will not be demonstrated.

3.6 Tools and Statistical Tests for Assessing Mixed Models

3.6.1 Intraclass correlation.

While it may be possible to categorise data into a hierarchy, it does not follow that mixed model regression is the default method of analysis. The usual way of determining whether MLM techniques are required is by way of the ICC. The ICC measures homogeneity of the responses within a cluster (West et al., 2007); it is a measure of the degree to which responses in a cluster are dependent. The ICC is comparable to the measure of association η^2 sometimes used with ANOVA (Bickel, 2007).

In respect to a dependent variable, the ICC is the ratio of between cluster variance, divided by the sum of between and within cluster variance (see Equation 9). When the ICC

is multiplied by 100, it represents the proportion of total variance that is accounted by the cluster. An ICC can be easily estimated using output provided in software packages that can do MLM, and if desired can be calculated for every level of the data. If the ICC for the second or third level of the data was being calculated, the between-group variance used in the formula below would be at level two and level three, respectively.

$$\frac{\textit{Between-group variance}}{\textit{Between-group variability + Within-group variability}} \qquad \textit{Equation 9}$$

While the ICC determines the degree of within-group homogeneity, it also establishes a baseline to assess whether adding covariates to the model reduces the amount of variability in the dependent variable. When there are no explanatory variables, just the intercept used to calculate the ICC, the ICC is referred to as the unconditional ICC. When explanatory variables are added to the model, the ICC is then known as a conditional ICC. As will be demonstrated below (see Section 3.7), the process behind multilevel modelling is to introduce theoretically informed explanatory variables or covariates to reduce as much variability as possible in the dependent variable.

3.6.2 Design effect and effective sample size.

In most datasets comprising clusters, nesting produces what has been described as a design effect. The design effect determines the loss of information due to the ICC (Goldstein, 1999). Information is lost through clustering because when there is an ICC related to a variable of interest, measurement on this variable for each additional person carries information redundant to that already collected. Thus, the amount of new information, per individual, diminishes as the sample size of a cluster increases (Hannan, 2006). The design effect is used to calculate the effective sample size. The effective sample size is an estimate of how big the dataset is ‘effectively’ after the ICC has been adjusted

for—after adjustment of the redundant information has been made (Kalton, 1983). The formulae used to calculate the design effect and the effective sample size are listed below:

$$design\ effect = 1 + (n-1)* ICC \qquad Equation\ 10$$

$$effective\ Sample\ Size = N / design\ effect \qquad Equation\ 11$$

In the above formulae, n equals the average number of observations per group and N equals the total number of observations in the sample. When the two formulae are considered together, it can be seen that as the ICC increases the effective sample size decreases. As an ICC can be calculated for every level of the data, so too, a design effect and effective sample size can be calculated for every level of the data.

3.6.3 Statistical power and its relationship to sample size.

Similar to traditional regression, the capacity to detect a relationship using MLM, if one exists, depends on four factors (Bickel, 2007):

1. the strength of the relationship
2. the designated alpha level
3. the magnitude of the correlations among the independent variables
4. effective sample size

It can be seen that if the first three factors are assumed constant in all LMM analysis, effective sample size is a major determinant of statistical power. However, the literature on sample size for LMM regression is extensive and sometimes inconsistent, with most perspectives heavily qualified with caveats (see Hox, 1998; Maas & Hox, 2005; Mok, 1995). The debate focuses on the underestimated standard error of fixed parameters when the number of second-level variables is less than 100. For example, it is argued with a sample of 50 groups (second-level variable) the SE of the fixed parameters can be underestimated by approximately 15%. Similarly, it is argued that with a sample of 50

groups, there is a possibility that the standard error for fixed parameters can be underestimated by approximately 7% (Maas & Hox, 2005).

Despite the lack of clarity in respect to LMM sample size, there are two 'rules-of-thumb' that are currently cited in the literature: the 20/30 rule and the 30/30 rule (Heck & Thomas, 2000). Respectively, these rules suggest a minimum of 20 groups with at least 30 individuals per group or a minimum of 30 groups with a minimum of 30 individuals per group will produce sufficient power. Moreover, because of the ICC, it has also been noted that the principle of diminishing returns applies as cluster sizes become larger; that is, little new information is gathered as the sample size increases. Thus, to reduce inefficiency, it is recommended that a cluster does not go beyond 50, and that more information will be obtained with a greater number of clusters, rather than fewer clusters with large cluster samples (Hannan, 2006).

3.6.4 Estimation of mixed models.

The suggested method for dealing with estimation of parameters with nested data tends to avoid the traditional estimation technique, OLS, in favour of estimation methods that are specifically designed for multilevel data. Maximum likelihood (ML) and residual (or restricted) maximum likelihood (REML) have been formulated as alternative estimation methods for LMM regression (Longford, 1993). Both techniques obtain parameter estimates based on the distribution of the data and by using an equation (function) that optimises the probability that the parameters in the model will be obtained (Casella & Berger, 2002).

The advantage of REML over ML is that it takes into consideration the number of parameters in the model. However, the difference in the parameter estimations between ML and REML becomes quite small, as the number of group-level observation increases (Luke, 2004; Snijders & Bosker, 1999). While either method does not seem to influence

the parameter estimates as the sample size increases, it has been suggested that ML can downwardly bias the variance explained in the model (Snijders & Bosker, 1999). Thus, REML is usually recommended as the preferred parameter estimation method, especially when building a model that is aiming to reduce the variance in the dependent variable (West et al., 2007).

3.6.5 Centring covariates.

With OLS regression, centring of independent variables is recommended to reduce multicollinearity, especially with random variables (Jaccard & Turrisi, 2003; Preacher, 2003). Grand-mean centring or group-mean centring are both recommended but the intercept and slope for the LMM regression equation are interpreted differently for each method of centring (Hox, 1998; Snijders & Bosker, 1999). Grand-mean centring of a variable is achieved by subtracting the value of the variable of interest from the mean value of that variable from the sample. By doing this, the value of the variable is then expressed as a deviation score from the sample mean.

Group-mean centring is similar. However, instead of subtracting the variable value from the sample mean, the variable is subtracted from the average value of its cluster or group. Thus, group-mean centring is a deviation measure from the cluster mean. Sometimes group-mean centring is referred to as context-centring (Bickel, 2007). When variables are not centred, the intercept represents the best estimate of the dependent variable when all the dependent variables are set to zero. When the dependent variables are grand-mean centred, the intercept is the best estimate when all the independent variables are set to equal their grand-mean. With group-mean centring, the intercept is the best estimate of the dependent variable with all the independent variables set to the group-mean (Paccagnella, 2006).

3.6.6 Model selection.

While specific strategies are used to build multilevel models, statistical tests are employed to compare different LMM. These tests assess whether the addition or removal of parameters improve the model fit with the sample data. The following test statistics are the most commonly employed in building LMM:

1. likelihood ratio tests (-2 Log Likelihood) for fixed parameters and covariance parameters;
2. tests for single fixed parameters
3. fit Criteria statistics

Statistical software for multilevel modelling produces a -2 Log Likelihood statistic for each model that is analysed. This statistic is an index of the 'lack of fit' of the model, and is often referred to as the deviance statistic (Bickel, 2007; Snijders & Bosker, 1999). However, the statistic has little interpretive value when considered in isolation. Usually, to assess which model is a better fit with sample data, the -2 Log Likelihood statistic from one model is compared to the -2 Log Likelihood statistic from another (Burnham & Anderson, 2002; Cavanaugh, 2005; Kuha, 2004). As the -2 Log Likelihood statistic follows a χ^2 distribution, this is done by assessing whether the difference is significant in respect to a χ^2 distribution (Bickel, 2007). The degrees of freedom (*df*) are obtained by subtracting the number of parameters in the first model from the number of parameters in the comparison model.

In general, it is assumed that when -2 Log Likelihood statistics are being compared, the same subset of data is being compared. Thus, if there are missing values in one model, and not in the other, the -2 Log Likelihood Ratio Test cannot be used (Rabe-Hesketh & Skrondal, 2008). Moreover, when comparing -2 Log Likelihood statistics for fixed parameters, the ML estimation method is recommended, and when comparing the -2 Log

Likelihood statistics for random parameters, the REML estimation is recommended (Snijders & Bosker, 1999).

When a single fixed parameter is added to the model, a t-test or z-statistic is used to assess if it acts as a significant predictor in the model. SPSS, SAS and R use t-tests, while Stata uses a z-statistic. The SPSS output in Table 3.1 indicates the t-test output for the fixed parameters for an LMM. Similarly, the Stata output in Table 3.3 indicates the z-test for the fixed parameters for a logistic mixed model. In keeping with the principle of parsimony, only significant dependent variables are included in LMM regression equations (Tabachnick & Fidell, 2005).

The final tool that is useful in LMM model building is the information criteria. The information criteria are also referred to as deviance statistics (Bickel, 2007), or fit statistics (West et al., 2007). These tools are indices of how well the model fits the data. When two models are compared, the smaller fit statistic is considered the better fitting model (Hox, 2002). Most software packages provide several information criteria statistics; these include: Akaike's information criterion (AIC), Hurvich and Tsai's Criterion, Bozdogan's criterion and Schwarz's Bayesian Criterion (SBC). Illustrated below are the formulae used to calculate AIC and SBC:

$$AIC = -2 \text{ Log Likelihood} + (2 * \text{number of parameters}) \qquad \textit{Equation 12}$$

$$SBC = -2 \text{ Log Likelihood} + \text{number of parameters} * \ln(N) \qquad \textit{Equation 13}$$

An examination of the AIC and SBC indicates that both the indexes increase as the number of parameters increase. Moreover, the SBC is a function of the number of level-one variables. Both criteria also use the -2 Log Likelihood statistic as the reference point. The virtues of these fit statistics and the other statistics mentioned above is that they punish analysts for using additional degrees of freedom (Hox, 2002). This is a parsimony

safeguard against using additional parameters in the model to provide the appearance of a better fit for the data, when in fact nothing, or very little, has been achieved. As the calculation of the SBC includes the number of level-one cases (N), it has been suggested to be a good indicator of the fit of the model that might be inflated because of a large sample size (Bickel, 2007).

However, while the information criteria are used to compare model fit, recent research in the area of fit statistics indicate that no information criteria stands apart as the best criterion to be used when assessing mixed models (Gurka, 2006). In summary, although minimising the information criterion is a convention currently used to encourage model parsimony, substantially more work still needs to be done in understanding the specific role information criteria play in the selection of the best fitting LMM (West et al., 2007).

3.7 Model-building Strategies

As the number of variables introduced into the model increases, the number of possible random and cross-level interactions also increases rapidly. To aid researchers in building linear and logistic LMMs, a variety of strategies have been recommended in the literature (see Bickel, 2007; Rabe-Hesketh & Skrondal, 2008; Snijders & Bosker, 1999). The strategies can be categorised into two groups:1) the step-up strategy; and 2) the top-down strategy (West et al., 2007).

3.7.1 Step-up strategy.

The step-up strategy comprises three steps:

1. start with an unconditional (null) model
2. build the level-one model by adding level-one covariates, and the consideration of level-two random effects

3. add level-two covariates to the level-two model, and adding random effects to the level-three equations to account for coefficients of the level-two covariates (West et al., 2007).

Starting with an unconditional or null model means creating a regression equation that has the intercept as the only parameter. The null model allows the intercept to vary by a higher level variable (level-two or level-three variable). It also allows the researcher to assess the ICC. Moreover, the null model provides a baseline that enables the researcher to assess the reduction in between-group and within-group variance as variables are entered into the model.

The second step focuses on building the level-one model by adding level-one covariates, and the consideration of level-two random effects**.** Level-one covariates are introduced to help reduce the within-group variance of the level-one model. Level-two random effects are also introduced to help explain random variance in level-one variables (Snijders & Bosker, 1999).

If the dataset has more than two levels of data, stage three follows a similar procedure to stage two; however, it is applied to level-two and level-three data. Instead of adding level-one covariates and level-two random effects, it involves adding level-two covariates and adding level-three random effects (West et al., 2007). Decisions about which variables are permitted to be fixed and which variables are permitted to be random should be theoretically informed.

It has been suggested that if a higher order variable and its relationship with the dependent variable is of principal interest to the researcher, it can be included in the model from the start when using the step-up approach (Snijders & Bosker, 1999).

The four studies included in this PhD used the step-up strategy. As the relationship between accreditation in the Good Sports programme (level-two variable) and alcohol-related behaviour was of particular interest in the four studies, this variable was included in step 1 of the model-building process.

3.7.2 The top-down strategy.

The top-down strategy involves starting with a model that includes the maximum number of fixed and random effects in the model, and then gradually removing fixed and random effects so that the most parsimonious model is developed (Verbeke & Molenberghs, 2000). While theory informs the top-down strategy, it also draws on analysis of the structure of the data to build a final model. West et al. (2007) summarise the top-down approach into four steps:

1. start with a model that considers all fixed effects
2. select a structure for the random effects
3. select a covariance structure for the residuals
4. reduce the model

The first stage in the step-up strategy begins by drawing on research and/or theory to include all the fixed effects of as many covariates and interactions that are to be considered. The second step assesses whether specific random effects should be added to the model. Each random effect is assessed individually determining whether a significant increase in the -2 Log Likelihood (using REML) occurs when the random effect is changed to a fixed effect.

The third step adjusts for the violation of the assumption that all the residuals are independent and identically distributed among the groups. This is determined by examining box-plots of the data. If the box-plots indicate that the data have heterogeneous

residual variance structure, the model includes a heterogeneous residual variance structure. If the data indicate that the variance is similar between groups, the model is defined as having a homogeneous residual covariance structure. While some LMM texts advocate for the top-down strategy, only a limited number of software packages (e.g. SAS and R) can select a covariance structure to match the data, underlying the decision not to use this strategy in the current project. Where the top-down strategy is used, step 4 involves using statistical tests (e.g. Likelihood Ratio Tests for fixed effects, and tests for covariance parameters) to decide whether to include or exclude various fixed effects.

3.8 Assumptions

After fitting a model, it is recommended that model diagnostics are undertaken. As with traditional regression, these diagnostics ensure that statistical assumptions of the analysis have not been violated. With OLS regression, diagnostics are undertaken prior to the analysis. However, because LMM has a covariance structure for each level of the data, and usually random effects, there are diagnostics for each level of the data. As a consequence of this complication, it is suggested that the diagnostics pertaining to the assumptions for LMM are employed throughout the model-building process, usually at the end of each step of the strategy being employed (e.g. step-up or top-down) (West et al., 2007).

Limitations and assumptions associated with the variables used in traditional regression apply to each level of the data in LMM regression (Tabachnick & Fidell, 2005). Thus, for each variable at each level of the data, checking for outliers, normality, linearity, homoscedasticity of residuals, and independence of observations needs to be assessed.

Normality, linearity and homoscedasticity of residuals can be assessed at each level using traditional exploratory regression analysis techniques (Normal P-P plots,

scatterplots) (Raudenbush & Bryk, 2002). Ideally, this analysis should be done for every cluster in each level. However, if there is a large number of clusters, they can be assessed as an aggregate over the respective level (Tabachnick & Fidell, 2005). Issues of sample size and multicollinearity are addressed slightly differently to traditional regression, as discussed above. As mixed model regression is chosen in response to a strong ICC, the violation of the assumption of independence is inherently addressed.

After fitting a random intercept model, it is recommended that a Hausman endogeneity test be undertaken (sometimes referred to as the Durbin-Wu-Hausman test) (Rabe-Hesketh & Skrondal, 2008). This test examines whether, after adjusting for the random intercepts, the between-group variance differs significantly. If significant differences are found, the random intercept model is probably misspecified and should not be used. The Hausman test comprises series of commands in Stata. This was the process used for the Hausman tests undertaken for the analyses presented in this PhD.

3.9 Conclusion

Mixed model regression, either with a continuous or dichotomous dependent variable, is used when the assumption of independence of observations and subsequently the independence of residuals cannot be fulfilled. When data are characterised by clusters or have been collected through a stratification technique, these assumptions cannot be met. A measure of the extent to which observations lack independence (are homogeneous) is provided by the ICC, and a significant ICC suggests that analysis techniques such as mixed model regression that accommodate homogeneity should be employed.

In this chapter, the rationale behind the need for mixed model regression and the mathematical theory behind the building of mixed model regression equations has been described and the conventions used to describe these equations clarified. The statistical

tests used to test and assess and build a mixed model regression equation were next explained. Finally, model-building strategies and the assumptions behind a mixed model regression equation were described. This theory, these statistical tests, and model-building strategies will now be employed in the four empirical studies (journal articles) that have analysed the association between the adoption of the Good Sports programme and alcohol-related behaviours in sports clubs.

Not all journals use mathematical require notation to describe the MLM model used in an analysis. As only one journal out of the four papers submitted (Chapter 4) as part of this PhD has used mathematical notation, this notation is only presented in that chapter.

Study One (Article One)

Rowland, B., Allen, F., & Toumbourou, J. W. (2011). Impact of Alcohol Harm Reduction Strategies in Community Sports Clubs: Pilot Evaluation of the Good Sports Program. Health Psychology. Advance online publication. doi: 10.1037/a0026397

These pages are designed to assist the reader link the preceding chapters with the rationale for undertaking the study one (submitted and accepted article one). Article one was designed to assess the initial levels of the programme. This was done in the following ways:

1. Compare prevalence of risky drinking between individuals who belong to clubs that are accredited as level-one Good Sports clubs, with prevalence levels of risky drinking among individuals who belong to clubs that are accredited as level-two Good Sports clubs;
2. Compare prevalence of risky drinking with individuals who belong to level-one- and level-two-accredited Good Sports clubs with prevalence of risky drinking in the broader community;
3. Assess whether higher accreditation level was associated with lower levels of alcohol consumption.

The study may be described as an ‘adoption study’, as it did not set out to test specific causal relationships. Rather, it examined whether there was an association with adopting harm-reduction strategies formally implemented as part of the Good Sports programme, and reduced alcohol consumption. As implementing and evaluating interventions at a community level are logistically complex, ethically challenging, and resource intensive, the study also provided information that enabled an assessment of

whether greater investment in the programme and its evaluation could be justified. It also provided information for power and sample size calculations for future studies.

1. The paper has been accepted for publication by the Journal *Health Psychology*, an American Psychological Association journal. This journal has an A* Class ranking according to the 2011 Excellence in Research for Australia (ERA), classification; it has an impact factor of 3.982.

Monash University

Declaration for Thesis Chapter 4

Declaration by candidate

In the case of Chapter 4 the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Design study, data collection, lead analysis and write-up of article	65–70%

The following co-authors contributed to the work. Co-authors who are students at Monash University must also indicate the extent of their contribution in percentage terms:

Name	Nature of contribution	Extent of contribution (%) For student & co-authors only
Associate Professor Felicity Allen	Analysis and write-up	N/A
Professor John Toumbourou	Analysis and write-up	N/A

Candidate's Signature	[redacted]	Date 18 August, 2011

Declaration by co-authors

The undersigned hereby certify that:

1. the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors
2. they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise
3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication
4. there are no other authors of the publication according to these criteria

5. potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit
6. the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)	Deakin University, School of Psychology, Burwood Campus, Burwood Highway Melbourne

[Please note that the location(s) must be institutional in nature, and should be indicated here as a department, centre or institute, with specific campus identification where relevant.]

Signature 1	[redacted] Associate Professor Felicity Allen	Date 18th Aug 2011
Signature 2	[redacted] Professor John W Toumbourou	18th Aug 2011

Chapter 4: Alcohol Harm-Reduction Strategies and Community Sports Clubs: Pilot Evaluation of the Good Sports Programme

Health Psychology

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Impact of Alcohol Harm Reduction Strategies in Community Sports Clubs: Pilot Evaluation of the Good Sports Program

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Objective: Approximately 4.5 million Australians are involved in community sports clubs. A high level of alcohol consumption tends to be commonplace in this setting. The only program of its type in the world, the Good Sports program was designed to reduce harmful alcohol consumption in these Australian community sports clubs. The program offers a staged accreditation process to encourage the implementation of alcohol harm-reduction strategies. ***Method:*** We conducted a postintervention adoption study to evaluate whether community sports club accreditation through the Good Sports program was associated with lower rates of alcohol consumption. We examined alcohol consumption rates in 113 clubs (N = 1,968 participants) and compared these to consumption rates in the general community. We hypothesized that members of clubs with more advanced implementation of the Good Sports accreditation program (Stage Two) would consume less alcohol than those with less advanced implementation (Stage One). ***Results:*** Multilevel modeling (MLM) indicated that on days when teams competed, Stage Two club members consumed 19% less alcohol than Stage One club members. MLM also indicated that the length of time a club had been in the Good Sports program was associated with reduced rates of weekly drinking that exceeded Australian short-term risky drinking guidelines. However consumption rates for all clubs were still higher than the general community. Higher accreditation stage also predicted reduced long-term risky drinking by club members. ***Conclusion:*** Our findings suggest that community sports clubs show evidence of higher levels of alcohol consumption and higher rates of risky consumption than the general community. Implementation of the Good Sports accreditation strategy was associated with lower alcohol consumption in these settings.

Keywords: alcohol, Good Sports program, harm-reduction strategies, risky drinking, multilevel modeling

Organized community sport—individuals participating in a structured competition or practice session for a sport—makes many positive contributions to community life. Substantial mental (Fox, 1999), physical, and social health benefits are gained by participating in sport (Melzer, Kayser, & Pichard, 2004; Warburton, Nicol, & Bredin, 2006). Unfortunately, sports participation throughout the developed world and in many developing nations is also associated with drinking harmful amounts of alcohol—a major preventable contributor to health and social problems (NHMRC, 2009). However, health promotion theory suggests that social settings, such as community sports clubs, could in fact facilitate and promote healthy behavior. This study examined the association between risky alcohol consumption and the level of implementation of a formal accreditation program aimed at reducing risky alcohol consumption in Australian community sports clubs. Community sports clubs are groups that offer the opportunity for organized sport for community members, usually in a particular geographical or local government area.

Alcohol Prevalence in Sports Clubs

International evidence suggests a strong association between excessive alcohol consumption and participation in community sport. In England, a national household survey indicated that heavier alcohol consumption was associated with playing sports or belonging to a sports club (Poortinga, 2007). In New Zealand, rugby players have reported higher levels of harmful alcohol consumption than community members (O'Brien, Blackie, & Hunter, 2005; Quarrie et al., 1996), and American college athletes have reported higher levels of harmful consumption than other students, and that playing sports predicted alcohol misuse (Brenner & Swanik, 2007; Ford, 2007).

In an Australian study of Australian Rules Football (AFL), Australian Rugby Union, Australian Rugby League, cricket, tennis, and Surf Life Saving, Duff, Scealy, and Rowland (2005) found that 34% of club members reported consuming five or more standard drinks on each club visit; prevalence estimates for club members were markedly higher than those in the general community (10%) at that time (Australian Institute of Health and Welfare, 2005).

A Settings Approach to Interventions

Consistent high-risk alcohol consumption reported across different sports suggests that environmental and systemic factors

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influence alcohol-related behavior in community sports clubs. Behavior ecological theory argues that environment is a key determinant of health behaviors (Hovell, Wahhlgren, & Gerhrman, 2002). Based on the principles of operant conditioning, this theory proposes that behavior can be modified when environmental conditions are modified. Proponents have argued that identifying critical environmental influences and using them to change behavior are crucial to developing effective and efficient interventions (Bartholomew, Parcel, Kok, & Gottlieb, 2006). The most effective interventions are usually applied at several critical levels, not just as a lone strategy (McLeroy, Bibeau, Steckler, & Glanz, 1988). The international health promotion movement has also advocated change in environmental structures to modify health behavior with the Ottawa Charter for Health Promotion (World Health Organization, 1986). Environmental structures are policies and strategies that promote healthy environments and that promote healthy choices.

Evidence of the Efficacy of Environmental Influences on Alcohol Consumption

Cochrane reviews, systematic reviews, and meta-analyses strongly demonstrate that modifying the environment, particularly through accessibility and availability, can reduce alcohol consumption (see Anderson, Chisholm, & Fuhr, 2009; Booth et al., 2008; Fogarty, 2006; Gallet, 2007; Ker & Chinnock, 2010; Loxley et al., 2004). Restricting where and when alcohol may be used and obtained is particularly effective (Babor et al., 2010; Booth et al., 2008; Ker & Chinnock, 2010). Restrictions may apply to certain locations (Holder, 2008) and/or the times of sale of alcohol (Duailibi et al., 2007).

Restricting access by increasing prices has also been demonstrated to reduce alcohol consumption and to modify drinking behavior (Booth et al., 2008; Fogarty, 2006; Gallet, 2007). If the price of an alcoholic beverage is increased, consumers switch to a cheaper beverage within their preferred category (e.g., beer, wine, flavored alcoholic beverage) (Anderson, Chisolm, & Fuhr, 2009). Thus, it has therefore been proposed that, as a strategy to reduce alcohol consumption, happy hour and cheap drink promotions should be banned (Österberg, 2001). Meta-analyses (Ker & Chinnock, 2010) and longitudinal (Bryant & Williams, 2000) studies have also demonstrated that when bar staff are trained in responsible serving of alcohol (RSA) practices and these practices are supported by management and enforced, fewer patrons become intoxicated.

Community interventions (involving several schools and/or towns) have reduced alcohol-related injury and adolescent uptake of alcohol (Holder, Saltz, Grube, Voas, et al., 1997; Holder, Saltz, Grube, Treno, et al., 1997; Perry et al., 1996, 2002). A recent Cochrane Review, however, revealed that there is no evidence of an effect of alcohol-related strategies or policies on behavior in community sports clubs (Priest, Armstrong, Doyle, & Waters, 2008). The present study aimed to address this gap in the literature.

The Good Sports Program

In 2010, approximately 4.5 million Australians aged 15 years and older were involved with organized sport as players, officials, members, or supporters (Australian Bureau of Statistics, this can be updated to 2010). The Good Sports program, an initiative of the Australian Drug Foundation, was developed and piloted in Australian community sports clubs where it is provided free-of-charge (see Duff & Munro, 2007). The primary aim of the program is to implement multilevel systemic change within sports clubs to reduce the incidence of alcohol-related problems. Change is achieved through a three-stage accreditation program (see Appendix). Clubs progress through the program in a graded, incremental fashion, by implementing policies and strategies to reduce alcohol-related harm. After a club has implemented all relevant policies, it is classified as a Stage Three−accredited Good Sports club. Stage One accreditation focuses on abiding by liquor licensing laws and RSA training of bar staff; Stage Two focuses on the provision of alternative food and drink; and Stage Three focuses on policy development, review, and enforcement (Duff & Munro, 2007; Munro, 2000).

The GS program is unique; no other program exists anywhere else in the world. Currently, the majority of clubs participating in the program are in Australia's southeastern states: Victoria, South Australia, and Tasmania. Most have either achieved Stage One or Stage Two, while a few have achieved Stage Three. However, it has been suggested that if programs like Good Sports are to be successful, they will depend on community engagement and high levels of social and financial capital (Casswell, 2000; Holder, Saltz, Grube, Voas, et al., 1997; Holder, Saltz, Grube, Treno, et al., 1997).

Thus, as a first stage in the evaluation of the effectiveness of interventions like Good Sports, traditional experimental designs may limit the impact and delivery of the intervention (Sanson-Fisher, Bonevski, Green, & D'Este, 2007). Adoption studies—studies that examine groups that have adopted strategies—have been suggested as a prudent first step in the iterative process of developing and evaluating these interventions, because they evaluate the initial impact of the intervention and whether greater investment in the program and its evaluation can be justified (Flay, 1986; Kirkwood, Cousens, Victora, & de Zoysa, 1997; Sanson-Fisher et al., 2007). Adoption studies do not establish causal relationships; rather, they assess whether there is a reduction in targeted outcomes associated with the adoption of program components (Kirkwood et al., 1997).

Thus, the present study was a postintervention adoption study (Sanson-Fisher et al., 2007), testing whether level of accreditation and length of time in program and implementation were associated with lower rates of alcohol consumption. To achieve this, we compared consumption between accreditation stages. We also compared alcohol consumption levels among members participating in the Good Sports program with consumption levels in the Australian community.

More specifically, we hypothesized that as Stage One accredited clubs have fewer structural strategies in place compared with Stage Two accredited clubs, Stage One accredited clubs will consume greater amounts of alcohol than Stage Two accredited clubs.

Method

Design

Using the Good Sports database, all current Stage One and Stage Two clubs in Victoria, South Australia, and Tasmania were iden-

tified. Only AFL and cricket clubs were invited, because these clubs were the most common in the program. Eligible clubs were sent a letter inviting them to participate in the study; included with the letter were 30 surveys, with instructions on how clubs should randomly distribute and return surveys. Individuals were instructed to return sealed surveys, in envelopes provided, to a delegated club member. Clubs returned all surveys (completed and noncompleted) in a postage-paid return envelope, which was also provided. Ethics approval for the study was provided by the Monash University Standing Committee on Ethics in Research Involving Humans.

Overall, 65 Stage One clubs and 48 Stage Two clubs participated in the study. Table 1 presents the data at a club level. A total of 1968 surveys were returned from 113 clubs. At the club level, this represented a 27% return rate from cricket clubs and 32% return rate from football clubs.

The majority of clubs studied were from Victoria, where the Good Sports program originated. The average socioeconomic status (SES) indices for clubs' geographical locations were similar for Stage One and Stage Two clubs. Chi-square tests and *t*-tests were used to analyze differences between clubs at the two stages of accreditation. There were significant differences between the number of cricket and football clubs, $\chi^2(2, N = 1968) = 163.69, p < 0.001$; the club state of origin, $\chi 2 = 163.69, p = .000$; and regional location of club, $\chi^2(3, N = 1968) = 31.39, p < 0.001$. There were no significant differences in SES indices across clubs, which were all approximately normally distributed.

Club members were invited to complete a survey on their drinking behavior. Table 2 compares the respondent survey demographic data at an individual level for clubs at the two stages. The age range (18–74 years) and mean age (36 years) for club members in both stage groups were similar. Close to one third (32%) of the participants were between 20 and 30 years old. As might be expected in the male-dominated sports surveyed, three quarters (75%) of the participants were male. One third of the sample worked in a trade-related (blue-collar) field. The majority of respondents were players.

Participant characteristics were generally similar across the two club accreditation stages. Nevertheless, the average age of respondents in Stage Two clubs was higher, $t(1886) = -2.32, p < .05$, and there were more players in Stage One clubs, $\chi^2(1, N = 1968) = 12.59, p < .001$, compared to Stage Two. Between stages, there were no significant differences in income, $\chi^2,(9, N = 1690) = 8.38, p > .05$, occupation, $\chi^2,(8, N = 1968) = 4.61, p > .05$), or years of education $\chi^2,(, N = 1882) = 6.04, p > .05$.

Table 1
Demographic Details of Clubs

	Stage One (*n*)	Stage Two (*n*)
Type of sport		
Australian Football League	47	41
Cricket	18	7
Club in a major city	21	13
State		
Victoria	51	46
South Australia	7	0
Tasmania	7	2
Regions		
Inner regional	23	21
Outer regional/remote	21	14
N (total)	65	48
Mean SES advantage/disadvantage*	954	954

Note. * SES advantage/disadvantage (Australian Bureau of Statistics, 2006), see Method section.

Table 2
Comparison of Surveyed Member Characteristics by Club Accreditation Stage

Participant details	Stage One	Stage Two
Male	76%	73%
Age (years)		
Range	18–74	18–74
M	35.4	36.8
SD	13.1	13.1
Income ($AU1,000s)		
Range	0–100+	0–100+
Mode	20–60 (61.9%)	20–60 (60.8%)
Education (%)		
Year 9 or less	4.7	5.4
Year 10	12.6	11.8
Year 11	15.7	16.7
Apprenticeship	10.1	10.9
Technical and further education	11.2	10.5
Year 12	26.5	23.3
University undergraduate	11.9	11.6
University postgraduate	7.3	9.8
Occupation (%)		
Manager/administrator	25.4	25.9
Trade/laborer	33.8	32.6
Clerical	14.0	14.0
Not in workforce*	26.8	27.4
Club involvement (%)		
Player	55.4	47.3
Supporter	41.6	40.2
N	1147	821

* Not in workforce category includes, students, carers, retirees, and unemployed individuals.

Measures

Alcohol consumption. Alcohol consumption was assessed using the Graduated Frequency Index (GFI) (Australian Institute of Health and Welfare, 2005) and the 7-day diary; both are used extensively in Australian research (Australian Institute of Health and Welfare, 2005; White & Hayman, 2006). The GFI is a series of questions that ask respondents to indicate how often (e.g., 1 to 2 days a week; once a month) and how much alcohol (e.g., 5 to 6 standard drinks; 1 to 2 standard drinks) they have consumed in the previous 12 months. Midpoints for "how often" (e.g., 1 to 2 days a week = 1.5 × 52 = 72 days a year; every day = 365 days a year) and the "how much" consumed (e.g., 5 to 6 drinks = 5.5 drinks per drinking occasion) are used to calculate the average amount of alcohol consumption over the 12 months preceding the survey by multiplying the midpoints for each quantity by the annual frequency and summing the products (Graham, Demers, Rehm, & Gmel, 2004; Greenfield, 2000). Average amounts of alcohol consumed over the 12-month period were used to determine whether it exceeded Australian guideline levels for long-term and short-term risky drinking.

The 7-day diary prompted respondents to report the amount of alcohol they consumed in the week before the survey. Respondents were asked to recall each day, starting with "yesterday", and to record the amount of alcohol consumed on each of the previous seven days (e.g., Wednesday, Tuesday, Monday. . .). The 7-day diary is less vulnerable to memory error, however, it may miss heavy episodic or sporadic drinking patterns with a less-than-weekly occurrence (Stockwell et al., 2004).

The GFI and 7-day diary are reliable and valid instruments for alcohol research (Graham et al., 2004; Poikolainen, Podkletnova, & Alho, 2002), particularly in developed countries (Gmel, Graham, Kuendig, & Kuntsche, 2006). All questions focused on alcohol consumption at the sports club, and a definition of a "standard drink" preceded the questions. Where possible, it is recommended that measures based on recent recall (e.g., 7-day diary) or long-term drinking patterns (e.g., GFI) be used in a battery of measures on alcohol consumption (Stockwell et al., 2004). Thus both types of measures were used in this study.

Risky drinking. The National Health and Medical Research Council (NHMRC) drinking guidelines (NHMRC, 2009) were used to compare risky drinking between accreditation stages. The long-term risk guideline states that to reduce the "probability" of suffering long-term alcohol-related disease or injury, healthy men and women should drink no more than two standard drinks on any one day. The guideline on short-term risky drinking aims to reduce risk of injury on a single occasion of drinking. It states that for men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury. An Australian standard drink contains 10 g of ethanol.

The Australian Drinking guidelines have recently been changed. Thus, for ease of comparison, when comparing prevalence statistics from this study to national prevalence, both the old guidelines (NHMRC, 2001) and current guidelines (NHMRC, 2009) are reported. The older guidelines defined risky drinking differently for men and women, and the recommended consumption levels were much higher than in the current guidelines. Short-term high-risk drinking for men, according to the old guidelines, was considered to be seven or more standard drinks per sitting and women five or more drinks for women. Long-term risky drinking for men was more than four drinks each day, and more than 2 each day for women.

Socioeconomic status. The SES, social advantage/disadvantage index, was drawn from the Australian Bureau of Statistics database, and assigned to clubs by matching the SES index to the clubs' postal (zip) codes (Australian Bureau of Statistics, 2006).

Statistical Analysis

Ninety-five percent confidence intervals are reported for all prevalence statistics. Regression analysis was undertaken when comparing consumption between accreditation stages. For the regression analyses, the independent variables were organized into three levels. Level one (individual variables) included alcohol consumption, and the individual covariates age, gender, and whether the respondent was a player at the club. Level two (club variables) were the club ID, state, type of sport (cricket or AFL football), and individual covariates aggregated by club: average age of club member, average percentage of men per club, average alcohol consumption per club, accreditation stage, and time (units of six months) the club had been in the Good Sports program. Level three (community variables) were rural or metropolitan index of club location (Australian Bureau of Statistics, 2005), and the SES index of club location (Australian Bureau of Statistics, 2006).

Multilevel modeling (MLM) was used to analyze the data. MLM is usually employed when data are characterized by a hierarchical structure (e.g., individuals within clubs) or when observations are not independent—that is, when they are clustered and have a degree of homogeneity (Bickel, 2007; Bryk & Raudenbush, 1992). In this study, club participants were considered to be clusters of individuals (clubs). The intraclass correlations (ICC), the measure of within-group homogeneity, for all the dependent measures are reported in Table 3. The ICC for the dependent variables ranged from .13 to .17, and all were significant at the 5% level. Table 3 indicates the design effect and the effective sample size due to the ICC.

The significant ICC indicated that MLM would be the appropriate analysis technique. MLM would allow assessment of contextual and environmental factors between clubs in relation to the amount of alcohol consumption and the probability of risky drinking. Statistical assumptions for MLM are the same as for ordinary least squares regression, when the dependent variable is continuous, and the same as logistic regression when the dependent variable is binary; however, MLM also requires that the variance within groups (clubs) does not differ statistically between groups (clubs) (Rabe-Hesketh & Skrondal, 2008; Tabachnick & Fidell, 2005). The analysis was undertaken with Stata, Version 11.

Control variables. Individual and club-level demographics, and individual demographics aggregated at a club level, were considered as control variables. The Hausman specification test was used to test for potential biases within the clusters (clubs) due to omitted covariates in final MLM random intercept models (Rabe-Hesketh & Skrondal, 2008; Snijders & Bosker, 1999).

Analytical strategy. For the regression analyses, following West, Welch, and Galecki (2007), a 3-part analytical strategy was used. First, a null model (only a random intercept, varying by club) was analyzed. We also examined whether the random intercept further varied by third-level variables. Second, individual-level variables were entered into the model, and the consideration of

Table 3
Intraclass Correlations for Dependant Measures

Dependent variable	ICC and 95% CI	*N*	Average *N* per Club	Design Effect	Effective Sample Size
Alcohol consumption (Saturday)	.13 [.09, .18]	1723	15	2.82	611
Risky drinking (short-term)	.16 [.09, .23]	1918	17	3.56	539
Risky drinking (long-term)	.17 [.11, .26]	1918	16	3.55	540

* ICC = intraclass correlation coefficient; 95% CI = 95% confidence interval.

level one (individual) random effects was undertaken; nonsignificant predictors were removed from the model (model one). Third, club-level variables were entered, and second-level random effects were considered; nonsignificant predictors were removed (model two). Accreditation stage was the principle variable of interest, so it was introduced into the analysis with the level one variables (model one), and interactions with the variable accreditation were examined throughout the model-building process. Because there are often age and gender differences in alcohol consumption (Australian Institute of Health and Welfare, 2007), these variables were examined to see if they varied by club. Further, because accreditation was of principal interest, it was also examined to see if it varied by club. To assist in the interpretation of the intercept in some models, some variables (metric and binary) were grand-mean centered.

Results

Prevalence of Alcohol Consumption

Alcohol consumption at the club during the week before the survey, assessed using the 7-day diary, is shown in Table 4. Using the current (NHMRC, 2009) and the old (NHMRC, 2001) drinking guidelines, the proportions of short-term risky drinkers for the competition playing day (Saturday) and for the week are also listed.

The greatest amount of alcohol consumption was reported on the Saturday competition playing day. Thursday (training day for cricket and football clubs) had the next highest level of consumption. Using the current (NHMRC, 2009) and old (NHMRC, 2001) drinking guidelines and relevant prevalence statistics, the proportion of short-term risky drinkers on Saturday and throughout the week was lower in Stage Two clubs.

Table 5 shows the proportions of short- and long-term risky drinking that occurred over the 12 months before the survey, as measured by the GFI, using both the old (NHMRC, 2001) and new (NHMRC, 2009) drinking guidelines. It also compares consumption levels with the broader Australian community (Australian Institute of Health and Welfare, 2007), based on the 2001 and 2009 drinking guidelines drinking guidelines.

Overall, the proportion of risky alcohol consumption was higher in Stage One− and in Stage Two−accredited clubs compared to the broader community. However, consistent with our hypothesis, using either the old or new drinking guidelines, consumption was lower in Stage Two− clubs than that in Stage One−accredited clubs, for all measures of consumption (Tables 4 and 5). There were fewer abstainers in Stage One (6%) and Stage Two (9%) clubs compared to the national data for the general community (16% & 20%).

Alcohol Consumption on Playing Day Between Accreditation Stages

The MLM for alcohol consumption on the playing day (Saturday) is summarized in Table 6. Consistent with our hypothesis, the results of model one indicate that accreditation stage predicted alcohol consumption on the competition playing day before the survey, $\beta = -0.93$; $p < .05$. Individuals in Stage Two clubs consumed approximately 0.7 fewer standard drinks than partici-

Table 4
Number of Standard Drinks Each Day of Week and Percentage Short-Term Risky Drinking (With 95% Confidence Intervals), by Accreditation Stage

Accreditation Stage	Mean Number of Standard Drinks Consumed Each Day of the Week (95% CI)							Percentage Risky Drinking (95% CI)			
								2001 Guidelines*		2009 Guidelines*	
	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Risky Saturday	Risky Week	Risky Saturday	Risky Week
Stage 1	4.20 [3.90, 4.51]	0.83 [0.65, 1.01]	0.12 [0.07, 0.17]	0.47 [0.38, 0.55]	0.31 [0.22, 0.40]	1.75 [1.59, 1.91]	0.76 [0.57, 0.96]	24 [22, 27]	40 [36, 43]	34 [31, 37]	52 [49, 56]
Stage 2	3.21 [2.87, 3.54]	0.51 [0.36, 0.66]	0.11 [0.15, 0.17]	0.43 [0.34, 0.52]	0.20 [0.09, 0.32]	1.54 [1.35, 1.73]	0.46 [0.32, 0.61]	16 [14, 19]	29 [25, 33]	24 [21, 27]	41 [37, 45]
Total	3.79 [3.56, 4.02]	0.70 [0.58, 0.82]	0.11 [0.08, 0.16]	0.45 [0.39, 0.51]	0.27 [0.19, 0.34]	1.66 [1.54, 1.79]	0.64 [0.51, 0.77]	21 [19, 23]	35 [33, 38]	30 [28, 32]	48 [45, 50]
N	1723	1553	1524	1575	1468	1694	1534	1692	1299	1723	1408

* Risky Saturday = short-term risky drinker on Saturday; Risky Week = short-term risky drinker in last 7 days.

Table 5
Percentage With Risky Consumption (With 95% Confidence Intervals) as Per NHMRC 2001 and 2009 Guidelines (N = 1918)

Accreditation stage	Abstainers	2001 Guidelines (95% CI)				2009 Guidelines (95% CI)			
		Weekly	Monthly	Yearly	Long-Term	Weekly	Monthly	Yearly	Long-Term
Stage 1	6 [5, 8]	12 [11, 15]	42 [39, 45]	57 [54, 60]	14 [12, 16]	21 [20, 24]	56 [53, 58]	68 [66, 71]	29 [27, 32]
Stage 2	9 [7, 12]	11 [9, 13]	35 [32, 38]	51 [47, 54]	13 [10, 15]	17 [14, 20]	46 [42, 50]	62 [58, 65]	24 [21, 26]
Total	8 [6, 9]	12 [10, 13]	39 [37, 41]	54 [53, 57]	14 [12, 15]	20 [18, 22]	52 [49, 54]	66 [63, 68]	27 [25, 29]
National	16* & 20#	8	20	35	10	15	28	39	20

* National figures are for 2001 guidelines based on data from the Australian Institute of Health and Welfare (2007). * National figures for 2009 guidelines are based on Australian Institute of Health and Welfare (2011). Weekly, monthly, yearly: short-term risky drinking at least weekly, at least monthly, at least yearly.

pants in Stage One clubs. Model one reduced the variance between clubs by 10% ([2.91 – 2.61]/2.91) when compared to the null model. Only the average age of club members was a significant level two . . . predictor in model two. For each year the average age of a club increased, consumption on Saturday decreased by 0.14 standard drinks. Because all predictors, except accreditation, were centered, the intercept indicated that, when male and average age were set to zero, individuals in Stage Two clubs had 3.28 (4.82 − [2 × 0.77]) standard drinks, and individuals in Stage One clubs had 4.05 (4.82 − [1 × 0.77]) standard drinks. On average, individuals in Stage Two clubs consumed 19% fewer standard drinks than those in Stage One clubs, and model two explained 33% ((2.91–1.96)/2.91) of the variance between clubs when compared to the null model. No significant interactions with the variable accreditation were found.

For alcohol consumption on playing day, a Hausman test indicated that the within-group (club) variance for the random intercept model did not differ significantly between clubs for the final model (model two), $\chi^2(2, N = 1692) = 0.17$, $p > .05$. The change in the −2 log-likelihood statistic indicated that model two was a significant improvement to model one, $\chi^2(1, N = 1692) = 20$, $p < .01$, and model two was a significantly better fit than the null model, $\chi^2(3, N = 1692) = 33.44$, $p < .05$. Residual diagnostics indicated that the level one residuals and random effects were approximately normally distributed and that there were no outliers. The MLM equation for the final model was as follows:

$$\text{Saturday Consumption}_{ij} = \beta_{oj} + \beta_{10}(\text{accreditation}) + \beta_{20}(\text{Male}) + \beta_{30}(\text{average age}) + \mu_{oj} + e_{ij}$$

where Saturday consumption$_{ij}$ = alcohol consumption of individual *i,* on Saturday, in club *j*;

β_{0j} = the intercept (mean alcohol consumption across clubs);

μ_{0j} = the random effect that club *J* has on individual alcohol consumption; and

e_{ij} = individual level residual.

Short-Term Weekly Risky Drinking Between Accreditation Stages

The MLM for short-term weekly alcohol consumption is outlined in Table 7. Contrary to our hypothesis, accreditation showed a protective effect, but was not significant, odds ratio (*OR*) = 0.69, $p > .05$, in its effect on short-term risky consumption in the previous 12 months. Being a male community sports club member, *OR* = 1.78, $p < .05$, was a significant predictor of short-term weekly risky drinking; men were 78% more likely to drink at risky levels on a weekly basis than comparable women. Model one

Table 6
MLM for Estimated Alcohol Consumption on Playing Day (Saturday)

Predictor (IV)	Null Model	Model One		Model Two	
		β (95% CI)	*p*	β (95% CI)	*p*
Accreditation stage		−0.93 [−1.69, −0.17]	.017	−0.77 [−.17, −.03]	.032
Male (centred)		0.74 [0.22, 1.27]	.005	0.77 [0.02, 0.13]	.004
Average age (centered)		—	—	−0.14 [−.02, −.004]	.000
Intercept	3.69	4.46 [3 .24, 5.68]	.000	4.82 [3.76, 5.87]	.000
N_1 (individual)	1692	1692		1692	
N_2 (clubs)	113	113		113	
σ^2 between	2.91	2.61		1.96	
σ^2 within	20.10	20.06		20.06	
df	3	5		6	
−LL	5001.31	4994.59		4984.59	
AIC	1008.62	10001.52		9981.18	
BIC	10024.92	9999.18		10013.79	

Note. −LL = log likelihood; AIC = Akaike information criteria; BIC = Bayesian information criteria; Male (centered) male = 0.25, female = −0.75; Accreditation stage = 1; IV = independent variable.

Table 7
Estimated Binary Logistic MLM for Short-Term Weekly Risky Drinking, Over the Previous 12 Months

		Model One		Model Two		
Predictor (IV)	Null Model	OR (95% CI)	*p*	OR (95% CI)	β	*p*
Accreditation stage		.69 [0.46, 1.03]	.066	.68 [0.40, 1.17]	−0.38	.168
Male		1.81 [1.30, 2.52]	0	1.78 [1.28, 2.49]	−0.58	.001
Years in GS		—		1.57 [1.06, 2.32]	0.45	.026
Years in GS^2		—		0.96 [0.93, 0.99]	−0.04	.019
N_1 (individual)	1785	1785		1785		
N_2 (clubs)	113	113		113		
σ^2 between	0.66	58		0.51		
df	2	4		6		
−LL	875.64	867.42		864.72		
AIC	1755.27	1742.84		1741.44		
BIC	1766.24	1764.79		1774.36		

Note. −LL = log likelihood; AIC = Akaike information criteria; BIC = Bayesian information criteria; Male = 1; Accreditation stage = 1; Years in GS = years in Good Sports program; Years in GS^2 = years in Good Sports Program, squared; IV = Independent variable.

reduced the variance between the groups by 12% when compared with the null model ([.66 − .58]/.66). The amount of time in the Good Sports program, introduced as a quadratic function, predicted short-term risky drinking in the previous 12 months. Model two reduced the variance between the groups by 23% ([.66 − .51]/.66). No significant interactions with the variable accreditation were found. A Hausman test indicated that the random intercept model for the within-group (club) variance did not differ significantly between clubs for the final model (model two), $\chi^2(1, N = 1785) = 1.77, p > .05$). The change in the −2log-likelihood statistic indicated that model two did not differ significantly from model one, $\chi^2(2, N = 1785) = 5.85, p = .067$; however, model two was a significantly better fit than the null model, χ^2 (6, $N = 1785) = 21.83, p < .05$. The MLM equation for model two was as follows:

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_0 + \beta_1(accreditation)_{ij} + \beta_2(male)_{ij} + \beta_3(yearsGS)_{ij} + \beta_4(yearsGS)^2_{ij} + u_{0j}$$

where $\pi_{ij}/1 - \pi_{ij} =$ odds that short-term risky drinking = 1;

i represents individuals; *j* represents clubs; and

the intercept β_0 is shared by all clubs; and the random effect (μ_{0j}) is specific to club *j*.

Figure 1 shows the relationship between predicted short-term weekly risky drinking over the previous 12 months and the number of years the individual's club had been in the Good Sports program, while controlling for all the other variables in model two. The exact turning point for the gradient is the coefficient (β) for the number of years in the program divided by twice the coefficient for the number of years ([.90/2] × .16 = 2.8 years). Thus, after approximately three years in the program, the probability that any member was a weekly short-term risky drinker declined. Figure 1 also demonstrates that after a club had participated for approximately 4.5 years, the probability of any member being a weekly short-term risky drinker was lower than that of a member of a club participating for less than 4.5 years.

Long-Term Risky Drinking

Consistent with the hypothesis, the final model (model one) showed that accreditation, $OR = 0.67$, $P < .05$, significantly protected from long-term risky consumption in the previous 12 months; being a male community sports club member, $OR = 1.52$, $P < .05$, significantly increased the odds of long-term risky drinking; and more years of education was associated with significantly reduced odds of long-term risky drinking, $OR = 0.93$, $P < .05$. Compared to the null model, a substantial proportion (46%) of the variance between clubs was reduced in model 1 where gender and accreditation were specified as random (unstructured covariance) variables ([0.59 − .32]/0.59). None of the level two variables added to the model. Overall, individuals in Stage Two clubs were 34% less likely to be long-term risky drinkers, compared to individuals in Stage One clubs. No significant interactions with the variable accreditation were found. Table 8 outlines both the null and final models for long-term risky drinking. The MLM equation for the final model was as follows:

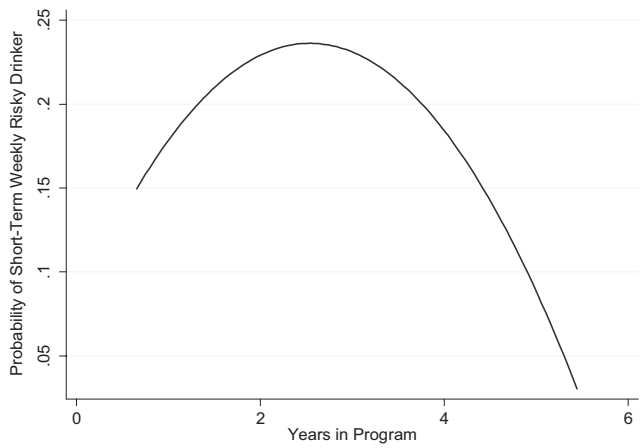

Figure 1. Predicted probability for Short-Term Risky Drinking in Past Week by Years in Good Sports Program.

Table 8
Estimated Binary Logistic MLM for Long-Term Risky Drinking Model

Predictor (IV)	Null Model	Model One OR (95% CI)	*p*
Accreditation stage		.67 [0.45, 0.99]	.043
Male		1.52 [1.08, 2.14]	.015
Age		0.99 [0.98, 1.0]	.007
Education		0.99 [0.88, 0.99]	.018
N_1 (individual)	1824	1824	
N_2 (clubs)	113	113	
Random effects			
σ^2 between clubs	0.590	.316	
σ^2 male		.236	
σ^2 accreditation		.205	
Covariance (unstructured)			
Male* Accreditation		.065	
Male* Constant		.015	
Accreditation*constant		−.207	
df	2	8	
−LL	−110.17	−991.55	
AIC	2024.34	2005.11	
BIC	2035.36	2065.67	

Note. −LL = log likelihood; AIC = Akaike information criteria; BIC = Bayesian information criterion; σ^2 between clubs = variance between club groups.
* Male = 1; IV = Independent variable.

$$\log\left(\frac{ij}{1-\pi_{ij}}\right) = \beta_0 + \beta_1(accreditation)_{ij} + \beta_2(male)_{ij} + \beta_3(age)_{ij} + \beta_4(education)_{ij} + u_{0j} + u_{5j}(accreditation)_{ij} + u_{6j}(male)_{ij}$$

where $\pi_{ij}/\ 1-\pi_{ij}$ = log odds that long-term risky drinking = 1;
i represents individuals; *j* represents clubs;
The intercept β_0 is shared by all clubs; and
The random effects (μ_{0j}, $\mu_{5j,}$ μ_{6j}) are specific to club *j*.

The change in the −2 log-likelihood statistic indicated that the final model was a significantly better fit than the null model (χ^2 (7, $N = 1824$) = 37.04; $p > .05$).

Discussion

This article presents the first comparative analysis of patterns of alcohol use and the stage of club involvement in the Good Sports program. This program accredits community sports clubs according to the degree of formal implementation of alcohol harm−minimization strategies. The hypothesis that members of Stage One clubs would drink more alcohol compared with individuals in Stage Two clubs was supported.

This study therefore suggests an association among general alcohol consumption, short- and long-term risky drinking, and the degree of formal implementation of harm-reduction strategies in community sports clubs. We found high rates of risky alcohol consumption in sports clubs compared to the general Australian community, supporting the call for intervention in community sports clubs. Overall, while large amounts of short- and long-term risky drinking occurred in community sports clubs, less alcohol consumption occurred in Stage Two clubs than in Stage One clubs.

The regression analysis indicated that, on a playing day (Saturday), individuals in Stage One clubs typically consumed more alcohol (4.1 standard drinks) than the maximum amount recommended in the NHMRC guidelines (four standard drinks) for one sitting. By contrast, average consumption on the Saturday in Stage Two clubs was only 3.2 standard drinks. The lower likelihood of short-term risky drinking suggests that members of Stage Two clubs are at lower risk of alcohol-related incidents, such as violence, drink-driving, and accidents (NHMRC, 2009). The resulting benefits for the club and community from clubs achieving Stage Two accreditation may include reduced antisocial and disruptive behavior as well as promoting the image of the club as an attractive and family-friendly setting.

The regression analysis indicates that amounts of weekly short-term risky alcohol consumption assessed over the previous 12 months is not directly related to the accreditation stage, but is associated with the length of time the club has been in the Good Sports program. The longer a club is in the program, the less likely it is that short-term risky alcohol consumption will occur. Interpretations of this finding include the possibilities that, over time, members' drinking patterns may moderate as a result of the program; heavy drinking clubs may drop out of the Good Sports program; or heavy drinkers may drop out of Good Sports−accredited clubs. The quadratic relationship between time in the program and short-term risky drinking lends some support to these hypotheses. These interpretations need to be explored in future research.

Regression analyses also indicated that there is an association between reduced long-term risky drinking and the Good Sports program. However, the effect differs between clubs. Once the analysis was adjusted for other covariates, accreditation stage was only significant when specified as a random variable. This study has not identified the characteristics that lead to the club variation. However, a possible interpretation of this finding is that long-term risky drinking is harder to modify than short-term risky drinking. Future research should explore other club-level characteristics that may influence or moderate the relationship between harm-reduction strategies and long-term risky drinking. Possible moderating variables could include the sense of belonging or social capital in a community sports club (Casswell, 2000). Factors that affect long-term risky drinking in other contexts could also be explored in the sports club setting, such as whether members drink in other settings (i.e., hotels and bars) that sponsor the club, after drinking at the sports club (Black, Lawson, & Fleishman, 1999).

Overall, this study has demonstrated a dose-response type association between alcohol consumption accreditation stage and the length of time clubs participate in the Good Sports accreditation program. The findings are compatible with behavior ecological theory (Hovell et al., 2002), which suggests that the implementation of multilevel harm−reduction strategies (McLeroy et al., 1988) can affect alcohol consumption and that time is required for environmental change processes to be enacted. The study also provides guidance for power calculations for future studies, and strong justification for greater investment in a stronger designed evaluation study.

Study Limitations

The present study has a number of limitations. First, it had a cross-sectional design, thus it is difficult to argue for a causal relationship between the observed association between harm-reduction strategies and lower rates of risky drinking. Furthermore, all alcohol consumption measures were self-reported, so the pressure for social desirability might result in underreporting of actual consumption. While the log-likelihood statistic was used to assess model fit and is a recommended fit statistic for MLM models (Bickel, 2007), the BIC statistic in all of the final models showed an increase, thus suggesting that the final model may not be the most parsimonious on all criteria. The Bayesian information criterion (BIC) was not used as the main fit statistic in the present analysis because it may be misleading when an unstructured covariance structure has been employed (Bickel, 2007; Hox, 2002), as occurred in the final model for long-term risky drinking (see Table 8).

While clubs included in this study were accredited based on evidence that they adopted the strategies of the Good Sports program, how far clubs rigorously implemented and abided by those strategies is unclear. Future studies might investigate precisely how implementation alters drinking behavior and examine drinking behavior in clubs not participating in the Good Sports program.

Conclusion

We provide preliminary evidence for the efficacy of a complex real-world intervention, targeting a natural population group that exhibits high rates of risky drinking, namely, community sports clubs. The study demonstrates a negative association between alcohol consumption and both higher accreditation as well as time spent in the Good Sports program. Although the design is limited in its ability to support causal inference, there are strengths in the population health and community focus of the intervention and the use of an adoption design and a multilevel analysis. The study findings provide evidence to support the theory of change underlying the early phases of the implementation, development, and evaluation of the Good Sports program. Our evidence suggests that a greater investment in a more rigorously designed community trial is justified. Because substantial numbers of people participate in sports clubs and that club settings have high rates of alcohol consumption, the Good Sports program may have the potential to reduce physical injury, and illness significantly, and thereby to reduce the financial costs associated with alcohol consumption in the Australian and international communities.

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(*Appendix follows*)

Appendix

Policies and Strategies Underlying the Accreditation Levels of the Good Sports Program

Stage One*

- Clubs comply with states liquor licensing laws;
- at least one bar staff member on duty is trained in responsible serving of alcohol;
- Liquor is only served within specified hours;
- People under 18 years of age do not serve and are not served alcohol; and
- Drunk and intoxicated people not served or allowed to enter the premises.

Stage Two*

- Provision of low and nonalcoholic drinks;
- All bar staff members on duty are trained in "responsible serving of alcohol";
- Bar staff do not consume alcohol on duty;
- Club maintains an alcohol incident register;
- Tap water is provided free of charge;
- Multiple food options are made available when the bar is open for more than 90 minutes;
- Clubs implement a safe transport strategy, for example, use of a designated driver program, taxi vouchers, or key register;
- Clubs do not conduct any of the following: happy hours (free drink periods); cheap drink promotions; drinking competitions; drink vouchers; all you can drink functions; and alcohol only awards or raffle prizes; and
- All indoor areas are smoke free, and club does not sell cigarettes.

Stage Three*

Club has a Good Sports written policy which addresses the following:

- bar management;
- responsible serving of alcohol;
- underage drinking; alcohol alternatives;
- food options;
- safe transport; smoke free; club trips;
- noncompliance;
- promotion of policy; and
- policy review.

* "Stages of accreditation" are usually referred to as "levels of accreditation"; however, to avoid confusion with the phrase "levels of data" as used in this article, for the purpose of this study, accreditation levels will be referred to as stages of accreditation.

Study Two (Article Two)

Rowland, B., Toumbourou, J. W., & Allen, F. (2012). Reducing alcohol-impaired driving in community sports clubs: Evaluating the Good Sports program. Journal of Studies on Alcohol and Drugs, 73(2), 316-327

These pages are designed to assist the reader to integrate previous chapters with the rationale for undertaking study two (article two in this PhD). Data for study two were collected at the same time as study one and constitute the same sample and design. Study two assessed the programme in respect to a different outcome variable to study one—drink driving. The following analyses were completed for study two:

1. The prevalence of drink driving between individuals who belong to clubs accredited as level-one Good Sports clubs was compared with individuals who belong to clubs accredited as level-two Good Sports clubs
2. The prevalence of drink driving with individuals who belong to level-one- and level-two-accredited Good Sports clubs was compared with the prevalence of drink driving in the broader community
3. Assessing whether belonging to level-two-accredited club was associated with reduced odds of drink driving compared to belonging to a level-one-accredited club
4. Assessing whether an increased number of safe-transport strategies, formally implemented as part of level-two Good Sports accreditation, was associated with reduced odds of drink driving

Like study one, study two is an adoption study, not a controlled evaluation that is amenable to tests of specific causal relationships. Study two examined whether there was

an association with adopting safe-transport strategies, formally implemented as a part of the Good Sports programme, and reduction in odds of drink driving. The study also aimed to gather information that would enable an assessment of whether greater investment in the programme and its evaluation could be justified.

2. The paper has been accepted into the *Journal of Studies on Alcohol and Drugs.* This journal has an A-Class ranking according to the 2011 Excellence in Research for Australia (ERA), classification; it has an impact factor of 2.128.

Monash University

Declaration for Thesis Chapter 5

Declaration by candidate

In the case of Chapter 5, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Design study, data collection, lead analysis and write-up of article	65–70%

The following co-authors contributed to the work. Co-authors who are students at Monash University must also indicate the extent of their contribution in percentage terms:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Professor John Toumbourou	Analysis and write-up	N/A
Associate Professor Felicity Allen	Analysis and write-up	N/A

Candidate's Signature	[redacted]	Date 18 August,2012

Declaration by co-authors

The undersigned hereby certify that:

1. the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors
2. they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise
3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication
4. there are no other authors of the publication according to these criteria
5. potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit
6. the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)	Deakin University, School of Psychology, Burwood Campus, Burwood Highway Melbourne

[Please note that the location(s) must be institutional in nature, and should be indicated here as a department, centre or institute, with specific campus identification where relevant.]

Signature 1	[redacted] Associate Professor Felicity Allen	Date 18th Aug 2011
Signature 2	[redacted] Professor John W Toumbourou	18th Aug 2011

Chapter 5: Alcohol-impaired Driving in Community Sports Clubs: Evaluating the Good Sports Programme

Reducing Alcohol-Impaired Driving in Community Sports Clubs: Evaluating the Good Sports Program

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ABSTRACT. Objective: The Good Sports program uses a systematic accreditation process to implement gradual alcohol-related harm-reduction strategies in Australian community sports clubs that aim to reduce the incidence of harmful alcohol-related behaviors, such as drink driving. This study tested whether the Good Sports program reduced the incidence of drink driving and whether reductions are related to the level of program implementation. **Method:** An adoption versus nonadoption pilot study was undertaken with 65 cricket and 48 Australian Football League clubs (N = 1,968 individuals). Associations between the stage of accreditation (Stage 1 and Stage 2) and the likelihood of driving with an illegal blood alcohol concentration (BAC) were examined. Alcohol-use diary accounts were used to calculate BAC before driving home from the club. **Results:** The percentage of club members driving at least once in the previous week with a BAC estimate greater than .05% (the legal limit in Australia) was lower in clubs that had achieved Stage 2 Good Sports accreditation (7%, 95% CI [5%, 9%]) than those that had not (8%, 95% CI [6%, 9%]), but this was not significantly different. However, multilevel modeling identified a larger number of the safe-transport strategies, implemented as part of Stage 2 accreditation, which were associated with a significantly lower probability of drink driving. Being a risky drinker at the club, and the average number of risky drinkers at the club, was also predictive of drink driving. **Conclusions:** The findings of this pilot study suggest that implementation of the Good Sports program is likely to have a significant effect on harms associated with drink driving in Australia and elsewhere. Further community studies will be required, however, to examine precisely how the program is achieving improvements and whether it can be refined to have a greater impact in both Australia and overseas. (*J. Stud. Alcohol Drugs, 73,* 316–327, 2012)

WORLDWIDE, HIGH LEVELS OF ALCOHOL consumption are evident among members (i.e., players and supporters) of community sports clubs (Brenner and Swanik, 2007; Ford, 2007; O'Brien et al., 2007; Quarrie et al., 2001). Although alcohol consumption by club members may occur in a variety of settings, including the home (Leonard, 2001; Norström, 1998), licensed venues (Hughes et al., 2008), and the workplace (Pidd et al., 2006), Australian studies indicate that sports clubs are settings where large amounts of this consumption occurs (Dietze and Fitzgerald, 2008; Duff et al., 2005; Snow and Munro, 2000, 2006). Because sports clubs are often located some distance from dwellings, the combination of high-risk consumption and the need to travel home makes community sports clubs a high-risk setting for drink driving (driving a car while over the legal blood alcohol concentration [BAC], set in all Australian states at .05%) (Lang and Stockwell, 1991; Snow and Munro, 2000). This study examined the impact of the Good Sports program on reducing alcohol-impaired driving of individuals who consume alcohol at community sports clubs.

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Random breath testing

Random breath testing (RBT) is the most common drink-driving countermeasure used in Australia. Introduced in 1976, it involves establishing traffic checkpoints to assess the breath alcohol concentration of drivers, a proxy measure of blood alcohol concentration (BAC). Motorists passing these checkpoints are pulled over for breath testing (World Health Organization, 2007). These checkpoints are randomly located and vary daily, and their locations are not publicly announced (Harrison et al., 2003). RBT is based on deterrence, not detection (Homel, 1988); thus, it attempts to deter individuals from drink driving, rather than detecting all individuals with BAC over the legal limit.

For RBT to be effective, the testing needs to be highly visible, well publicized, and perceived to be ubiquitous. The locations of roadside testing stations need to be unpredictable and impossible to evade. Moreover, the campaign needs to be well resourced and funded over a very long period (Zaal, 1994). Given the limited resources of the police force and the sporadic nature of breath testing, it is not surprising that individuals perceive the risk of being apprehended for drink driving as low (Moore et al., 1993). Furthermore, because there are usually numerous sports clubs located throughout any one municipality, it is most likely not practical to target locations near these settings for RBT. In these types of circumstances, authorities use large-scale preven-

tion approaches, usually through the media, as a means of increasing awareness of the presence of RBT stations in the community, in the hope of deterring individuals from drink driving (Vanlaar, 2008).

Alternative drink-driving countermeasures

Given RBT's limitations, there is clearly a place for additional community-based strategies to reduce the likelihood that an individual will drive while drunk, especially in settings where high levels of alcohol consumption occur, such as community sports clubs. Several single strategies have been trialed in licensed premises, including designated driver programs (McKnight and Voas, 2001), responsible alcohol server training (Salz, 1997), and free transport (Loxley et al., 2004).

Broader strategies targeting whole communities, such as lower BAC levels for new and inexperienced drivers (drivers who have a license for less than 3 years), graduated licensing for novice drivers (Babor et al., 2003), and reducing alcohol consumption at a population level (McKnight and Voas, 2001), have also been trialed. A recent review determined that the most effective drink-driving programs are community based. These types of programs are usually characterized by mobilizing the community in a planned process to address the issue, have multiple strategies, and aim to reduce alcohol consumption (Shults et al., 2009). The conceptual model as to how these processes and strategies work in multicomponent programs is outlined in Figure 1.

Good Sports program

In Australia, the Good Sports program has been developed to reduce risky alcohol consumption and alcohol-impaired driving in community sports clubs. The program is structured around a three-stage accreditation program. The program is funded by the Commonwealth and state governments of Australia, sometimes directly, or indirectly through government-funded health-promoting organizations such as the Victorian Health Promotion organization ("Vichealth"). Provided free of charge and with the aid of a dedicated project officer and other physical resources (e.g., signage, kits), clubs are mobilized to implement multiple strategies to reduce the supply, demand, and harm of alcohol (see Figure 2). Clubs implementing all strategies become a "Level 3" accredited Good Sports club (Duff and Munro, 2007; Munro, 2000). (To avoid confusion with the "levels of data" described below, the accreditation levels will be referred to as stages.) Clubs progress through the accreditation stages at their own pace.

For clubs to be accredited as Stage 2, they need to formally implement and promote at least one safe-transport strategy from a list of 10 that are recommended (Duff and Munro, 2007). To ensure commitment to providing safe-transport options to members, clubs are encouraged to implement at least three strategies at Stage 2 and at least five by Stage 3. The 10 strategies promoted as part of the program are listed in Figure 2. Often, for economic and practical reasons, taxi drivers are reluctant to drive to community sports clubs in rural locations. Thus, safe-transport strategies that involve taxis (e.g., free telephone calls for taxi services) are of limited or no benefit to rurally located clubs. For reasons such as these, and also because clubs are not-for-profit organizations serviced by volunteers, the three (Stage 2) and five (Stage 3) formula for safe-transport strategies is not mandatory but nevertheless is strongly encouraged.

Despite the evidence for the effectiveness of drink-driving countermeasures in licensed venues, a recent Cochrane review reported that there is no evidence of drink-driving countermeasures being applied in the community sports club setting (Priest et al., 2008). The present study was an adoption versus nonadoption comparison study (Sanson-Fisher et al., 2007) designed to establish whether the adoption of drink-driving countermeasures as part of the Good Sports program is associated with lower rates of drink driving. Clubs accredited at Stage 2, with drink-driving countermea-

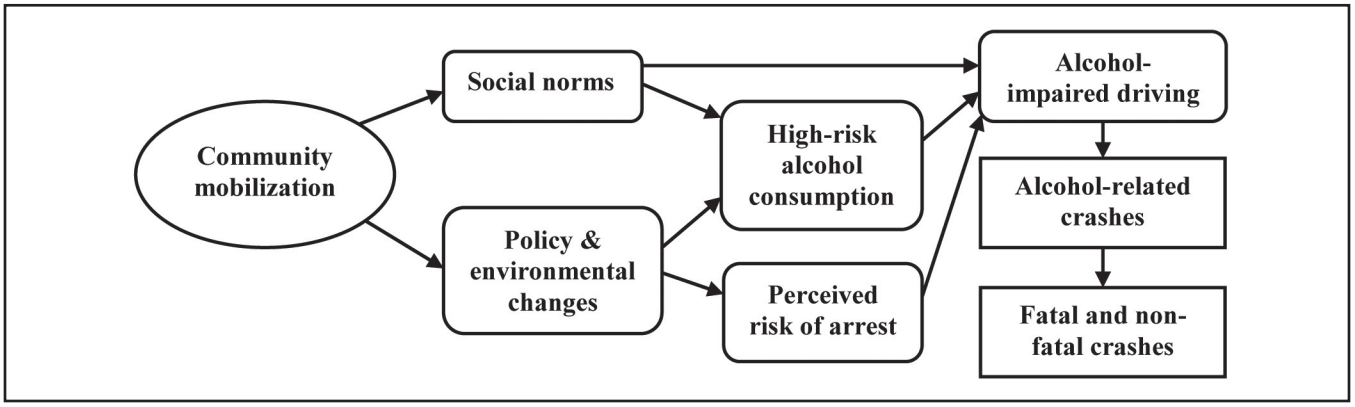

FIGURE 1. Conceptualized pathways through which multicomponent drink-driving programs work. Source: Shults et al. (2009). The rectangles with the rounded corners are intermediate outcomes; the rectangles with the square corners are health outcomes; the oval is community mobilization intervention. Reprinted with permission from Elsevier Inc.

Stage 1
- Clubs comply with state liquor licensing laws.
- At least one bar staff member on duty is trained in "responsible serving of alcohol."
- Alcohol is only served within specified hours.
- People younger than 18 do not serve and are not served alcohol.
- Drunk and intoxicated people not served or allowed to enter the premises.

Stage 2
- Provision of low-alcohol and nonalcoholic drinks.
- All bar staff members on duty are trained in responsible serving of alcohol.
- Bar staff do not consume alcohol on duty.
- Club maintains an alcohol-incident register.
- Tap water is provided free of charge.
- Substantial food options are made available when the bar is open for more than 90 minutes.
- Clubs are required to implement at least 1 but encouraged to implement 4 of the 10 transport strategies: (1) designated driver program, (2) key register, (3) taxi vouchers as prizes, (4) taxi numbers clearly displayed, (5) free call services for transport, (6) free club transport, (7) free nonalcoholic drinks for designated drivers, (8) free bar snacks for designated drivers, (9) free nonalcoholic drinks for bar servers, (10) free bar snacks for bar servers.
- Clubs do not conduct any of the following: happy hours, cheap drink promotions, drinking competitions, drink vouchers, all-you-can-drink functions, and alcohol-only awards or raffle prizes.
- All indoor areas are smoke free, and club does not sell cigarettes.

Stage 3
- Club has a Good Sports written policy that addresses the following: bar management, responsible serving of alcohol, underage drinking, alcohol alternatives, food options, safe transport, smoke free, club trips, noncompliance, promotion of policy, and policy review.

FIGURE 2. Policies and strategies underlying the accreditation levels of the Good Sports program

sures formally implemented as part of the program, were compared with Stage 1 accredited clubs that had no drink-driving countermeasures formally implemented.

Theoretically, adoption studies do not seek to establish causal relationships; rather, they are "risk-factor" studies that assess whether there is a reduction in risk associated with the adoption of particular strategies (Kirkwood et al., 1997). Use of a comparison group is a valid element of an adoption study, as long as the comparison group varies in a systematic way (Sanson-Fisher et al., 2007). Adoption studies are thus a prudent first step in the iterative process of developing and evaluating large-scale interventions because they provide evidence of the worthiness of the intervention and whether greater investment in the program and its evaluation can be justified (Flay, 1986; Kirkwood et al., 1997; Sanson-Fisher, et al., 2007).

To test the efficacy of the Good Sports program and the role of degree of implementation in any improvements seen, we tested two hypotheses.

Hypothesis 1: There would be lower levels of drink driving in Stage 2 accredited clubs compared with Stage 1 accredited clubs.

Hypothesis 2: Implementation of multiple safe-transport strategies would predict lower rates of drink driving among members.

Method

Design and sample

All procedures were approved by the Monash University Human Research Ethics Committee. The sample comprised

TABLE 1. Individual and club demographic details

Variable	Stage 1	Stage 2	Statistic
Club details			
Sport, *n*			
Australian Football League	47	41	N.S.
Cricket	18	7	N.S.
Club location, *n*			
Major city	21	13	N.S.
Inner regional club	23	21	N.S.
Outer regional/remote club	21	14	N.S.
State, *n*			
Victorian	51	46	$\chi^2(2) = 7.65$*
South Australian	7	0	
Tasmanian	7	2	
Mean SES advantage/disadvantage of club location	954	954	N.S.
Total, *n* clubs	65	48	
Individual details			
Male, %	76	73	N.S.
Age, in years			
Range	18–74	18–74	
M	35.4	36.8	$t(1886) = -2.32$*
SD	13.1	13.1	
Income			
Range ($1,000s)	0–100+	0–100+	
Mode ($1,000s)	(20–60) (61.9%)	(20–60) (60.8%)	N.S.
Education, %			
Year 9 or less	4.7	5.4	N.S.
Year 10	12.6	11.8	N.S.
Year 11	15.7	16.7	N.S.
Apprenticeship	10.1	10.9	N.S.
TAFE	11.2	10.5	N.S.
Year 12	26.5	23.3	N.S.
University undergraduate	11.9	11.6	N.S.
University postgraduate	7.3	9.8	N.S.
Occupation, %			
Manager/administrator	25.4	25.9	N.S.
Trade/laborer	33.8	32.6	N.S.
Clerical	14.0	14.0	N.S.
Not in workforce	26.8	27.4	N.S.
Club involvement, %			
Player	55.4	47.3	$\chi^2(1) = 12.59$**
Supporter	41.6	40.2	N.S.
Total, *n* individuals	1,147	821	

Notes: Socioeconomic status (SES) advantage/disadvantage (Australian Bureau of Statistics, 2006), see Method section; income is reported in units of Aus. $1,000. TAFE = Tertiary and Further Education (not university level, but higher than secondary school); N.S. = nonsignificant difference between Stage 1 and Stage 2.
*$p < .05$; **$p < .01$.

a convenience sample of 65 Stage 1 accredited clubs and 48 Stage 2 accredited clubs. Only Australian Football League and cricket clubs in the Good Sports program in Victoria, South Australia, and Tasmania were invited to participate by distributing approximately 30 surveys randomly to club members within each of the selected clubs.

The majority were Victorian, as this is the state where the program began and the state in which the majority of clubs in the program are located. A total of 1,968 surveys were returned from 113 clubs. At a club level, this represented a 27% return rate from cricket clubs and a 32% return rate from football clubs. The socioeconomic status (SES) indices for clubs and their geographical locations were similar for Stage 1 and Stage 2 clubs. Table 1 outlines relevant data at the club and individual levels.

SES indices were drawn from the Australian Bureau of Statistics (ABS) database and were assigned to clubs by matching SES indices to each club's postcode (ABS, 2005). The index used was advantage/disadvantage (ABS, 2006); this index is a multidimensional construct incorporating measures such as level of income, employment, education, public transport, and infrastructure levels of a location (ABS, 2006). Occupations were organized also by using ABS categories (McLennan, 1997). Because these categories represent an ordered hierarchy, occupation was treated as a scaled variable. Age, income, SES, and occupation were approximately

normally distributed. Rural and metropolitan classification of clubs was also undertaken using ABS classifications (ABS, 2005). For the analysis, clubs were categorized into either a rural or a metropolitan location.

Approximately 15% of the sample was between ages 18 and 21 years. Because there is a zero-tolerance BAC for probationary drivers in Victoria and South Australia, age was categorized into below 21 years of age with 10-year increments thereafter. A probationary license holder has not yet achieved the requirement of 3 years without driving offenses while on a restricted license. In Australia, probationary drivers are generally younger than 21 years of age; hence, this age group was the reference category in the present study. Three quarters (75%) of the participants were male. Most participants (80%) reported an income less than Aus. $60,000 per year (equivalent to U.S. $2,367 at the time of publication). Participants' occupations ranged from professionals and managers to students and unemployed. However, one quarter of the sample (25%) worked in a trade-related (blue-collar) field. The greater proportion in both groups were players. As Table 1 outlines, there were significant differences between accreditation stage for the following variables: the number of respondents from each state where the clubs belonged, the mean age of respondents, and the number of players.

Measures

Alcohol consumption. Alcohol consumption was assessed using the graduated frequency index (Australian Institute of Health and Welfare, 2005) and the 7-day diary (7DD) (White and Hayman, 2006). All questions were framed around alcohol consumption at the sports club, and a definition of a standard drink preceded these questions. One Australian standard drink has 10 g of ethanol (National Health and Medical Research Council, 2009). The graduated frequency index (Australian Institute of Health and Welfare, 2002, 2005) and the 7DD (White et al., 2000, 2003) have been used extensively in Australian research. The graduated frequency index comprises a series of questions that require respondents to indicate how often alcohol is consumed (e.g., 1–2 days a week; once a month) and the average amount of alcohol per session (e.g., 5–6 standard drinks; 1–2 standard drinks) consumed in the last 12 months (Graham et al., 2004; Greenfield, 2000). The average amount of alcohol consumed over the 12-month period can be used to determine whether levels of alcohol use are in excess of Australian guidelines for long- and short-term risky drinking (National Health and Medical Research Council, 2009). The 7DD assessed how much alcohol individuals consumed for the 7 days before the survey, and for what period. The graduated frequency index and the 7DD have been demonstrated to be reliable and valid instruments for alcohol research (Graham et al., 2004; Poikolainen et al., 2002).

Blood alcohol content and drink driving. Using reported levels of alcohol consumption and time over which this alcohol was consumed from the 7DD, the following formula was used to calculate BAC:

$$\text{approximate BAC} = \frac{\text{grams of ethanol} - 7 \times (\text{period of consuption in hours})}{\text{Widmark factor} \times \text{kilograms of body weight} \times 10}$$

The Widmark factor represents the metabolic rate, which is .7 for men and .6 for women. This formula has been used in previous research to estimate BAC levels (Harding et al., 2001; Loxley et al., 1990; York et al., 2003) and is considered reliable because it accounts for the period in which the alcohol is consumed and gender differences in metabolic rate (Breslin et al., 1997; Stowell and Stowell, 1998; Watson, 1989). The approximate BAC measures the proportion of alcohol per mass of the body. Respondents were also asked which days they drove home from their clubs for the 7 days immediately before the survey. Individuals who had an estimated BAC greater than .05% for a given day and reported that they drove home on that day were categorized as drink drivers.

Statistical analysis. The independent variables were organized into three levels. Level 1 (individual) variables included alcohol consumption and the individual covariates age, gender, whether the respondent was a player at the club, and occupation. Level 2 (club) variables comprised the club, type of sport (cricket or Australian Football League football), and individual covariates aggregated by club: average age of club member, average proportion of men per club, average alcohol consumption per club, and time (units of 6 months, representing one sporting season) the club had been in the Good Sports program. Level 3 (community) variables were stages of accreditation, rural/metropolitan index of club location, SES index of club location, state in which a club was located, and the safe-transport strategies that are part of the Good Sports program.

The intraclass correlation for the drink-driving estimate during the week before the survey was .03 (95% CI [.01, .05]); thus, multilevel modeling was used because the data were characterized by a hierarchical structure and the observations were not independent of each other (Bickel, 2007; Bryk and Raudenbush, 1992). The analysis was undertaken using Stata Version 11 (StataCorp LP, College Station, TX).

Control variables. Individual and club-level demographics and various individual demographics aggregated at a club level (Level 2 variables, see above) were used as control variables. The Hausman specification test was also used to assess whether there were any potential biases within the clusters because of omitted covariates in the final multilevel modeling model (Rabe-Hesketh and Skrondal, 2008; Snijders and Bosker, 1999).

Table 2. Alcohol consumption, period over which alcohol was consumed, BAC, and drink driving for Stage 1 and 2 clubs

	Drinks		Time (hours)		BAC		Drink drove	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	% [95% CI]	*n*(DD)
Stage 1								
Saturday	4.20	4.95	2.52	3.15	.05	.08	5.30 [3.88, 6.72]	962
Sunday	0.83	2.77	1.38	2.47	.02	.05	1.60 [0.20, 3.20]	311
Monday	0.12	0.74	0.31	1.06	0	.01	0.40 [-0.38, 1.17]	253
Tuesday	0.47	1.31	0.39	1.09	0	.02	0.11 [-0.11, 0.34]	871
Wednesday	0.31	1.37	0.68	1.93	.01	.02	1.12 [-0.15, 2.40]	267
Thursday	1.75	2.57	1.20	1.54	.02	.04	2.73 [1.70, 3.77]	951
Friday	0.72	2.60	1.00	2.05	.02	.05	1.97 [0.40, 3.53]	305
Stage 2								
Saturday	3.21	4.51	2.06	2.81	.03	.07	4.53 [2.97, 6.09]	684
Sunday	0.51	1.94	1.20	2.54	.01	.04	1.40 [-0.19, 3.09]	207
Monday	0.11	0.74	0.25	0.99	0	.02	0	180
Tuesday	0.43	1.19	0.41	1.32	0	.01	0.47 [-0.06, 1.01]	634
Wednesday	0.20	1.41	0.38	1.68	0	.03	0.58 [-0.57, 1.74]	171
Thursday	1.52	2.43	1.17	1.69	.01	.03	2.90 [1.65, 4.16]	689
Friday	0.46	1.88	0.89	2.04	.02	.05	1.99 [0.04, 3.94]	201

Notes: BAC = blood alcohol concentration; *n*(DD) = number in drink driving analysis.

Analytical strategy. A four-step analytical strategy was used (West et al., 2007). First, a null model (only a random intercept) was analyzed. A null model provided a baseline variance estimate that enabled assessment of how much variables hierarchically added to the model reduced the variance between clubs. Second, the individual-level variables were entered into the equation (Model 1). Third, club-level variables were entered (Model 2). Finally, third-level variables were entered into the model (Model 3). Nonsignificant predictors were removed at each step of the model-building process.

Results

The proportion of weekly short-term risky drinkers was 21% and 16% for individuals in Stage 1 and Stage 2 clubs, respectively. Alcohol consumption for each day of the week, before the survey, for clubs accredited at Stage 1 and Stage 2 is outlined in Table 2. This table also portrays the average duration over which alcohol was consumed each day, the approximate BAC levels, and the proportion of drink drivers for each day.

Overall, alcohol consumption by individuals and their BAC levels on the weekdays in clubs accredited at Stage 1 and clubs accredited at Stage 2 were very similar, although consumption was always lower for individuals in Stage 2 accredited clubs. Thursday (training day) and Saturday (playing day) were the days when most alcohol was consumed and for the longest periods, and they were the highest risk days for drink driving. The estimated proportion of drink driving on any day in the week for the whole sample was 7.3% (95% CI [6.1, 8.3]). Broken down by accreditation stage, the estimate for Stage 1 clubs was 7.8% (95% CI [.6.1, 9.4]) and for Stage 2 clubs 6.7% (95% CI [5.0, 8.5]), but it was not significantly different.

Table 3 outlines the distribution of the safe-transport strategies implemented in Stage 2 accredited clubs. The strategies are listed in descending order of popularity, from left to right. Every Stage 2 club offered free calls to taxis (100%); 65% of clubs offered taxi vouchers as prizes. Approximately 10% of Stage 2 clubs had not achieved the recommended minimum requirement of three strategies. The types of strategies offered by clubs with only one or two safe-transport strategies were free calls to taxis and having taxi numbers displayed. Designated-driver strategies were only implemented in clubs with three or more strategies. Key registers were among the less common strategies. A majority of Stage 2 clubs offered 10 strategies as part of their safe-transport initiatives (67%).

Hypothesis testing

Table 4 depicts the significant variables retained in each step of the multilevel modeling model-building process. The dependent variable was whether individuals reported driving their cars home with a BAC estimated to be .05% or more on any day of the week before the survey. Model 1 demonstrates that as reported age increased above 21 years, the likelihood of drink driving also increased. Being a short-term risky drinker increased the odds of drink driving 2.75 times. The change in the -2 log likelihood statistic, $\chi^2(5, N = 1793) = 40.67$, $p < .01$, between Model 1 and the null model indicated that Model 1 was a significant improvement. Model 1 reduced the variance between clubs by approximately 25% [(0.47 – 0.35) / 0.47].

For Model 2, the average number of heavy drinkers in the club was the only variable that improved the model. The change in the -2 log likelihood statistic indicated that Model 2 was a significant improvement to the null model, $\chi^2(6, N = 1793) = 45.87$, $p < .01$, and overall explained 43% [(0.47

TABLE 3. Proportion and distribution of safe-transport strategies implemented in Stage 2 accredited clubs

No. strategies	Free calls taxis	Taxi numbers displayed	Free soft drinks to bar staff	Free snacks bar staff	Designated	Free club transport	Free snacks designated drivers	Free soft drinks to designated drivers	Key register	Taxi vouchers prizes	% (*n* clubs) with # strategies
1	X	•	•	•	•	•	•	•	•	•	2.08 (1)
2	X	X	•	•	•	•	•	•	•	•	2.08 (1)
3	X	X	•	•	X	X	•	•	•	•	6.25 (3)
4	X	X	X	•	X	•	X	X	X	•	4.17 (2)
5	X	X	X	X	X	X	•	•	•	•	6.25 (3)
6	X	X	•	X	X	X	X	•	•	•	2.08 (1)
7	X	X	X	X	X	X	X	X	X	•	6.25 (3)
8	X	X	X	X	X	X	X	X	•	•	2.08 (1)
9	X	X	X	X	X	X	X	X	X	•	4.17 (2)
10	X	X	X	X	X	X	X	X	X	X	66.67 (32)
% clubs offering strategy	100%	92%	85%	85%	83%	83%	81%	79%	75%	65%	

Notes: Table 3 cross-tabulates the type of strategies with the number of strategies offered by clubs. X = indicates whether strategy was offered by any Stage 2 clubs; • indicates that strategy was not offered by any Stage 2 clubs. Percentage at base of each column is the proportion of Stage 2 clubs that offered strategy. Statistics in last column indicate the percentage (and number) of Stage 2 clubs offering the number of strategies.

– 0.27) / 0.47] of the variance between clubs compared with the null model.

For Model 3, Stage 2 accreditation was mediated by the number of strategies implemented, and model fit improved when the quadratic function for the number of strategies rather than the accreditation level was entered into the model. Hence, Model 3 was developed by entering the number of strategies as a quadratic function, and the results revealed that this variable and whether the club was located in a metropolitan region both predicted drink driving. Model 3 was a significant improvement to the null model, $\chi^2(9, N = 1793) = 54.99$, $p < .01$. Adding the quadratic count of safe-transport strategies and metropolitan location improved the variance explained by 29%, increasing the amount of variance explained in Model 3 to 72% [(0.47 – 0.13) / 0.47] compared with the null model. A Hausman test indicated that for the final model, the within-group (club) variance was homogeneous between clubs, $\chi^2(5, N = 1793) = 2.6$, $p > .05$.

Figure 3 plots the parabolic relationship between the number of strategies and the predicted probability of drink driving when controlling for all the variables in Model 3. Overall, the probability that a respondent would drink drive increased when between one and four strategies were implemented. The gradient reverses when a club had between four and five safe-transport strategies implemented. Thus, respondents in Stage 2 clubs with between one and four

TABLE 4. Multilevel models for drink driving during the week

		Model 1		Model 2		Model 3		
Variable	Null	OR [95% CI]	*p*	OR [95% CI]	*p*	OR [95% CI]	*b*	*p*
Short-term risky drinker		2.75 [1.83, 4.13]	.000	2.30 [1.50, 3.53]	.000	2.28 [1.49, 3.50]	0.83	.000
Age (21–30)		5.77 [2.22, 14.18]	.000	5.85 [2.26, 15.17]	.000	5.49 [2.12, 14.18]	1.70	.000
Age (31–40)		5.63 [2.09, 15.16]	.000	5.83 [2.17, 15.70]	.000	5.58 [2.08, 14.93]	1.72	.000
Age (41–50)		5.64 [2.13, 14.96]	.000	5.93 [2.24, 15.70]	.000	5.72 [2.17, 15.08]	1.74	.000
Age (≥51)		4.68 [1.68, 13.04]	.000	4.97 [1.79, 13.83]	.000	4.62 [1.67, 12.80]	1.53	.000
Club risky				6.21 [1.34, 28.79]	.020	4.34 [1.01, 18.57]	1.47	.050
Safe no.						1.33 [1.02, 1.73]	0.28	.040
Safe no.^{2}						0.97 [0.94, 1.00]	-0.03	.030
Metro						0.60 [0.40, 0.91]	-0.51	.020
*N*1 (ind.)	1,793	1,793		1,793		1,793		
*N*2 (clubs)	113	113		113		113		
σ^2 between	0.469	0.352		0.268		0.127		
df	2	7		8		11		
−LL	460.68	440.34		437.74		433.18		
AIC	925.35	894.68		891.48		888.37		
BIC	936.34	933.12		935.41		948.77		

Notes: OR = odds ratio; CI = confidence interval; club risky = proportion of short-term risky drinkers at club; safe no. = number of safe-transport strategies; safe no.^{2} = number of safe-transport strategies squared; metro = club located in a metropolitan region; ind. = individual; –LL = negative log likelihood statistic; AIC = Akiake Information Criteria statistic; BIC = Bayesian Information Criteria statistic.

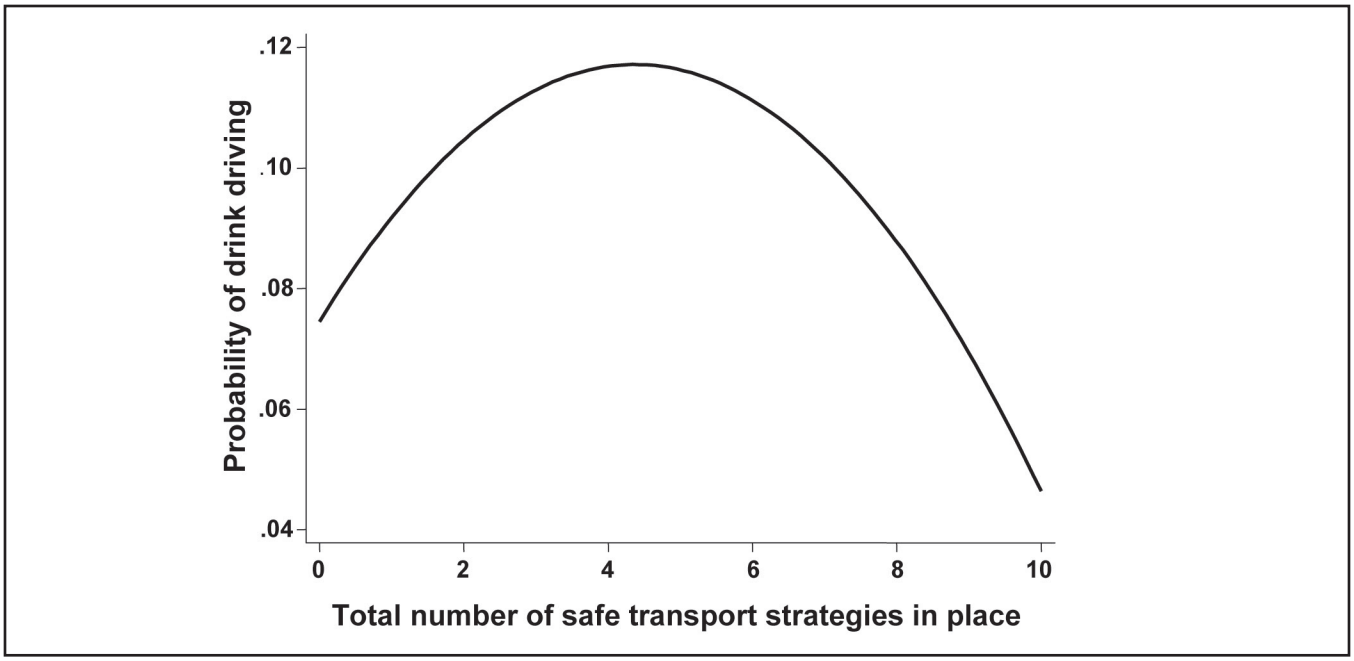

FIGURE 3. Predicted probability for drink driving as a function of the number of safe-transport strategies

to five strategies were more likely to drink and drive than members in Stage 1 clubs with no safe-transport strategies implemented through the Good Sports program.

The point at which the odds of the increased probability of drinking in a club with zero strategies (Stage 1 clubs) is of equal magnitude to the odds of drinking at a club with safe-transport strategies was such that members in Stage 2 clubs with 10 strategies were statistically less likely to drink drive compared with members in Stage 1 clubs. Members in Stage 2 clubs with one to nine strategies were either more likely than or as likely to drink drive as those in Stage 1 clubs.

Tetrachoric correlations between the safe-transport variables were calculated, and all were found to be greater than .9; thus, multicollinearity precluded undertaking a multivariate analysis with all the individual safe-transport strategies included. However, as an alternative analysis, particular combinations of strategies were entered into the final model in place of the quadratic count of safe-transport strategies. The

TABLE 5. Univariate and multivariate logistic regression analysis of safe-transport strategies implemented in stage 2 clubs in the prediction of drink driving

			Univariate		Multivariate	
Strategy	*n* (ind.)	*n* (clubs)	OR [95% CI]	*p*	OR [95% CI]	*p*
Designated driver program	718	40	0.66 [0.40, 1.07]	.089	0.79 [0.49, 1.26]	.308
Taxi vouchers (prizes)	546	31	0.62 [0.38, 1.01]	.054	0.67 [0.39, 1.14]	.141
Key register	661	36	0.94 [0.61, 1.44]	.776	0.91 [0.57, 1.44]	.677
Taxi numbers displayed	765	44	0.92 [0.61, 1.39]	.680	1.01 [0.65, 1.58]	.952
Taxi free call	821	48	0.97 [0.64-1.45]	.876	0.98 [0.63, 1.52]	.933
Free club transport	693	40	0.84 [0.55, 1.29]	.426	0.85 [0.53, 1.36]	.494
Free nonalcoholic drinks for designated drivers	695	38	0.93 [0.66, 1.42]	.742	0.76 [0.48, 1.21]	.242
Free bar snacks for designated drivers	714	39	1.00 [0.66, 1.51]	.989	0.88 [0.56, 1.39]	.587
Free nonalcoholic drinks for bar servers	723	41	1.01 [0.67, 1.54]	.931	0.91 [0.58, 1.43]	.676
Free bar snacks for bar servers	730	41	1.00 [0.66, 1.51]	.988	0.88 [0.56, 1.40]	.601
Three strategies: Taxi (vouchers & free calls & numbers)	546	31	0.57 [0.33, 0.97]	.040	0.67 [0.39, 1.1.4]	.141
Two strategies: Taxi (free calls & numbers)	765	44	0.91 [0.57, 1.46]	.698	1.01 [0.65, 1.58]	.952
Two strategies: Free drinks & snacks for bar staff	711	41	0.67 [0.41, 1.10]	.116	0.76 [0.48, 1.21]	.252
Two strategies: Free drinks & snacks for designated driver	691	38	0.68 [0.41, 1.10]	.113	0.76 [0.48, 1.21]	.242
Four strategies: Free drinks & snacks for bar staff & designated driver	682	37	0.70 [0.43, 1.40]	.159	0.78 [0.49, 1.24]	.292
Two strategies: Designated driver & free club transport	693	40	0.73 [0.45, 1.19]	.213	1.01 [0.65, 1.58]	.952

Notes: Ind. = individual; OR = odds ratio; CI = confidence interval.

purpose of the analysis was to generally examine possible strategy combinations that clubs that are poorly resourced may be able to implement as a bare minimum. Combinations were based on what the authors thought were strategies most likely to be practical and economical for community sports clubs to implement. The combinations of strategies examined are listed in Table 5. Again, multicollinearity precluded this analysis controlling for other safe-transport strategies that were implemented.

Table 5 outlines the univariate analysis and the multivariate analysis for the individual safe-transport strategies and also the combination of safe-transport strategies. The univariate column indicates that when confounders were not included, only taxi vouchers approached significance (p = .054) as a predictor of drink driving during the week. The multivariate column indicates that when individual strategies or a combination of strategies were entered, while controlling for Level 2 and Level 3 variables, none of the strategies were significant. Similarly, the univariate analysis of the combined strategies revealed that only strategies focusing on taxis were predictive of reduced odds of drink driving. However, the multivariate analysis that controlled for significant Level 1 and Level 2 confounders did not identify any significant strategy combinations.

Discussion

This study contributes new data on factors associated with drink driving in sports clubs in the southeastern states of Australia. Overall, the consumption levels for each day of the week were similar for clubs accredited at Stage 1 and Stage 2. For clubs at both stages, consumption was heaviest on Saturday—the day the sport was played. However, the period of consumption was over a longer period on any given day for individuals in Stage 2 accredited clubs. Thus, the BAC levels for individuals in Stage 2 accredited clubs were lower relative to individuals in Stage 1 accredited clubs with no formal safe-transport strategies implemented through the Good Sports program.

Overall, the incidence of any drink driving in the past 7 days for community sports club attendees was 7.3% (95% CI [6.1, 8.3]), with risks highest on Saturdays and Thursdays. This is substantially higher than the estimated prevalence of drink driving in Victoria, Australia, which is reported to be approximately 1% of the population (Wundersitz et al., 2007). The main hypothesis (Hypothesis 1)—that a higher accreditation stage would predict lower drink driving—was partially supported. Although the rates of drink driving in Stage 2 accredited clubs were lower relative to those in Stage 1 clubs, this effect was mediated by the number of safe-transport strategies implemented in the club.

The number of strategies did predict drink driving (Hypothesis 2); however, only in Stage 2 clubs with 10 strategies in place was the probability of drink driving significantly below the rate for Stage 1 clubs. Members in Stage 2 clubs with one to nine strategies had similar or increased rates of drink driving compared with members in Stage 1 clubs. Our crude analysis of types and clusters of safe-transport strategies could not identify a specific set of effective strategies.

Overall, the regression analyses indicated that when demographic and other variables were controlled, the number of safe-transport strategies was not linearly related to the prediction of drink driving but showed an inverse parabolic relationship. Having between one and five strategies as part of Stage 2 accreditation increased the chance of an individual drink driving compared with an individual in a Stage 1 accredited club. Table 3 indicates that clubs with between one and two strategies usually include free calls to taxis and having taxi numbers displayed. These strategies are relatively easy to implement, possibly explaining why clubs with fewer strategies chose these.

However, taxi numbers and free calls are strategies that do not provide structural, practical, and economical resources that make it easier to choose not to drink and drive. They are not strong preventive strategies; therefore, it is possible that these strategies are ignored or unnoticed by club members. Clubs in the Good Sports program that do formally promote these strategies may inadvertently permit people to drink more because of the belief that there are safe-transport strategies in place. For example, if someone has drunk enough alcohol to take them over the limit and has a car to drive home in, it is unlikely that free calls and taxi numbers will prevent him or her from drink driving. It is also possible that clubs not in the Good Sports program may use these strategies informally. This may be why there may be an increase in the odds of drink driving for Good Sports clubs with these strategies in place when compared with non–Good Sports clubs.

A closer examination of the parabolic relationship between the probability of drink driving and the number of strategies in Stage 2 accredited clubs reveals that the reduction in probability occurs when clubs have between four and five strategies in place, the turning point for the parabola (Figure 3). Table 3 indicates that clubs with four to five strategies in place usually have taxi numbers displayed, free calls to taxis, designated driver programs, and free club transport. These strategies require a greater investment of resources by community sports clubs and thus may be proxy measures of an active commitment to reducing drink driving; they may also be indicative of a setting that makes it easier to choose not to drink and drive. This may be why the probability of drink driving begins to decline in these clubs.

A similar argument could be made for clubs with six to nine strategies. Clubs with 10 strategies in place as part of Stage 2 accreditation have all those described above but also include taxi vouchers as prizes and a key register. Both these strategies have financial and logistical implications for community sports clubs and thus indicate a club firmly

committed to facilitating a reduction in drink driving and providing a strong health-promoting environment. Providing more options also gives individuals more choice; thus, this may also facilitate making sober driving an easier choice.

The finding that rural clubs and older members had an increased probability of drink driving is consistent with other studies. Rural drivers drink drive more often than urban drivers because there is less public transport available, and they also perceive the risk of being caught through RBT to be low (Harrison and Pronk, 1998). The comparable findings in this study suggest that rural sport club populations may also drink drive for the same reasons. Similarly, the significant association with age supports previous research showing that probationary license restrictions (typically applying to drivers until age 21) are associated with reductions in drink driving. The current findings did not find adult (after age 30) maturity to be associated with a reduction in drink driving.

The findings revealed that both members' heavy drinking and the number of short-term risky drinkers in a club increased the odds of drink driving. This suggests that although harm-reduction strategies do reduce drink driving, normative group behavior also affects individual drink-driving behavior. These findings are consistent with the conceptual model outlined in the introduction (Figure 1), which suggests that social norms influence drink-driving behavior (Shults et al., 2001). Thus, if drink driving is to be reduced in the community sports club setting, strategies must tackle the influence of group and club norms. The present study has shown that clubs with heavy drinking norms and clubs that weakly implement safe-transport strategies have higher rates of drink driving. Thus, community sports clubs may find it more difficult to implement safe-transport strategies if club members condone heavy drinking. Therefore, both issues need to be addressed simultaneously.

Limitations and strengths

Our study has a number of limitations. It is a cross-sectional design; thus, it cannot be argued that the observation associating safe driving strategies with lower drink driving is causally related. Alcohol consumption and whether a respondent drove home are self-reported; therefore, social desirability and thus underreporting are possibilities. The study was not blinded; hence, the Hawthorne effect may have resulted in intervention respondents underestimating their drinking behavior. BACs have been mathematically calculated; whereas the BAC formula is a validated measure, it is based on the assumption that alcohol consumption has been reported accurately. The response rate is low; however, this is not surprising given that clubs are not-for-profit organizations and are principally serviced by volunteers. Although generalization of the findings needs to be made with caution, response rates were similar at both accreditation stages, suggesting they were unlikely to have reduced internal validity.

Notwithstanding the limitations, this study has a number of strengths. It has demonstrated a dose–response association with strategies recommended in the Good Sports accreditation program and levels of drink driving. The findings are not incompatible with behavior ecological theory (Hovell et al., 1997), which suggests that the implementation of multilevel harm-reduction strategies (McLeroy et al., 1988) can affect drink driving in a sports setting. It is also consistent with behavior ecological theory, which suggests that several environmental influences are more effective than lone or a few environmental influences.

The analysis technique is another strength. The multilevel analysis has ensured that the homogeneity of individuals in a club has not biased the standard error, and subsequently the *p* values (Bickel, 2007). Moreover, the Hausman specification test after each analysis has ensured that, after adjusting for covariates, the variance within clubs was homogeneous (Rabe-Hesketh and Skrondal, 2008; Snijders and Bosker, 1999).

Implications and conclusion

Overall, this study has provided preliminary evidence for the efficacy of a complex real-world intervention, targeting a complex population group—community sports clubs. It has demonstrated an association between drink driving and drink-driving countermeasures, formally implemented as part of the Good Sports program. From a population health and community intervention perspective, the adoption design combined with the analyses method provides evidence of effectiveness for the early phases of the implementation, as well as development and evaluation of the Good Sports program. Moreover, the evidence suggests that greater investment in a community trial is justified. Given that substantial numbers of individuals participate in sports clubs throughout Australia and the rest of the world, the findings indicate that it is possible that the Good Sports program has the potential to reduce physical injury, illness, and financial costs associated with drink driving in the Australian community and possibly abroad.

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Study Three (Article Three)

Rowland, B., Toumbourou, J. & Allen, F. (2012). Association of risky alcohol consumption and accreditation with the 'Good Sports' alcohol-management programme. *Journal of Epidemiology and Community Health*. doi:10.1136/jech-2011-200334.

These pages are designed to assist the reader link the literature review and prior sections with the rationale for undertaking study three (article three in this PhD). Study three uses data collected from community sports clubs not participating in the Good Sports programme and clubs at all three stages of accreditation. As the previous two studies demonstrated that higher levels of the programme were associated with lower levels of alcohol consumption and drink driving, the next two studies used a stronger design to investigate the programme further. Study three also sought to investigate the intervention variables that were significantly associated with outcomes in the earlier studies.

Overall, article three was designed to assess the programme with respect to alcohol consumption. The analyses were completed in the following way:

1. Alcohol consumption at the community sports club was examined for associations with risk in the short term (on a single occasion) and risk of alcohol-related harm over a lifetime (in the short- and long-term).
2. Multilevel regression was used to test for a possible dose-response association between accreditation level and alcohol consumption. An accreditation variable was created in which non–Good Sports clubs were assigned a value of zero and clubs accredited at stages one, two and three were assigned these values, respectively.

Similar to the previous two studies, study three is an adoption study; it was not designed to test specific causal relationships.

3. The paper has been submitted and accepted by the *Journal of Epidemiology and Community Health*. This journal requires that at the end of the article a summary of 'what is known', and 'what the study adds', to be included. This journal has a A-Class ranking according to the 2011 Excellence in Research for Australia (ERA), classification; it has an impact factor of 2.983.

Monash University

Declaration for Thesis Chapter 6

Declaration by candidate

In the case of Chapter 6. the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Design study, data collection, lead analysis and write-up of article	65–70%

The following co-authors contributed to the work. Co-authors who are students at Monash University must also indicate the extent of their contribution in percentage terms:

Name	Nature of contribution	Extent of contribution (%) for student co-authors only
Associate Professor Felicity Allen	Analysis and write-up	N/A
Professor John Toumbourou	Analysis and write-up	N/A

Candidate's Signature	[redacted]	Date 18 August, 2012

Declaration by co-authors

The undersigned hereby certify that:

1. the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors
2. they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise
3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication
4. there are no other authors of the publication according to these criteria
5. potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit
6. the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)	Deakin University, School of Psychology, Burwood Campus, Burwood Highway Melbourne

[Please note that the location(s) must be institutional in nature, and should be indicated here as a department, centre or institute, with specific campus identification where relevant.]

Signature 1	[redacted] Associate Professor Felicity Allen	Date 18th August 2011
Signature 2	[redacted] Professor John Toumbourou	18th August 2011

Chapter 6: Association of Risky Alcohol Consumption and Accreditation in the ‘Good Sports’ Alcohol-management Programme

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Association of risky alcohol consumption and accreditation in the 'Good Sports' alcohol management programme

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ABSTRACT

Background Involvement in community sports clubs is often associated with high levels of risky alcohol consumption; however, developing prevention-focused interventions in these settings can be complex. We examined the association of reduced risky alcohol consumption with the implementation of the Good Sports Programme (GSP)—a programme that accredits clubs in three stages, on the basis of their implementation of alcohol-related harm reduction strategies.

Methods Using a cross section of football and cricket clubs, consumption was compared between clubs accredited at level 1, 2 or 3 of the GSP and clubs not accredited (92 clubs; 1924 individuals). Drinking above Australian guidelines for short-term risk (more than four standard drinks) on the last playing day prior to the survey and drinking at the club over the last 12 months at average levels exceeding short- and long-term risk (more than two standard drinks) guidelines were also examined.

Results Multilevel modelling indicated that higher accreditation stage (0, 1, 2, 3) was associated with a 0.79 reduction in the odds of risky consumption on the playing day; a 0.85 reduction in the odds for short-term risky drinking, and a 0.86 reduction in long-term risky drinking.

Conclusions The findings suggest that higher accreditation in the GSP is associated with reduced rates of risky alcohol use at a population level.

Internationally, many people participate in a sporting activity or belong to a community sports club. In the UK, over 40% of the population of 61 million report participating in a moderate-intensity sport,[1] and in Australia, approximately 22% of the population of 22.5 million participate in community sports clubs, as players, officials or supporters.[2] Participation in sport can improve fitness,[3–5] provide opportunities for social engagement[6 7] and may enhance mental well-being.[8 9]

Community sports clubs, however, are strongly associated with risky levels of alcohol consumption. A national household survey in England revealed that heavier alcohol consumption is associated with playing sport or belonging to a sports club.[10] In New Zealand, higher levels of harmful alcohol consumption occur among rugby players than community members generally.[11 12] An Australian study indicated that 34% of club members consumed five or more standard drinks each time they visited their club.[13]

Behaviour Ecological Theory argues that the environment is a key determinant of health behaviours.[14] Based on the principles of operant conditioning, this theory proposes that behaviour changes when environmental influences are modified. Proponents argue that identifying critical environmental influences and then using them to change behaviour are crucial to developing effective and efficient interventions.[15] The most effective interventions are usually applied at several critical levels, not just as a lone strategy.[16]

However, developing successful prevention-focused interventions in community sports clubs can be challenging. With limited financial resources, interventions are typically managed by volunteers[17]; clubs depend on alcohol sales to raise revenue; they also have strong traditions of drinking games, and excessive consumption is often perceived as a means to building club camaraderie and social capital.[13 18 19]

In Australia, the Good Sports Programme (GSP) was developed by the Australian Drug Foundation to reduce risky alcohol consumption in sports clubs.[20–22] Grounded in Behaviour Ecological Theory, the programme aims to reduce risky alcohol consumption through a three-stage accreditation programme. Provided free of charge, and with the aid of a dedicated project officer, clubs implement multiple strategies to reduce the supply, demand and harm of alcohol. Stage 1 accreditation focuses on ensuring clubs abide by liquor licensing laws and Responsible Service of Alcohol (RSA) training of bar staff; stage 2 accreditation focuses on the provision of alternative food, drink and revenue-raising and stage 3 focuses on policy development, review and enforcement (see Duff and Munro,[20] and Munro[21]). Once clubs have implemented all relevant strategies, they are classified as a 'stage 3' accredited Good Sports club. No similar programme could be located anywhere else in the world.

The present study compared levels of alcohol use among members of clubs that have adopted the GSP with individuals in clubs that had not. There were two hypotheses: first, it was hypothesised that there would be a dose–response effect between successively higher stages of Good Sports accreditation and lower alcohol consumption; and second, individuals in Non-Good Sports clubs would consume the most alcohol.

METHODS

Participants

All procedures were approved by the ethics committee at Monash University. Cricket and Australian Football League (AFL) clubs from the states of Victoria and South Australia participating

in the GSP were assigned a socioeconomic status (SES) index (advantage/disadvantage) corresponding to the club's post-code.[23] Databases for non-GSP clubs were secured from peak sporting bodies, and these clubs were also assigned an SES index. Twenty-five per cent of clubs with more than 50 members were then randomly selected from each SES quartile and invited to participate in the study.

A total of 92 clubs (1924 individuals) participated; 54% response rate from GSP-participating clubs and a 55% response rate from non-GSP clubs. Table 1 outlines the demographic and club details of the sample. Between accreditation stages, there were no significant differences in the number of cricket and AFL cubs ($\chi^2(3, N=92) = 2.867$; $p>0.05$), geographic location ($\chi^2(9, N=92) = 10.963$; $p>0.05$) and SES index ($F_{3,92}=0.61$; $p>0.05$); however, there were significantly more Victorian clubs ($\chi^2(3, N=92)=14.54$; $p<0.01$).

At an individual level, there were no significant differences between the stages in the age and income of respondents, years of education and whether respondents were players. There were, however, significant differences in the percentage of men ($\chi^2(3, N=1865)=10.47$; $p=0.015$) and in the occupation of respondents ($\chi^2(12, N=1772)=30.48$; $p<0.01$).

Table 1 Club and demographic details

	Non-Good Sports	Stage 1	Stage 2	Stage 3
Club details (N)				
Australian Football League	22	13	15	12
Cricket	6	6	9	9
Victoria	20	14	24	21
South Australia	8	5	0	0
Major city	8	8	11	8
Inner regional	12	11	10	8
Outer regional/remote	8	0	3	5
Mean club SES advantage/disadvantage	983.24	964.83	953.99	990.31
Total clubs	28	19	24	21
Club participant details				
Age				
Range	18–91	18–74	18–80	18–83
Mean	33.95	33.59	35.65	34.12
SD	13.66	12.68	13.50	13.26
Income ($1000s)				
Range	0–165	0–175	0–175	0–140
Mean	39.52	41.18	42.00	43.14
Gender (% male)	78.63	83.96	74.65	78.19
Education (%)				
Year 9 or less	5.69	2.56	4.43	4.56
Year 10	10.28	8.63	13.47	13.42
Year 11	15.41	17.89	16.24	13.16
Apprenticeship	24.95	28.12	25.09	24.56
TAFE	11.38	9.90	10.15	10.38
Year 12	9.54	12.78	9.41	9.11
Uni. undergraduate	13.21	13.42	12.36	14.43
Uni. postgraduate	8.81	6.39	8.12	9.62
Other	1.00	0.32	0.74	0.76
Average years of education	13	13	13	13
Occupation (%)				
Manager/administrator	23.48	26.10	33.20	27.94
Trade/labourer	42.05	42.03	34.94	36.29
Clerical	12.88	16.61	12.16	18.02
Not in workforce	21.59	15.25	19.69	17.75
Club involvement (%)				
Player	58.47	57.88	48.21	56.80
Supporter	32.88	28.48	40.17	40.10
Club member, N	590	330	585	419

TAFE, Technical and Further Education (Australia's main trade and vocational training institution).

MEASURES

Outcome measures

Alcohol consumption was assessed using the Graduated Frequency Index (GFI),[24] and the retrospective 7-day diary (7DD). The GFI and the 7DD are validated and reliable measures; both have been used extensively in Australian research.[24 25] All questions concerned alcohol consumption at the sports club, preceded by a definition of an Australian standard drink. Short- and long-term risky drinking was assessed with the NHMRC Australian drinking guidelines.[26] The guideline for reducing alcohol-related harm over a lifetime indicated that healthy men and women should not drink, on average, more than two standard drinks per day. The guideline for reducing the risk of harm on a single occasion states that men or women should not drink any more than four standard drinks on a single occasion.

Independent variables

Accreditation stage and time in the GSP was identified by official Good Sports records; these records are managed by the Good Sports national office in liaison with the club's dedicated project officer (see Duff and Munro[20]). Accreditation was modelled as a continuous variable, and time in the GSP was measured in units of 6 months (approximately one sporting season). Non-Good Sports clubs were assigned a value of zero. Bonding Social Capital[27] items were measured using a variation of individual items drawn for the validated Oynx and Bullen social capital instrument.[28] Questions included: Do you feel part of the club community? During the week, do you choose to have meals (socialise) with club members? Do you help out as a volunteer at your club? Responses were made on a 6-point Likert scale.

The validated Depression, Anxiety and Stress Scale (DASS) was used to measure mental health. The DASS is a 42 item self-report questionnaire designed to measure the emotional states of depression, anxiety and stress.[29] Cronbach's α for the scales with the current sample were stress (0.89), anxiety (0.77) and depression (0.91). Responses were made on a 4-point Likert scale. SES indicators were drawn from the Australian Bureau of Statistics Database.[23] Illicit drug use, smoking status and relationship status (single or married/defacto) questions were taken from the Australian National Household Survey.[30]

Statistical analysis

The independent variables were organised into three levels. Level 1 (individual) included alcohol consumption and the individual covariates: age, gender, whether the respondent was a player at the club, occupation, DASS, illicit drug use, and social capital measures. Level 2 (club variables) were the club-id, State, type of sport (cricket or AFL football) and individual covariates aggregated by club: average age of club member, average proportion of men per club, average alcohol consumption per club, accreditation stage and time (units of 6 months) the club had been in the GSP. Level 3 (community variables) were rural/metropolitan index of club location[31] and SES index of club location.[23]

Multilevel modelling was used to analyse the data.[32 33] The intraclass correlations for all the dependent measures are reported in table 2; and all were significant.[34] The analysis was

Table 2 Alcohol consumption in last 12 months and previous week, while at club, by accreditation stage, using Graduated Frequency Index and 7-day diary.

		Percentage risky drinking in last 12 months % (95% CI)				M (95% CI) drinks over last 12 months		Consumption on last playing day, M (95% CI), % of members	
	Abstainers	Weekly more than four drinks	Monthly more than four drinks	Yearly more than four drinks	Average more than two per day	Drinks per day while at club	Drink days per week while at club	Drinks Saturday	Short-term Risky Saturday
Non	9 (6.97 to 11.67)	22 (18.52 to 25.21)	53 (48.76 to 56.75)	65 (61.41 to 69.11)	74 (70.69 to 77.78)	4.5 (4.24 to 4.81)	2.2 (1.98 to 2.33)	3.7 (3.28 to 4.16)	23 (19.32 to 26.10)
S1	11 (8.05 to 14.98)	19 (15.12 to 23.68)	49 (45.98 to 51.75)	60 (54.69 to 65.31)	69 (64.39 to 74.39)	4.2 (3.81 to 4.56)	2.3 (2.03 to 2.52)	3.3 (2.78 to 3.85)	17 (13.17 to 21.37)
S2	11 (8.25 to 13.29)	23 (19.81 to 26.68)	48 (43.63 to 51.75)	58 (53.94 to 61.96)	69 (59.10 to 68.35)	4.1 (3.83 to 4.37)	2.2 (2.00 to 2.37)	3.0 (2.63 to 3.37)	17 (14.35 to 20.52)
S3	16 (12.90 to 20.33)	15 (11.38 to 18.21)	41 (35.85 to 45.29)	55 (49.87 to 59.44)	64 (59.10 to 68.35)	3.7 (3.39 to 4.01)	1.9 (1.70 to 2.12)	2.9 (2.53 to 3.34)	14 (10.95 to 17.69)
Total	12 (10.26 to 13.31)	20 (18.52 to 22.12)	48 (45.74 to 50.21)	60 (57.63 to 62.02)	69 (67.32 to 71.45)	4.2 (4.01 to 4.31)	2.1 (2.03 to 2.23)	3.2 (3.04 to 3.48)	18 (16.61 to 20.08)
ICC (95% CI)	0.13 (0.07 to 0.22)	0.13 (0.08 to 0.21)	0.08 (0.05 to 0.13)	0.08 (0.04 to 0.13)	0.08 (0.05 to 0.14)	0.08 (0.15 to 0.12)	0.09 (0.05 to 0.12)	0.09 (0.05 to 0.13)	0.14 (0.08 to 0.22)

S1, stage 1; S2, stage 2; S3, stage 3. Weekly more than four drinks, drank more than four drinks per occasion at club, at least on a weekly basis; monthly more than four drinks, drank more than four drinks per occasion at club, at least on a monthly basis; yearly more than four drinks, drank more than four drinks per occasion at club, at least on a yearly basis; average more than two per day, drank average more than two drinks per day of the year, while at club.
ICC, intraclass correlation; M, mean.

undertaken using Stata, V.11, and for all analyses, the club-id was specified as a random effect; it was expected that the relationship between dependent and independent variables would vary on a club-by-club basis.

Analytical strategy

A three-part analytical strategy was used.[35] First, a null model (only a random intercept, varying by club) was tested. Whether the random intercept, also further varied by third-level variables, was also examined. Second, individual-level variables were entered into the initial null model, and the consideration of level 1 (individual) random effects was undertaken; non-significant predictors were removed from the model (model 1). Third, club-level variables were entered, and second-level random effects were considered; non-significant predictors were removed (model 2). As accreditation stage was the principle variable of interest, it was introduced into the analysis with the level 1 variables (model 1). As accreditation was theorised to hold additive benefits at each successive stage, it was entered as a continuous variable (0, 1, 2, 3).

RESULTS

Table 2 outlines the amount and frequency of alcohol consumption for both measures of alcohol consumption. For both measures (GFI and 7DD), greater levels of risky consumption occurred in non-Good Sports clubs compared to individuals in stage 3 accredited clubs. There were fewer abstainers (9%) in non-Good Sports clubs compared to clubs at other stages of accreditation (11%–16%). For long-term risky drinking (average of more than two standard drinks per day), the highest proportion was among stage 1 accredited clubs (74%). The average number of drinks per day at the club was highest in non-Good Sports clubs (4.5); individuals in non-Good Sports clubs, stage 1 and stage 2 clubs on average exceeded Australian guidelines, with the exception of stage 3 (3.7).

Table 3 presents the statistical model building for short-term risky drinking on the playing day (Saturday). For model 1, significant predictors were whether respondents were players, in married or defacto relationships, were smokers, in trade or labouring occupations, volunteered, and accreditation level. The second model indicated that the average age of club members and the average frequency of times members had a meal with other members were also significant predictors. None of the level 3 variables were significant.

The final model (model 2) indicated that for each successive stage of accreditation, the odds of short-term risky drinking were reduced by 0.80. The final model explained 17% (0.52−0.43/(0.52)) of the variance between the clubs, and model 2 was a significantly better fit than the null model ($\chi^2(3, N=1694) = 91.1$; $p<0.05$). A Hausman test indicated the variance within clubs, for the final model, did not differ significantly between clubs ($\chi^2(10, N=1694)=3.15$; $p>0.05$).

Table 4 presents the models for past week short-term risky drinking. The dichotomous dependent variable assessed whether members consumed, on average, more than four standard drinks each time they drank at their clubs in the week prior to the survey. Model 1 indicates that younger age, male gender, being a player, lower education, illicit drug use, club belonging and socialising and accreditation were significant predictors.

For model 2, the average age of respondents and average proportion married were predictive; none of the level 3 variables were significant. In the final model, for each successive increase in the stage of accreditation, the odds of risky alcohol consumption were reduced by 0.85. This model explained 29%

Table 3 Prediction of short-term risky alcohol consumption (more than four drinks) on playing day (Saturday)

		Model 1		Model 2	
	Null	OR (95% CI)	p Value	OR (95% CI)	p Value
Accreditation	—	0.80 (0.66 to 0.96)	0.017	0.79 (0.66 to 0.94)	0.011
Player	—	2.05 (1.50 to 2.79)	0.000	2.23 (1.63 to 3.06)	0.001
Relationship	—	0.63 (0.47 to 0.84)	0.001	0.61 (0.46 to 0.81)	0.001
Smoke		1.57 (1.14 to 2.14)	0.005	1.56 (1.14 to 2.13)	0.005
Trade/labourer		1.80 (1.36 to 2.37)	0.000	1.79 (1.36 to 2.36)	0.000
Volunteer		1.10 (1.01 to 1.19)	0.026	1.09 (1.00 to 1.18)	0.039
Average age				1.05 (1.02 to 1.09)	0.004
Average meal				1.50 (1.10 to 2.06)	0.011
N_1 (individuals)	1694	1694		1694	
N_2 (clubs)	92	92		92	
σ^2 between	0.523	0.525		0.425	
df	2	8		10	
−LL	779.47	743.74		738.25	
AIC	1562.94	1503.49		1496.49	
BIC	1573.81	1546.97		1550.85	

−LL, −log likelihood; σ^2 between, variance between clubs; AIC, Akaike's Information Criteria; BIC, Bayesian Information Criteria. Accreditation, level of accreditation: 0=non-Good Sports; 1, stage 1; 2, stage 2; 3, stage 3. Relationship (1=married/defacto; 0=single). Smoke (1=yes; 0=no). Trade/labourer, works in trade/labourer occupation (1=yes; 0=no). Volunteer, extent respondents volunteers at club. Average meal: average Average frequency of times members had a meal with other club members.

of the variance ((0.42−0.30)/0.42) between clubs. Model 2 was a significantly better fit than the null model ($\chi^2(10, N=1706) =171.05$; $p<0.05$), and an Hausman test indicated that, for the final model, the variance within clubs did not differ significantly between clubs ($\chi^2(7, N=1706)=7.32$; $p>0.05$).

Table 5 depicts the model building for long-term risky drinking. Long-term risky drinking was a dichotomous variable; whether a respondent, on average, consumed more than two standard drinks each day of the week (more than 14 per week), while at the club. Accreditation, greater levels of feeling safe, belonging and socialising at the club were associated with increased odds of long-term risky drinking.

For model 2, average income of club members, average number of married individuals and average levels of anxiety and stress were all significant. For each stage of accreditation, a 0.86 reduction in the odds of risky drinking was observed. The final model explained 47% of the variance between the groups ((0.30−0.16)/0.30)); none of the level 3 variables were significant. Model 2 was a significantly better fit than the null model ($\chi^2(11, N=1779)=185.10$; $p<0.05$), and a Hausman test indicated that the variance within clubs did not differ significantly between clubs ($\chi^2(6, N=1779)=4.43$; $p>0.05$).

DISCUSSION

The first hypothesis that a dose−response relationship would be observed between successively higher accreditation stages and lower risky drinking levels was supported. Findings revealed, per accreditation stage, a 0.79 reduction in the odds of risky consumption on the playing day, a 0.85 reduction for short-term

Table 4 Prediction of short-term risky alcohol consumption (at least one session more than four drinks) in the week prior to the survey

		Model 1		Model 2	
	Null	OR (95% CI)	p Value	OR (95% CI)	p Value
Accreditation	—	0.82 (0.71 to 0.95)	0.01	0.85 (0.74 to 0.99)	0.04
Age	—	0.98 (0.97 to 0.99)	0.00	0.98 (0.97 to 0.99)	0.00
Gender	—	0.36 (0.26 to 0.48)	0.00	0.36 (0.26 to 0.48)	0.00
Player		1.33 (1.00 to 1.77)	0.05	1.33 (1.01 to 1.77)	0.05
Education		0.94 (0.90 to 0.99)	0.02	0.94 (0.90 to 0.99)	0.02
Illicit		2.31 (1.54 to 3.45)	0.00	2.25 (1.51 to 3.36)	0.00
Club-belong		1.11 (1.02 to 1.22)	0.02	1.11 (1.02 to 1.22)	0.02
Socialise		1.10 (1.03 to 1.17)	0.01	1.10 (1.03 to 1.17)	0.01
Av. age				1.06 (1.02 to 1.10)	0.01
Av. married				0.19 (0.06 to 0.60)	0.00
N_1 (individuals)	1706	1706		1706	
N_2 (clubs)	92	92		92	
σ^2 between	0.419	0.358		0.296	
df	2	10		12	
−2LL	112.27	1031.31		1026.74	
AIC	2228.53	2082.63		2077.48	
BIC	2239.41	2137.05		2142.78	

−LL, −log likelihood; σ^2 between, variance between clubs; AIC, Akaike's Information Criteria; BIC, Bayesian Information Criteria. Accreditation, level of accreditation: 0=non-Good Sports; 1=stage 1; 2=stage 2; 3=stage 3. Gender (1=male; 2=female). Education: years of education. Illicit: ever used illicit drugs (1=yes; 0=no). Club-belong: social capital measure of feeling like belongs at club. Socialise: social capital measure of extent respondent socialises at club. Av. age: the average age of respondents. Av. married: the average proportion of respondents at club in married or defacto relationship.

Table 5 Long-term risky alcohol consumption (averaging more than two drinks per day) in the 12 months prior to the survey.

		Model 1		Model 2	
	Null	OR (95% CI)	p Value	OR (95% CI)	p Value
Accreditation	–	0.88 (0.77 to 1.01)	0.07	0.86 (0.75 to 0.98)	0.02
Age	–	0.98 (0.97 to 0.98)	0.00	0.97 (0.97 to 0.98)	0.00
Gender	–	0.34 (0.26 to 0.44)	0.00	0.34 (0.26 to 0.44)	0.00
Illicit		1.96 (1.20 to 3.22)	0.01	1.92 (1.17 to 3.15)	0.01
Club-belong		1.17 (1.06 to 1.29)	0.00	1.17 (1.06 to 1.29)	0.00
Safe		1.16 (1.02 to 1.32)	0.02	1.16 (1.02 to 1.32)	0.02
Socialise		1.13 (1.06 to 1.21)	0.00	1.13 (1.05 to 1.21)	0.00
Av. income				1.02 (1.00 to 1.03)	0.03
Av. married				0.36 (0.16 to 0.83)	0.02
Av. anxiety				0.75 (0.64 to 0.89)	0.00
Av. stress				1.16 (1.03 to 1.30)	0.01
N_1 (individuals)	1779	1779		1779	
N_2 (clubs)	92	92		92	
σ^2 between	0.295	0.240		0.163	
df.	2	9		13	
−LL	1061.12	976.44		−968.57	
AIC	2126.24	1970.89		1963.15	
BIC	2137.21	2020.24		2034.44	

−LL, −log likelihood; σ^2 between, variance between clubs; AIC, Akaike's Information Criteria; BIC, Bayesian Information Criteria. Accreditation, level of accreditation: 0=non-Good Sports; 1=stage 1; 2=stage 2; 3=stage 3. Gender (1=male; 2=female). Club-belong: extent respondent feels a sense of belonging at club. Safe: extent respondent feels the club is a safe place. Av. Anxiety: average anxiety level of respondents at club. Av. stress; average stress levels at club.

risky drinking and a 0.86 reduction in long-term risky drinking. The second hypothesis that higher levels of alcohol consumption would be observed in non-Good Sports clubs was also generally supported (Table 2).

Social capital measures predicted increased levels of alcohol consumption, and overall, the prevalence of all forms of risky drinking was highest in non-Good Sports clubs, and lowest in stage 3 clubs. Overall, the study strongly supports Behaviour Ecological Theory, which argues that interventions applied at several critical levels are more likely to be effective than single-level and one-off interventions. The prevalence of short-term risky drinking in the last 12 months by members of stage 1 and stage 2 accredited clubs is very similar to the figures in an earlier pilot study.[22] However, unlike the pilot, the present study did not identify a relationship between time in the programme and reduced short-term risky drinking.

Prevalence of long-term risky drinking was substantially higher in non-Good Sports clubs (74%) compared to stage 3 accredited clubs (64%). Reductions were observable for successive increases in accreditation stages (table 2). Moreover, the multivariate analysis, after assessing and adjusting for individual, group and contextual confounders, revealed a 0.86 reduction in the odds of being a long-term risky drinker, for each increase in accreditation stage. This finding shows promise, suggesting that longitudinal and randomised evaluations of the programme should be now conducted.

Individuals who felt a sense of belonging at their clubs had increased odds of between 1.11 and 1.17 of being a short- or long-term risky drinker. These findings fit Social Development Theory[36] and suggest that feelings of attachment to groups with heavy drinking norms increases the risk of engaging in these behaviours. The findings are aligned with the 'dark side' of social capital—social capital that reduces rather than enhances health.[27]

Individual mental health was not associated with risky drinking suggesting that risky drinking at clubs is not associated with mental health comorbidity. Risky drinking at community sports clubs probably occurs because of social and cultural influences, rather than to alleviate emotional symptoms. Long-term risky drinking was found to be associated with collective levels of stress and anxiety according with findings that health behaviours may be influenced by political or social unease.[37]

While older individuals were at less risk of short-term risky drinking during the week (OR: 0.98) and of long-term risky drinking (OR: 0.97), greater consumption on the playing day was influenced by the proportion of older individuals present (OR: 1.05). This may reflect the numbers and demographics of the people drawn to the club on playing day; more individuals come to watch the match and socialise at the club compared to the weekday. In contrast, during the week individuals gathering at the club usually train and then socialise. On these days, attendees are more often players and usually the younger members.

Illicit drug use was associated with short-term risky drinking (OR: 2.25) and long-term risky drinking (OR: 1.92). This is consistent with previous findings that illicit drug use is often associated with risky alcohol consumption.[38] Smoking (OR: 1.56) was associated with increased consumption on the playing day (Saturday). This is consistent with previous research that indicates that smoking is often correlated with alcohol consumption.[39]

Being in an intimate relationship and having a higher proportion of married members reduced the risk of drinking at risky levels. This suggests that relationships have a protective effect on overall alcohol consumption. In contrast, working in a trade (blue collar occupation) increased the risk of drinking at risky levels, consistent with previous research showing that a high proportion of individuals in trade drink at risky levels.[10]

Uniquely, this study compares alcohol-related behaviour in clubs that have adopted the Good Sports alcohol management programme with clubs that have not. Overall, the findings contribute new evidence about the association between alcohol consumption and a staged alcohol management intervention, specifically within community sports clubs settings. The design,

What is already known on this subject

- Community sports clubs are a vital element of a country's social fabric.
- Unfortunately, in this setting, high levels of risky drinking occur.
- In licensed venues, where risky consumption also occurs, the implementation of alcohol management strategies can reduce risky consumption.
- However, there is little evidence that these strategies can be effective in community sports clubs.

What this study adds

- This study examines the association of risky drinking with the formal and gradual implementation of alcohol management strategies, through the Good Sports Program, in community sports clubs.
- Findings indicate that higher levels of Good Sports Program accreditation is strongly associated with lower levels of long- and short-term risky alcohol consumption.

however, was focused on cross-sectional measurement and non-randomised allocation to the accreditation process, limiting the potential to draw causal conclusions. Although the current findings were compatible with the possibility that accreditation influenced reductions in alcohol use, there was also evidence to suggest that the associations may have been due to selection effects.

Accreditation stage was associated with occupation and levels of abstaining from alcohol. Accreditation is not likely to have caused these associations and so that the association with alcohol consumption and accreditation may have been partly due to selection effects. Clubs with abstainers or moderate drinkers with higher incomes and more prestigious occupations may have been more attracted to accreditation. Longitudinal and randomised trials of the GSP will be required to clarify this. Ethnicity of club members was not explored, though this is related to alcohol consumption, especially among those participating in sport.[40] This should be considered in future research.

Overall, the current study provides one of the few surveys of alcohol consumption within the context of sport club involvement in an alcohol management intervention. Thus, it contributes to a greater understanding of alcohol consumption in settings that are known to hold risks in both Australia and internationally. Causal inference is not warranted, but the study clearly shows that the GSP is strongly associated with lower levels of long- and short-term risky alcohol consumption. Given that the many people involved with community sports clubs, there is substantial potential and opportunity for the GSP to improve the health of both individuals and communities across the world.

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Study Four (Article Four)

Rowland, B., Toumbourou, J. & Allen, F. (submitted). Drink driving in community sports clubs: Adopting the Good Sports alcohol-management programme. *Accident Analysis and Prevention.* doi:10.1016/j.aap.2012.01.024.

These pages are designed to assist the reader understand the rationale for undertaking study four (article four in this PhD). Study four uses data collected from the same sample and design as the previous study (study three); however, the outcome examined in this study is different—drink driving.

Study two, which compared drink driving in level-one and level-two clubs, suggested that the Good Sports programme was associated with lower levels of drink driving. However, there was no linear association between accreditation level and drink driving; rather, an inverse parabolic relationship between the number of drink-driving countermeasures and reduced drink driving was found. To explore the relationship of the Good Sports programme with drink driving, study four compared drink driving in community sports clubs not participating in the Good Sports programme and in clubs that had achieved different levels of accreditation (level one, level two and level three).

The programme's relationship to drink driving was measured in the following ways:

1. A dose-response association between accreditation (0 represented non–Good Sports and 1–3 represented accreditation stage) and drink driving in the week prior to the survey was examined.

2. A dose-response association between the proportion of time a club had participated in the Good Sports programme (number of sporting seasons) and drink driving in the week prior to the survey was examined.

Similar to the previous three studies, study four is an adoption study; it did not set out to test specific causal relationships.

The paper has been accepted by the Journal *Accident Analysis and Prevention*. This journal has an A*class ranking according to the 2011 Excellence in Research for Australia (ERA), classification; it has an impact factor of 2.717.

Monash University

Declaration for Thesis Chapter 7

Declaration by candidate

In the case of Chapter 7, the nature and extent of my contribution to the work was the following:

Nature of contribution	Extent of contribution (%)
Data collection, lead analysis and write-up of article	65–70%

The following co-authors contributed to the work. Co-authors who are students at Monash University must also indicate the extent of their contribution in percentage terms:

Name	Nature of contribution	Extent of contribution (%) for student co authors only
Associate Professor Felicity Allen	Analysis and write-up	N/A
Professor John Toumbourou	Analysis and write-up	N/A

Candidate's Signature	[redacted]	Date 18 August, 2011

Declaration by co-authors

The undersigned hereby certify that:

1. the above declaration correctly reflects the nature and extent of the candidate's contribution to this work, and the nature of the contribution of each of the co-authors
2. they meet the criteria for authorship in that they have participated in the conception, execution, or interpretation, of at least that part of the publication in their field of expertise
3. they take public responsibility for their part of the publication, except for the responsible author who accepts overall responsibility for the publication
4. there are no other authors of the publication according to these criteria
5. potential conflicts of interest have been disclosed to (a) granting bodies, (b) the editor or publisher of journals or other publications, and (c) the head of the responsible academic unit
6. the original data are stored at the following location(s) and will be held for at least five years from the date indicated below:

Location(s)	Deakin University, School of Psychology, Burwood Campus, Burwood Highway Melbourne

[Please note that the location(s) must be institutional in nature, and should be indicated here as a department, centre or institute, with specific campus identification where relevant.]

Signature 1	[redacted] Associate Professor Felicity Allen	Date 18th Aug 2011
Signature 2	[redacted] Professor John W Toumbourou	18th Aug 2011

Chapter 7: Drink Driving in Community Sports Clubs: Adopting the Good Sports Alcohol-management Programme

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Drink-driving in community sports clubs: Adopting the Good Sports alcohol management program

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ABSTRACT

Throughout the developed world, community sports clubs are a high-risk setting for alcohol-impaired driving. The Good Sports program accredits community sports clubs to encourage implementation of alcohol-focussed harm-reduction and safe-transport strategies. This study tested for associations between participation in the Good Sports program and reduced rates of drink-driving amongst club members. Multilevel modelling indicated that for each season a club was in the program there was an 8% reduction in the odds of drink-driving. These findings may arise due to clubs with lower rates of alcohol use maintaining longer involvement in the program. However, the findings are also compatible with the intention of the Good Sports program to reduce the risk that club members will drive whilst alcohol impaired.

About 2.3 billion people worldwide consume alcohol (WHO, 2004). Whilst many people use alcohol benignly, high levels of alcohol consumption frequently occur in settings where individuals gather to play or watch community sport. These settings include sports clubs situated in the local community (Black et al., 1999; Duff et al., 2005; Poortinga, 2006; Quarrie et al., 1996), or sports clubs associated with institutions such as universities or colleges (Lisha and Sussman, 2010; Lorente et al., 2003; Martens et al., 2006). As these settings are community located, individuals travel from clubs to their abodes or other venues after consuming alcohol (Lang and Stockwell, 1991; Snow and Munro, 2000). The combination of high risk consumption and the need to travel makes community sports clubs a high risk setting for drink-driving.

In high income countries, 20% of fatally injured drivers are alcohol impaired (WHO, 2007). In many countries, impairment is usually assessed by blood alcohol content (BAC), and individual BAC levels are associated with amount of alcohol drunk over a specified time period, and gender (Breslin et al., 1997; Stowell and Stowell, 1998; Watson, 1989). The usual methods for detecting BAC is through breathalysers or blood tests (WHO, 2007). Breathalysers assess the amount of alcohol in a given proportion of exhaled breath; blood tests analyse the proportion of alcohol per unit of blood.

In some countries breathalysers are used at roadside breath testing (BT) stations, by law enforcement agencies; blood testing is usually undertaken in clinical settings (Homel, 1993) to confirm BAC levels. BT stations can be used for preventive effects, especially when implemented on a large scale, and located on roadsides that provide high visibility and clear observation of police presence. BT can be also repressive; that is, they are used in settings and times where the highest number of drink-drivers are expected, such as outside drinking establishments. The aim of the preventive approach is to act as a deterrent by increasing an individual's perceived likelihood of being caught by BT; in contrast, the aim of the repressive approach is to increase the actual likelihood of getting caught (Vanlaar, 2008).

For countries where roadside BT is used, the extent it is utilised varies according to police resources, and thus some people may perceive the risk of being apprehended for drink driving as low (Moore et al., 1993; Vanlaar, 2008). Individuals most likely to believe this are males under 30 and young rural drivers. Strategies to avoid detection include travelling via backstreets, or on quiet streets late at night (Harrison and Pronk, 1998). Other individual level predictors include living in a low socio-economic area, being single or divorced, working in a blue-collar profession, and having little education (Harrison, 1998; Nickel, 1990; Peck et al., 1994). Alcohol dependency, binge drinking, frequency of drinking, having used

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or using illicit drugs, and feeling sad or lonely are also predictors (Macdonald and Dooley, 1993).

Internationally, a variety of strategies have been implemented in drinking establishments that have been demonstrated to reduce the proportion of alcohol impaired drivers. Responsible service of alcohol (RSA) training coupled with active management support has been shown to reduce the level of intoxication of patrons, and thus reduce the possibility of drink-driving (Shults et al., 2001). Similarly, enforced BAC levels, and lower BAC levels for novice drivers (Shults et al., 2001), sustained social marketing and community mobilisation (Elder, 2004; Shults et al., 2009) which includes large scale police enforcement, community announcements, and the regulation and monitoring of alcohol licences, can reduce the level of drink-driving in developed countries. However, in contrast, there is insufficient evidence to suggest that designated driver programs reduce the possibility of impaired driving (Ditter et al., 2005). Overall, the best interventions have been deemed to have multiple strategies, aim to reduce alcohol consumption, and engage stakeholders in a planned process to address the issue (Shults et al., 2009).

In Australia, the Good Sports program has been developed to reduce risky alcohol consumption and alcohol-impaired driving in community sports clubs. The program is structured around a three level accreditation program and provided free-of-charge. With the aid of a dedicated Project Officer and other physical resources (e.g. signage, kits) clubs are assisted to implement multiple strategies to reduce the supply, demand and harm of alcohol. Clubs implementing all strategies become a "Level 3" accredited Good Sports club (see Duff and Munro, 2007; Munro, 2000). (To avoid confusion with the "levels of data" described below, the accreditation levels will be referred to as Stages.)

Stage one focusses on the legal and responsible sale of alcohol. The second stage focusses on alternative food and drink options, and the provision of safe-transport strategies. Clubs must implement a minimum of two safe-transport strategies; but are encouraged to implement at least four strategies from a list of ten. The third stage focusses on policy development; ensuring that all alcohol management changes made by the club are enshrined in a regularly reviewed club policy and that there are practices to follow if club members do not abide by it. No similar program could be located anywhere else in the world.

Evaluations completed to date associate the Good Sports club with reduced alcohol use and harm. In a cross-sectional study, Stage two accredited clubs with ten safe-transport strategies were at reduced risk of drink-driving, compared to stage on accredited clubs with no strategies formally implemented as part of the Good sports Program (Rowland et al., 2012). However, no study has compared the prevalence of impaired driving by club members for all three stages of accreditation of the Good Sports program, with members from non-participating clubs. This study aimed to fill this gap in the literature.

It was hypothesised that individuals belonging to clubs participating in the Good Sports program would be at lower risk of drink driving compared to individuals in non-participating clubs. In assessing this hypothesis, three dose-response associations were examined. First, whether an increased level of accreditation was associated with reduced risk of drink-driving. Second, whether increased time in the program was associated with reduced risk of drink-driving. Third, whether the number of safe-transport strategies implemented was associated with a reduced risk of drink-driving. The hypotheses, and the three associations, were based on Behaviour Ecological Theory which argues that the environment is a key determinant of health behaviours (Hovell et al., 2002), and that the most effective interventions are usually those applied at several critical levels, in contrast to relying on a single strategy (McLeroy et al., 1988).

1. Method

1.1. Participants

All procedures were approved by the Monash University Standing Committee for Ethics Involving Humans. Cricket and Australian Football League (AFL) clubs from the Australian states of Victoria and South Australia in the Good Sports program were assigned an SES (socioeconomic status) index score (advantage/disadvantage) that corresponded to the postcode of the club's location. These scores were obtained from the Australian Bureau of Statistics (ABS) (ABS, 2006b). Databases for non-Good Sports clubs were secured from peak sporting bodies, and these clubs were also assigned an SES index. To avoid clubs with relatively small number of members only clubs with 50 or more members were invited to participate. Twenty-five percent of these clubs were randomly selected from each SES quartile. Table 1 outlines the club data, and Table 2 shows the details of the respondents.

Table 1
Club details.

Club details	Non (27)	Stage one (23)	Stage two (21)	Stage three (21)
Australian Football League (AFL)	22	13	15	12
Cricket	6	6	9	9
Victoria	20	14	24	21
South Australia	8	5	0	0
Major city	8	8	11	8
Inner regional	12	11	10	8
Outer regional/remote	8	0	3	5
Mean SES				
Advantage/disadvantage[a]	983.24	964.83	953.99	990.31
Total clubs	28	19	24	21

[a] Higher values designate higher SES.

Table 2
Individual demographic details.

	Non	Stage one	Stage two	Stage three
Participant details				
Age				
Range	18–91	18–74	18–80	18–83
Mean	33.95	33.59	35.65	34.12
SD	13.66	12.68	13.50	13.26
Income ($1000s)				
Range	0–165	0–175	0–175	0–140
Mean	39.52	41.18	42.00	43.14
Gender (% male)	78.63	83.96	74.65	78.19
Education (%)				
Year 9 or less	5.69	2.56	4.43	4.56
Year 10	10.28	8.63	13.47	13.42
Year 11	15.41	17.89	16.24	13.16
Apprenticeship	24.95	28.12	25.09	24.56
TAFE	11.38	9.90	10.15	10.38
Year 12	9.54	12.78	9.41	9.11
Uni. undergraduate	13.21	13.42	12.36	14.43
Uni. postgraduate	8.81	6.39	8.12	9.62
Other	1.00	0.32	0.74	0.76
Av. years of education	13	13	13	13
Occupation (%)				
Manager/administrator	23.48	26.10	33.20	27.94
Trade/labourer	42.05	42.03	34.94	36.29
Clerical	12.88	16.61	12.16	18.02
Not in workforce	21.59	15.25	19.69	17.75
Club involvement (%)				
Player	58.47	57.88	48.21	56.80
Supporter	32.88	28.48	40.17	40.10
N	590	330	585	419
Average *N* per club	21	17	24	20
Max *N* per club	42	39	50	42
Min *N* per club	1	1	10	6

A total of 92 clubs (1924 individuals) participated; at a club level, this represented a 54% response rate from Good Sports participating clubs and a 55% response rate from non-Good Sports clubs. Between accreditation stages, there were similar numbers of AFL clubs ($n = 62$) and cricket clubs ($n = 30$) ($\chi^2(3, N = 92) = 3.76$; $p > .05$); similar numbers of metropolitan clubs ($\chi^2(3, N = 92) = 1.08$; $p > .05$); and similar SES decile indexes ($\chi^2(27, N = 92) = 25.98$; $p > .05$). However, there were significantly more Victorian clubs ($\chi^2(3, N = 92) = 14.70$; $p < .05$), than South Australian clubs. There were also significant differences between stages and geographic location ($\chi^2(9, N = 1924) = 43.58$; $p = .000$), and significant differences between the SES index ($F(3,1892) = 37.26$; $p = .000$).

Club representatives were asked to select between 10 and 30 club members, with a maximum of 50. In clustered samples, where observations are not independent, a sample between 10 and 30 within each cluster has been judged to be the most efficient, and beyond 50 probably inefficient (Bickel, 2007; Blakely and Subramanian, 2006). Table 2 above presents the individual response rate, maximum, and minimum response rate at an individual level. The average number of surveys returned from clubs were 21, 17, 24, 20, for non-Good Sports clubs, stage one, stage two, and stage three clubs, respectively. For each survey returned, clubs were rewarded with an additional entry into a raffle of AU$2000. At an individual level, between stages, the differences between the age and income of respondents, and years of education, and whether a player, were not significant. There were, however, significantly different numbers of males ($\chi^2(3, N = 1865) = 10.47$; $p = .015$), and occupations ($\chi^2(1, N = 1724) = 5.68$; $p = .000$) between accreditation stage (Box 1).

Box 1: Policies and strategies underlying the accreditation stages of the Good Sports program.

Stage one;
- Clubs comply with states liquor licensing laws;
- At least one bar staff member on duty is trained in "responsible serving of alcohol" (RSA)
- Liquor is only served within specified hours
- People under 18 do not serve and are not served alcohol
- Drunk and intoxicated people not served or allowed to enter the premises

Stage two;
- Provision of low and non-alcoholic drinks;
- All bar staff members on duty are trained in RSA
- Bar staff do not consume alcohol on duty
- Club maintains an alcohol incident register
- Tap water is provided free of charge
- Substantial food options are made available when the bar is open for more than 90 min
- Clubs must implement one safe transport strategy. However, clubs are encouraged to implement at least 4 out of the following 10 strategies: (1) designated driver program; (2) key register; (3) taxi vouchers as prizes; (4) taxi numbers clearly displayed; (5) free call services for transport; (6) free club transport; (7) free non-alcoholic drinks for designated drivers; (8) free bar snacks for designated drivers; (9) free non-alcoholic drinks for designated drivers; (10) free bar-snacks for bar servers.
- Clubs do not conduct any of the following: happy hours; cheap drink promotions; drinking competitions; drink vouchers; all you can drink functions; and alcohol only awards or raffle prizes.
- All indoor areas are smoke free, and club does not sell cigarettes

Stage three;
- Club has a Good Sports written policy which addresses the following: bar management; responsible serving of alcohol; underage drinking; alcohol alternatives; food options; safe transport; smoke free; club trips; non-compliance; promotion of policy; and policy review.

2. Measurement

2.1. Alcohol consumption

All alcohol questions were framed around alcohol consumption at the sports club, and a definition of a standard drink preceded them. One Australian standard drink has 10gms of ethanol (NHMRC, 2009). Alcohol consumption was assessed using the graduated frequency index (GFI) (AIHW, 2005), and the 7-day diary (7DD) (White and Hayman, 2006); both these have been used extensively in Australian research (AIHW, 2002, 2005; White and Hayman, 2006; White et al., 2003, 2000); and are reliable and valid (Graham et al., 2004; Poikolainen et al., 2002).

The GFI is comprised of a series of questions requesting respondents to indicate how often alcohol is consumed (e.g. 1–2 days a week; once a month) and the amounts of alcohol (e.g. 5–6 standard drinks; 1–2 standard drinks) consumed in the last 12 months (Graham et al., 2004; Greenfield, 2000). Average amount of alcohol consumed over the 12-month period can be used to determine whether levels of alcohol use are in excess of Australian guidelines for long- and short-term risky drinking (NHMRC, 2009).

Short-term risky consumption per drinking day at club, as measured by the GFI, was used as a covariate in the regression analyses (see analytical strategy below). The 7-day diary (7DD) assessed how much alcohol individuals consumed for the seven days before the survey, and how long in hours per day they consumed alcohol. The 7DD was used to calculate BAC.

2.2. Blood alcohol content and drink driving

An approximate BAC was calculated as follows:

$$\text{Approximate BAC} = \frac{\text{grams ethanol} - 7 \times (\text{period of consumption in hours})}{\text{Widmark factor} \times \text{body weight(kg)} \times 10}$$

The approximate BAC formula measures proportion of alcohol per body mass. The Widmark factor represents the metabolic rate; 0.7 for men and 0.6 for women. The formula has been used in previous research to estimate BAC levels (Harding et al., 2001; Loxley et al., 1990; York et al., 2003), and is considered reliable (Breslin et al., 1997; Stowell and Stowell, 1998; Watson, 1989). Respondents were also asked which days they drove home from their clubs for the seven days immediately before the survey. Individuals with an estimated BAC over .05 who also drove their cars after drinking at the club on the same day, for any of 7 days prior to the survey, were categorised as drink-driving in the last week. Drink-driving in the last 7 days was the dependent variable in the regression analysis outlined below.

2.3. Independent variables

Accreditation stage was identified by official Good Sports records; these records are managed by the Good Sports national office in liaison with the club's dedicated project officer (see Duff and Munro, 2007). Accreditation was modelled as an ordinal variable (0 = non-Good Sports and 1–3 represented accreditation stage), as clubs must progress through the stages of accreditation in a particular order; however, accreditation was also modelled as a categorical variable with non-Good sports clubs as the referent. Time in the Good Sports program was taken from the official Good Sports

records and calculated in units of 6 months (one sporting season is approximately 6 months); non-Good Sports clubs were allocated zero for this variable. Socio-economic status (SES) indicators and location were drawn from the ABS database (ABS, 2006b).

Illicit drug use, relationship status, and demographic questions were taken from the Australian National Household survey (AIHW, 2007). Occupation was categorised into a binary variable indicating individuals in trade, labour or transport (blue-collar), and those who were not. Similarly, relationship status was a binary variable, indicating those in a relationship (e.g. married, de facto; partner), and those who were not. The depression, anxiety, and stress, scale (DASS) measured mental health. The DASS is a 42 item self-report questionnaire assessing depression, anxiety and stress (Lovibond and Lovibond, 1995). The Cronbach's alpha for the scales with the current sample were: stress: 0.89; anxiety: 0.77; and depression: 0.91. Responses were made on a 4-point Likert scale.

3. Analysis

The intraclass correlation (ICC) for drink driving on any day of the 7DD, on a club-by-club basis was 0.19 (95CI: .09–.35), significant at the 0.05 level (Acock, 2008); with an average of 20 participants per club this translated into a design effect of 4.61. This indicated a high degree of homogeneity within clubs for drink-driving, and that multilevel modelling (MLM) should be used to analyse the data (Bickel, 2007; Bryk and Raudenbush, 1992). The analysis was undertaken using Stata, version 11, and for all analyses the club-id was specified as a random effect.

The independent variables were organised into three levels. Level-one (individual) included risky alcohol consumption, individual demographics, whether the respondent was a player at the club, illicit drug use, depression, anxiety, and stress. Level two (club) variables were the club-id, State, type of sport (cricket or AFL football) and individual demographic covariates aggregated by club: average age of club member, average proportion of males per club, average alcohol consumption per club, accreditation stage, and time (units of 6 months) the club had been in the Good Sports program. Level three (community) were rural/metropolitan index of club location, and SES index of club location.

3.1. Analytical strategy

A three-part bottom-up analytical strategy was used (West et al., 2007). First, a null model (only a random intercept, varying by club) was analysed. Whether the random intercept varied further by third-level variables, was also examined. A null model provided a baseline variance enabling assessment of how much variables hierarchically added reduced the variance between clubs. Second, individual-level variables were entered into the model, and consideration of level one (individual) random effects was undertaken; non-significant predictors were removed from the model (model one). Third, club-level variables were entered, and second level random effects were considered; non-significant predictors were removed (model two). Finally, level three variables were entered and non-significant predictors were removed (model three). Interactions were examined across and within levels at each stage of the model building process.

Both accreditation stage, time (seasons in the program), and number of strategies were considered in the model building process. However, high correlations between these variables (>0.8, $p < .05$), precluded using them in the model simultaneously. In separate model building processes, accreditation stage, time in the program, and number of strategies were introduced into the analysis (using the analytical strategy described above). Accreditation, modelled as either an ordinal or categorical variable, and number of strategies were not significant predictors; however, time in the program was. Thus, time in the program is presented in the final model building results.

4. Results

BAC levels were highest on the playing day, Saturday; followed by training day, Thursday, when clubs train and usually nominate teams for the weekend game. There were no identified levels of drink-driving during the week in stage one clubs; similarly Thursday was the only weekday with identified levels of drink-driving for stage three clubs. Table 3 below indicates, for Saturdays and Thursdays, the average number of standard drinks, average time alcohol was consumed, and the approximate BAC of individuals for individuals in non-Good Sports clubs, stage one, stage two, and stage three clubs. On Saturday, the highest level of drink-driving was in non-Good Sports clubs.

Risky consumption (>4 standard drinks) per drinking day, was highest in non-Good Sports clubs, and lowest in stage-three accredited clubs: non (46%); stage one (41%); stage two (38%); stage three (31%). Table 4 presents the model building for any drink-driving in the previous week. Model one indicated that for each season a club was in the Good Sports program, the odds of an individual driving from the club whilst over the legal limit decreased by 8%. Increased age was associated with an increased chance of driving whilst over the legal limit. Similarly individuals drinking at levels placing them at short-term risk whilst at the club (OR: 3.32), or males (OR: 5.45) had higher odds of driving from the club over the legal limit. Mental health, illicit drug use, and relationship status were not significant predictors of drink-driving. Model one, with just individual level variables, explained 24% ((.78–.50)/.78)) of the variance between clubs.

Model two indicated that adding the contextual variables of "average number of individuals in blue-collar professions", and "average number of married people" substantially reduced the variance between clubs. As the average number of blue-collar individuals increased, so did the odds of drink-driving (OR: 12.89). Similarly, as the number of married people increased, odds of drink-driving rose (OR: 4.67).

Model two explained 72% ((.78–.22)/.78)) of the variance between clubs. Time in the Good Sports program remained a significant predictor with the contextual variables added; for every season (6 months) a club was in the Good Sports program a reduction of 8% in the odds of drink-driving was observed. Overall, model two was a significantly better fit than the null model ($\chi^2(9, N = 1777) = 89.47$; $p < 05$), and a Hausman test indicated the

Table 3
Alcohol consumed, time over which alcohol was consumed, BAC and drink-driving for respondents, broken down by accreditation stage.

Day	Drinks		Time (h)		BAC		Drink drove% (95CI)
	M	SD	*M*	SD	*M*	SD	
Non Good Sports							
Sat	3.72	5.41	2.25	2.87	.042	.072	3.22 (1.79, 4.64)
Thur	1.17	2.23	0.83	1.56	.013	.029	3.05 (1.66, 4.44)
Stage one							
Sat	3.32	4.96	2.26	2.89	.039	.064	2.42 (0.76, 4.09)
Thur	1.28	1.87	1.17	1.52	.013	.021	0
Stage two							
Sat	2.99	4.67	2.11	2.74	.032	.57	1.71 (0.66, 2.76)
Thur	1.33	2.94	1.03	1.51	.014	.027	3.08 (1.67, 4.48)
Stage three							
Sat	2.93	4.21	3.07	3.20	.031	.055	2.39 (0.92, 3.85)
Thur	1.26	1.26	1.49	1.84	.012	.023	1.43 (0.29, 2.57)

Note: M = mean; SD = standard deviation; BAC = blood alcohol content; 95CI = 95% confidence interval.

Table 4
Prediction of drink-driving in the week prior to the survey.

	Null	Model one		Model two	
		OR (95CI)	*P*	OR (95CI)	*P*
Time in GS	–	0.92 (.85, 1.00)	0.042	0.92 (.86, .99)	0.036
Risky		3.32 (2.05, 5.39)	0.000	3.36 (2.08, 5.44)	0.000
Age: 18–20		Referent		Referent	
Age: 21–30	–	5.34 (1.56, 18.33)	0.008	4.62 (1.36, 15.69)	0.014
Age: 31–40	–	7.02 (1.96, 25.09)	0.003	5.53. (1.56, 19.68)	0.008
Age: 41–50	–	11.11 (3.17, 38.93)	0.000	8.09 (2.31, 28.35)	0.001
Age: 51+	–	9.90 (2.72, 35.95)	0.000	7.57 (2.09, 27.42)	0.002
Male	–	5.45 (1.93, 15.35)	0.001	5.37 (1.91, 15.08)	0.001
Blue-collar	–			12.89 (2.54, 65.46)	0.002
Av_married	–			4.67 (1.22, 17.91)	0.024
N_1 (ind.)	1777	1777		1777	
N_2 (clubs)	92	92		92	
σ^2 between	.781	.504		.216	
df	2	9		11	
-LL	353.46	316.47		308.73	
AIC	710.93	650.94		639.45	
BIC	721.90	700.28		699.76	

-LL: -log likelihood; AIC: Akaike's information criteria; BIC: Bayesian information criteria; Ind.: individuals; σ^2: between: variance between clubs. Blue collar: works in blue collar profession (1 = yes; 0 = no); Av_married: the average number of married individuals in the club.

variance within clubs did not differ significantly between clubs ($\chi^2(6, N = 1777) = 4.79$; $p > 05$). None of the level three variables added to the model.

5. Discussion

This study supports the hypothesis that there would be a reduced risk of drink-driving for clubs participating in the Good Sports program. This relationship was found to be a function of how long (seasons in the program) a club was in the program; but was not as clearly related to accreditation level, or the number of safe transport strategies a club had implemented. Australian monitoring of drink driving in Australia suggests that approximately 1% of the population drive whilst impaired with alcohol (Wundersitz et al., 2007). With prevalence estimates on Saturday and Thursday of between 1% and 3%, there were higher rates of drink-driving in the community sports clubs surveyed in the present study than in the general community. However, this study suggests that over time, the Good Sports program may reduce these high rates of alcohol-impaired driving.

The association with the length of time a club has been in the Good Sports program and reduced drink-driving suggests drink-driving in community sports clubs may be more associated with the work the club achieves over time changing culture and overall reduction in alcohol consumption, and less related to achieving specific drink-driving strategies (stage 2) or policies (stage 3). This concurs with findings for broader community drink-driving interventions, which suggest that reducing drink-driving behaviours depends on a combination of sustained strategies, reinforcing messages, and lower alcohol consumption (Babor et al., 2010; Ditter et al., 2005). This is also consistent with Behaviour Ecological Theory which suggests that the combination of multiple strategies intervening consistently over a sustained period of time, are the most effective (Hovell et al., 2002; McLeroy et al., 1988).

The finding that the number of safe-transport strategies did not predict reduced drink-driving is inconsistent with an earlier study comparing drink-driving between individuals in stage-two and stage-one clubs (Rowland et al., 2011). Rowland, Toumbourou, et al. found that stage two accredited clubs with ten safe-transport strategies formally implemented were at reduced risk of drink-driving, compared to stage one accredited clubs. The findings were interpreted to suggest that the number and type of strategies were proxy measures of a clubs commitment to reducing drink-driving.

However, the earlier study did not compare drink-driving in stage three clubs, nor non-participating clubs. The current findings suggest that "time in the program" is a stronger proxy indicator for commitment and preparedness to change an alcohol culture, specifically drink-driving. This finding may be due to time in the program increasing the level of safe alcohol-related behaviour. Alternatively, clubs with higher levels of safe alcohol-related behaviour may have persisted with the program for longer periods. Good Sports official records indicate that approximately 20% of clubs that register for the program do not provide any further information about their club to the Good Sports Project Officer, and thus are withdrawn from the program (GS National Office, 2010). As only 20% of clubs drop out of the program, it is unlikely that differential club retention explained the association with drink-driving. Future research should nevertheless examine the profiles of clubs that are withdrawn from the program.

The finding that short-term risky drinkers at the club were 3.32 times more likely to drink-drive, compared to those who were not risky drinkers, is consistent with previous research. Whilst specific strategies can reduce drink-driving, one of the more efficient ways is by reducing overall consumption (McKnight and Voas, 2001; Shults et al., 2009). Previous studies have found Good Sports accreditation stage was associated with reduced risky consumption (Rowland et al., 2011), and thus consistent with the view that Good Sports clubs should have lower rates of drink-driving.

Consistent with previous research (Macdonald and Dooley, 1993; Nickel, 1990; Peck et al., 1994, 1995), the demographic variables age, gender, and occupation predicted drink-driving. These findings suggest that some demographic risk factors are common to both general community, and community sports club settings. However, given the higher rates of consumption in sports clubs than the general community, other environmental influences may also be associated with consumption and subsequent drink-driving behaviour in community sports clubs.

Inconsistent with previous research (Macdonald and Dooley, 1993), having used or using illicit drugs, and mental health measures were not predictors of drink-driving. Drug use may be less common in community sports clubs, compared to other settings, as clubs attract a diverse collection of individuals, including families and children (ABS, 2006a, 2007). Individuals in sports clubs may include relatively few that drink to manage mental health issues, but rather drinking may be related to social motives such as celebration of victory, and to build club camaraderie (Duff et al., 2005;

Long, 2008; Weitzman and Chen, 2005). These possibilities could be explored in future research.

This study has a number of limitations. First, the study is cross-sectional, thus it cannot be argued that the observation associating accreditation stage with lower drink driving is causally related. Second, alcohol consumption, and whether a respondent drove home are self-reported, so social-desirability and the Hawthorne Effect, are possible. Individuals were selected by club officials and there is a possibility that individual response rates are not representative at a club level. However, the high level of respondents for each stage mitigates this concern to some degree. Further, members belonging to longer-term Good Sports clubs, may be more aware of risky alcohol consumption levels, and thus may underreport consumption.

6. Implications for practice

Notwithstanding the limitations, this study has demonstrated an association between time in the Good Sports program and reduced drink-driving. Whilst the design does not permit strong causal interpretation, the associations are consistent with prior studies in being compatible with the Good Sports program's intended change goals. Consistent with stages of evaluation for large scale health promotion programs (Flay, 1986), the findings to date for the Good Sports program support the programs readiness for evaluation using randomised assignment and longitudinal follow-up. Given that substantial numbers of individuals participate in sports clubs throughout Australia and the world, the findings indicate the Good Sports program has potential to reduce injury and harm on the road, and subsequently save financial costs associated with drink-driving in the Australian and international community.

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Chapter 8: General Summary and Discussion

This thesis began with the premise that the consumption of alcohol has both long- and short-term health consequences when consumed at risky levels. Short-term consequences may include fatalities, physical injury or road accidents due to impaired cognitive performance and diminished reaction times (NHMRC, 2009). Long-term consequences may include alcohol-related diseases such as cirrhosis of the liver, stroke, hypertension, cardiovascular disease and an array of cancers (NHMRC, 2009). It also began by showing that a substantial proportion of the adult population in Australia (approximately 26%) are involved with organised community sport clubs, a setting where high levels of risky alcohol consumption occur.

With the knowledge that community sports clubs are settings for risky levels of alcohol consumption, the Good Sports programme was developed. The programme's over-riding aim is to implement multilevel systemic change within sports clubs intended to reduce the prevalence of alcohol-related problems. It does this through a three-stage accreditation programme. Clubs progress through the programme in a graded incremental fashion, by implementing policies and strategies, to reduce alcohol-related harm (Duff & Munro, 2007; Munro, 2000). As clubs are not-for-profit organisations, and serviced by volunteers, the programme is provided free of charge, and clubs progress through the stages of accreditation at their own pace (minimum of 2 years; maximum 5 years). This thesis examined the association of various measures of programme adoption on two outcomes—alcohol consumption and impaired driving (drink driving).

This thesis sought to complete a preliminary assessment of the programme. Four adoption studies were undertaken examining associations between a variety of programme measures and outcomes. Adoption studies are ideally suited to programmes that are heavily dependent on community engagement, and where experimental and random allocation to intervention groups is impractical or not feasible (Sanson-Fisher et al., 2007). Adoption studies also assist in the gradual establishment of evidence of large health-promotion programmes, as in cases where adoption studies evaluate programmes negatively, they guard against over investment, especially if a programme is poorly designed (Flay, 1986; Kirkwood et al., 1997; Sanson-Fisher et al., 2007). Positive associations between programme adoption and outcomes open the way for investment in research designs that can more definitively test causal impacts.

The results of the four studies are described in detail below and (taken together) have demonstrated lower rates of alcohol consumption associated with club accreditation stage, and lower rates of drink driving related to the clubs' length of time in the Good Sports programme. Overall, the findings suggested that the Goods Sports programme has potential to reduce alcohol-related harm for community sports clubs in Australia, and possibly in other English-speaking countries. An overview of the content of this thesis, key findings, implications, overall limitations, and future research follows.

Chapter 1 showed that alcohol-management strategies implemented in drinking establishments licensed to sell alcohol, such as public bars and hotels, was associated with reduced consumption and alcohol-related harm. These strategies are grounded in a philosophy of harm minimisation, and thus were organised into strategies that reduced supply through limiting availability and access; strategies that reduced demand through legislation; and strategies that reduced demand through laws and community mobilisation.

Drink-driving countermeasures were also shown to be associated with reduced levels of impaired driving, especially when the targeted group is engaged in the implementation of the strategies. The epidemiology and risk factors associated with alcohol consumption and drink driving were also presented in Chapter 1. It was argued that as health-promotion interventions targeting large populations are both expensive and logistically complex to implement, evaluations of these types of programmes should be undertaken incrementally.

Chapter 2 critically evaluated the four dominant health behaviour theories used in the health-promotion literature. These theories were: the HBM, the TRA and TPB, the TTM, and the SCT. It was noted that the TPB has evolved into a more advanced theory called the IBM. It was concluded that these theories have limited explanatory power, and that there is little evidence supporting their validity. While the more recent theories such as the SCT and the IBM emphasise the role of the environment on eliciting and maintaining health behaviours, it was underscored that more attention should be given to the impact of the environment on health behaviours.

Building on the advances in health behaviour theory, the work done in the areas of public health, epidemiology (i.e. social determinants of health, and determinants of drug and alcohol use), the principles of the Ottawa Charter, and philosophy of the extended mind, it was argued that the contribution of the environment should be given greater acknowledgement in health behaviour theory and research. Specifically, it was argued that while individual psychological constructs (e.g. self-efficacy; perceived control) did influence behaviour, targeting the environment was likely to be more effective, especially when trying to influence the behaviours of populations or large groups. At the same time, it was noted that behavioural influences can be conceptualised as occurring within a number of nested levels (e.g. individual influences; within intrapersonal, and environmental

influences), and the most effective interventions have multiple leverage points. These interventions were described as ecological.

Grounded in the evidence that community sports clubs are settings where harmful levels of consumption occur, and that strategies targeting the environment are associated with reduced consumption (as described in Chapter 1), the Good Sports programme was developed. Using the PRECEDE/PROCEED planning framework, the leverage points for the programme were identified. With social ecological theory, and the PRECEDE/PROCEED planning framework in mind, evaluation of the Good Sports programme was undertaken.

The statistical methods used to assess the impact of the evaluation were presented in Chapter 3. Multilevel modelling, a type of regression that accommodates the violation of the independence assumption produced by clustering within different levels of influence, was outlined. The theory, model-building process, and the fit statistics were all described. Examples of the mathematical notation, and mathematical theory were also presented. Chapters 4, 5, 6 and 7 reported the four studies that were undertaken.

8.1 Summary of the Findings of the Four Adoption Studies

The first two studies examined the potential for differences associated with the programme, by comparing clubs that had either reached stage-one or stage-two accreditation, in respect to risky alcohol consumption (study one) and drink driving (study two). As clubs are allowed up to five years to progress up to stage-three accreditation (Duff & Munro, 2007), there were few clubs at stage three when this PhD began. Thus, only clubs at stage-one and stage-two accreditation were used in the first two studies. However, in keeping with Flay's (1986) evaluation phases, it was argued that if sufficient evidence of change associated with the programme could be identified with these 'early adoption'

studies, further investment in evaluation of the programme could be justified. Thus, the first two studies also examined whether further investment in the evaluation of the programme could be warranted.

8.1.1 Alcohol consumption (study one and study three).

Study one, the comparison of alcohol consumption between members in clubs accredited at stage one, compared to consumption between members accredited at stage two, found significant differences in consumption on the day when teams competed (Saturday). Stage-two club members consumed 19% less alcohol, than stage-one club members. Further analysis also indicated that the length of time a club had been in the Good Sports programme was associated with reduced short-term risky drinking. Accreditation stage was associated with levels of long-term risky drinking by club members. However, while consumption rates were lower in stage-two clubs, consumption in both stage-one and stage-two clubs was still higher than in the general community (Rowland, Allen et al., 2011).

Study one showed that high rates of harmful alcohol consumption occurred in community sports clubs, and that implementation of the Good Sports accreditation strategy was associated with lower alcohol consumption, after controlling for a range of relevant predictors. However, the accreditation programme could not be fully assessed, as there was neither a control group, nor clubs that had achieved stage-three accreditation. However, there was a comparison group (stage one compared to stage two) and this was consistent with recommended designs for the early phases of the evaluation of community interventions (Flay, 1986). Other limitations were that only gender and age of club members were controlled for in the analysis, and that clubs volunteered to participate in the programme. It was possible that the effects associated with accreditation and time in the

programme may be partly or more strongly attributed to clubs self-selecting to be in the programme. Notwithstanding the noted limitations, the 19% reduction in risky drinking, between accreditation stages maintained after controlling for confounding variables was in line with the programme goals. The design limitations noted in study one were addressed in the data collection and analysis for the second round of data collection analysed in study three.

Study three examined alcohol consumption of individuals in stages one, two and three. It also examined alcohol consumption of individuals in clubs that were not participating in the programme. Including a comparison group provided a stronger design, thus enabling collection of stronger evidence on the impact of the Good Sports programme. Consistent with the study one findings, study three found a 22% reduction in the odds of risky alcohol consumption on the playing day with each successive increase in accreditation stage, when accreditation was treated as a continuous variable (non (0), 1, 2 & 3); a 15% reduction in odds, per accreditation stage for short-term risky drinking, and a 14% reduction in odds, per accreditation stage, for long-term risky drinking.

The results for short-term risky drinking on the playing day for study three resembled the results reported for risky drinking on the playing day in study one, which compared risky consumption between stage-one and stage-two clubs. Thus, study three offered evidence of replication and further confirmation of the association of lower alcohol use with the Good Sports programme. Overall, the findings of study one and study three revealed a consistent association between accreditation stage achieved as part of the Good Sports programme and lower levels of alcohol consumption. The overall results from studies one and three are consistent with the hypothesis that the Good Sports programme can reduce risky alcohol use at a population level.

8.1.2 Drink driving (study two and study four).

Studies two and four extended from studies one and three into an analysis of alcohol-related harms and specifically examined drink driving. The heaviest drinking days were both Thursday and Saturday. Study two found that the proportion of club members driving at least once in the previous week with a BAC estimate greater than 0.05 g per 100 ml of blood (g/dL)—the legal limit in Australia—was lower in clubs that had achieved stage-two Good Sports accreditation (7%, 95% Cl: 0.05–0.08) compared to those at stage one (8%; 95CI: 0.06–0.09), but this was not significantly different. However, the larger number of safe-transport strategies implemented as part of stage-two accreditation, was associated with a significantly lower probability of drink driving. Individuals in stage-two clubs with 10 drink-driving countermeasures formally implemented, were less likely to drink and drive compared to people in clubs with zero (level-one clubs) or less than 10 countermeasures formally in place.

Shults' (2009) conceptual model of how drink-driving programmes work was suggested as one possible interpretation of how the Good Sports programme may be associated with a reduction in drink driving. Shults' (2009) model suggests reductions in drink driving in the community are associated with the combination of community mobilisation, policy changes, changing of social norms, and reduction in overall alcohol consumption. It was suggested that the Good Sports programme had mobilised the club community and implemented policy changes, which subsequently influenced alcohol consumption and alcohol-impaired driving.

Overall, study two concluded that the Good Sports programme was associated with lower levels of drink driving. However, whether the observed change was due to the strategies or other factors such as sustained commitment to the programme (having 10 strategies may indicate this), could not be fully explored. Nevertheless, it was argued in the discussion that having 10 strategies in place may be a proxy measure for a club's commitment to responsible alcohol management and consumption. Taken as a whole, the study supported the hypothesis that Good Sports accredited clubs would be associated with lower drink driving. Study four followed up findings in study two by examining whether the associations were evident in a more complex adoption design comparing a no-intervention comparison and all three accreditation stages. Study four also examined the programme mechanisms that may be associated with reductions in drink driving.

Study four tested associations between participation in the Good Sports programme and rates of drink driving among club members in clubs from each accreditation stage (one, two and three) and clubs not participating in the Good Sports programme. Including a comparison group provided a stronger design, enabling collection of stronger evidence about the association of the programme with drink driving. The results indicated that neither accreditation stage nor number of strategies were significantly associated with drink driving; however, time in the programme was. For each season a club was in the programme, there was an 8% reduction in the odds of drink driving. The findings were inconsistent to some extent with the previous study's (study two) finding that having 10 drink-driving countermeasures predicted reduced odds of drink driving. However, the comparison in study four was different to study two and it had not been possible in study two to compare drink driving in stage-three clubs or non-participating clubs.

In the discussion of study four, it was suggested that time in the programme was possibly a stronger proxy for commitment and preparedness to change an alcohol culture, and specifically drink driving. However, a number of alternative interpretations could be made—specifically, that longer time in the programme could increase safe alcohol-related behaviour. Alternatively, clubs whose members typically showed safe alcohol-related behaviour may have persisted with the programme for a longer period. These counter-arguments were explored by examining Good Sports official records. It was found that approximately 20% of clubs that register for the programme provide no further information about their club to their project officer, and are withdrawn from the programme (Britt, 2009). Thus, there could be some accuracy to the latter interpretation of the results.

Despite the possible alternative interpretations, the evidence from studies two and four support an association with reduced drink driving and involvement with the Good Sports programme. Exactly how this is achieved is unclear. Nevertheless, the evidence from studies one and four suggests that further investment in evaluation is justified to establish in more detail the Good Sports programme's potential to reduce drink driving and therefore alcohol-related road-injury and harm in community sports clubs. The implications and the application of the findings of the four studies will now be discussed.

8.2 Implications and Applications of Findings to Practice

Overall, the differences in self reported alcohol-related behaviour between clubs in the accreditation stages and non-participating Good Sports clubs, gathered from the four studies, are substantial. Traditional experimental controlled trials, which focus on changes between individuals (e.g. drug trials and counselling interventions) consider a difference of a half of a standard deviation or a difference between 20% and 30% to be a medium size effect (Cohen, 1988). For the four studies reported, effect sizes in relation to alcohol

consumption ranged from 14% to 34%, and an 8% reduction per year in the programme for drink driving. While these studies do not demonstrate a cause-and-effect relationship between Good Sports accreditation and reduced alcohol-related behaviour, using the medium effect criterion, the findings are sizeable, and therefore, if the effects could be shown to be causally related to programme adoption, they would be important.

It has been argued earlier that methods used to assess and analyse individually focused interventions are not always directly transferable to community/population interventions. Using a similar logic, Fishbein (1996) argued that the traditional criterion for a medium effect of an individual intervention should be relaxed for public health interventions. He pointed out that in the commercial world, advertisers and manufacturers consider an increase in market share between 1% and 4%, to be highly successful because population changes of this scale translate into large numbers of individuals who have changed their behaviour. Fishbein argued that when examining interventions that target communities/populations, an effect size of 4% should be considered strong.

Fishbein's (1996) suggestion is consistent with Rose's (1992) second prevention axiom: a preventive measure that brings large benefits to a community may offer little to each participating individual. Rose (1992) suggested that even small changes at the individual level may bring about a large change within the broader community. Using Fishbein's (1996) criterion, and Rose's (1992) prevention axiom, the range of the effect sizes for the four studies of this PhD suggested that further evaluation of the Good Sports programme is justified given that the programme could reduce consumption within the community sports clubs setting, and the subsequent long- and short-term health consequences. Given that sports clubs are settings with a disproportionately high

prevalence of heavy alcohol users, such a reduction could substantially reduce the burden on the medical and health care system in Australia.

8.2.1 Risk and protective factors.

While the four studies did not demonstrate causation, they have identified individual and community risk and protective factors associated with harmful alcohol-related behaviour in this setting. These factors may be used to tailor and develop more effective prevention and health-promotion activities in this setting. Moreover, the drink-driving studies are the first ever to be undertaken in community sports clubs. Thus, they provide valuable insights and evidence into a behaviour with major costs and implications for the broader community. The implications and application of these risk and protective factors associated with risky drinking and drink driving in relation to practice will now be discussed.

The four studies reported have demonstrated that the high-risk days for alcohol consumption and related behaviour in community sports clubs are both Thursdays and Saturdays. Clubs can use this information to ensure that harm-reduction strategies are given greater focused attention on these days. This could be done through having more committee members present on these days and these members actively monitoring and enforcing harm-reduction strategies on these days. For example, committee members could actively monitor whether intoxicated individuals are allowed to enter the premises or continue to be served alcohol. Clubs could also put more resources into safe-transport options on Thursdays and Saturdays, thus possibly reducing the incidence of drink driving.

Enforcement agencies could also use this information to tailor both repressive and preventive drink-driving strategies (Vanlaar, 2008). For example, enforcement agencies could inform clubs in a given area that greater resources will be allocated to RBT on these

days; they could also place RBT stations close to community sports clubs on these days. Similarly, Liquor Licensing authorities could use this information to monitor whether clubs are adhering to liquor licensing laws. The collective effect of these practices would probably affect the level of alcohol consumption and drink driving in community sports clubs; it could also possibly enhance the Good Sports programme.

Age was consistently associated with risky drinking. The findings that young people consume alcohol at risky levels is consistent with the evidence presented in Chapter 1. However, the evidence that 'average older aged' clubs are also at risk is new evidence. There are a number of clubs in Australia that consist of older individuals. For example, a number of teams describing themselves as 'old boys teams' exist. These teams often consist of men who played competitive sport together when they were in their youth, and now play socially. Councils, club committee members and health-promotion workers can use this information to target health-promotion strategies with these types of clubs. It is possible that the older clubs are more resistant to change, and the adoption of low-risk drinking guidelines.

Age was also associated with alcohol-impaired driving. Older individuals were at increased risk of drink driving compared to individuals below 21. Individuals under the age of 21 being at reduced risk of drink driving is probably the product of restrictions on probationary drivers in Australia; that is, novice drivers may not drive with any alcohol in their blood (zero BAC). However, this description does not explain why there is an increased risk of drink driving until the age bracket of 41–50 years, whereafter the risk diminishes. The findings suggest that individuals who belong to clubs with predominantly older club members are also likely to have more members who drink drive more often than individuals who belong to clubs with predominantly younger members. Enforcement

agencies and clubs can use this information to target prevention strategies in areas where there are clubs with senior and mature aged members.

Education and occupation were associated with risky drinking and drink driving. This information can be used by local councils, law enforcement agencies, policy makers and funding agencies. Areas with low SES and education levels could be allocated a greater proportion of resources to implement harm-reduction strategies. This could be done through subsidising or funding of RSA training for bar staff. It could also be done through councils mandating clubs to implement a certain number of harm-reduction strategies, or accreditation in the Good Sports programme.

Individuals who belonged to clubs characterised by high levels of social capital were at increased risk of drinking at harmful levels. That is, individuals in clubs with high levels of socialising, sharing of meals, and volunteering were at increased risk of drinking at harmful levels. These findings suggest that members of clubs with more developed social rooms, where individuals can socialise for extended periods, and where they can dine, are at increased risk of drinking at harmful levels. Community sports clubs are an important part of a community's fabric and in bringing people together, but in using alcohol as a principal social lubricant, these settings may also increase the risk of alcohol-related harm in the community. These findings suggested that while clubs need to learn to manage and consume alcohol responsibly, they also need to develop strategies and activities that do not depend on alcohol consumption. Thus, reducing the long- and short-term consequences associated with consumption.

8.3 Implications and Applications of Findings to Theory

In relation to theory, the findings of this PhD demonstrate that environmental factors may play a substantial role in influencing behaviour. As identified in Chapter 2,

meta-analyses of studies using the dominant theories indicate that individual factors in these theories explain a maximum of 30% of the variance in individual behaviour. The statistical method used in this thesis was multilevel modelling and thus assessed changes at a group level, and in some cases also an individual level. For models with a continuous dependent variable, changes at an individual level could also be calculated. As most of the models analysed had dichotomous dependent variables, the variance at the individual level followed a Bernoulli distribution, and thus was fixed. However, the variance at the club level was not fixed and all the models that examined group-level variables substantially explained the variance between clubs.

For risky drinking, the variance explained between clubs was between 19% and 43%; the greater reductions being associated with long-term risky drinking. For alcohol-impaired driving (drink driving), the variance reduced (explained) between the groups was between 29% and 73%. While the models and analyses presented are not entirely the same as those used in analyses using traditional theories, the findings do lend strong support to the notion that environmental factors (namely those implemented through the Good Sports program) strongly influence behaviours of individuals, especially groups of individuals. These findings supported the IBM, which suggests that environment is a strong influencing factor on behaviour. They also supported Rose's (1992) notion that environmental strategies can be an effective way to change the behaviour of populations. Overall, the evidence of the four studies strongly supported the notion that environmental factors should be given greater consideration in future health-promotion work, especially when designing interventions in community sports clubs.

The findings also supported the idea that the most effective interventions have multiple leverage points and do not rely on one strategy (McLeroy et al., 1988). For the

two studies examining alcohol consumption, a dose-response association was observed. As accreditation stage increased, risky consumption decreased. While a direct causal association cannot be claimed, the findings are compatible with the intention of the Good Sports programme to reduce risky drinking. A dose-response was not found with levels of accreditation and alcohol-impaired driving. However, this may be because drink-driving behaviour may be harder to change, as it principally occurs outside the club setting. Thus, as study four identified, time in the programme and reducing overall alcohol consumption may be more strongly associated with alcohol-impaired driving.

8.4 Possible Areas of Programme Refinement of the Good Sports Programme

While the Good Sports programme fundamentally targets environmental influences, in keeping with an ecological approach and the PRECEDE/PROCEED planning model, the programme could be improved by incorporating factors associated with the individual. An ecological approach and the PRECEDE/PROCEED planning model suggest that individual and predisposing factors should be included in the design of strong interventions. To improve and enhance the Good Sports programme, it could target constructs such as personal agency (e.g. self-efficacy & perceived control), perceived norms, attitudes and beliefs. These are core constructs associated with SCT, the HBM and the TPB. Given that this PhD has found that a substantial proportion of the variance can be reduced when environmental strategies are implemented (while adjusting for general individual or demographic variables), it is possible that the Good Sports programme should also target some of the core constructs identified in the more common theories and known to be associated with health behaviours.

However, as identified in Chapter 2, when behaviour change needs to occur at a population level, targeting the individual can be costly and inefficient. Nevertheless, it is possible to target individual factors using a combined population and individual approach. For example, social marketing strategies that enhance knowledge about standard alcohol drinks, signs of intoxication, and consequences of short- and long-term risky drinking could be implemented at a policy or environmental level, as well as the individual level. The individual level could be targeted by the provision of general information/brochures about standard drinks and consequences of drinking. Similar strategies could be used to target values and attitudes, predisposing factors that have been identified to influence behaviour in the PRECEDE/PROCEED planning model.

In the PRECEDE/PROCEED framework, reinforcing factors are also critical influencing factors on individual and group behaviour. Thus, reinforcing factors could also be used to improve outcomes of the Good Sports programme. As suggested above, community sports clubs may use information about the heaviest drinking days to ensure that alcohol-management strategies are actively enforced on those days. To add to this strategy, committee members and others in leadership positions could be encouraged to model responsible drinking behaviour. Modelling behaviour by these individuals could improve the programme, as it would set a standard, and reinforce the behaviour of those already drinking responsibly.

Recently, the Australian Government provided funding and support for community sports clubs through its National Binge Drinking Strategy for a programme called ‘Club Champions’. This programme was designed to educate and support clubs in modelling healthy behaviour. While this programme will not be funded in perpetuity, this programme or a similar programme could add to the Good Sports programme. Other methods that

could help reinforce the programme would be having councils actively promoting responsible clubs through the media or offering clubs rebates such as reduced ground fees if they implemented alcohol-management strategies or became a Good Sports–accredited club. The media could also be encouraged to report responsible and family friendly clubs to reinforce responsible alcohol behaviour by clubs.

8.5 Limitations and Future Directions

Limitations of each study have been reported at the end of each separately and some of these have been repeated in this chapter. However, some limitations need to be considered when interpreting the results as a whole. First, while each of the four studies has demonstrated an association between some measures of Good Sports programme adoption and reductions in alcohol-related behaviour, none of the studies monitored the extent to which clubs accurately implemented or enforced Good Sports policies and practices. Process evaluations of the programme indicate that clubs generally report that, with help from their dedicated project officer, the implementation of the programme is not too difficult (Boot & Duff, 2003; Duff, 2002; Duff et al., 2003). Moreover, it is the role of the project officers and dedicated community partners to monitor clubs and ensure they adhere to the programme (Duff & Munro, 2007). Despite having these quality assurance measures in place, clubs' fidelity to the programme and accuracy of self-reporting cannot be guaranteed. Future efficacy, effectiveness and demonstration studies will need to ensure that process measures are gathered, monitored and analysed to maximise results for outcomes of the programme.

Self-reported alcohol consumption is a perennial limitation of all alcohol research. As a way of further examining the impact of the Good Sports programme on alcohol consumption, it may be beneficial to examine volume of alcohol sold per day (e.g. playing

day), per number of club members who bought alcohol that day. Both these statistics would be easy to collect and would provide a more accurate measure of alcohol consumption at a club level. These data would not indicate the proportion of individuals who are consuming at risky levels but they would indicate average club consumption. These measures could be combined to form an index of club consumption that could cross-validate self-report measures of alcohol consumption. For example, average alcohol consumption of individuals aggregated to the club level could be compared with average amount of alcohol sold per individual who purchased alcohol. This would test the accuracy of reported consumption.

The present study has not examined factors that may influence the sustainability of the Good Sports programme. Clubs rely on the revenue raised from the sale of alcohol (Duff & Munro, 2007; Snow & Munro, 2006). While the Good Sports programme tries to help clubs manage consumption alcohol responsibly, it needs to ensure that in doing this, it does not reduce overall income and viability of community sports clubs in the long term. Thus, for the Good Sports programme to be sustainable, clubs that embrace the programme need to acquire alternative revenue. If alternative revenue strategies are not given sufficient consideration, clubs may be unable to sustain alcohol-management strategies. Dependency on alcohol revenue for club sustainability therefore should be examined longitudinally in future research with Good Sports clubs.

This thesis has examined the most popular sports in Victoria and Australia—cricket and Australian rules football. Both these sports are played in all the states and territories of Australia (ABS, 2007a). However, other sports such as soccer, rugby union and rugby league are popular sports among Australian men. Conversely, sports actively pursued by Australian women include basketball, hockey, netball and tennis (ABS, 2010). Given the

range of sports played in Australia and the diversity of sports played either by men or women, the impact of the Good Sports programme on these sports should be examined in future research. Further, given that risky consumption of alcohol in Australia by females increasingly resembles risky consumption by males (AIHW, 2003, 2005, 2007; Averill & Power, 1995; Duff & Munro, 2007; Snow & Munro, 2006;), equal attention should be given to sports played predominantly by women.

Finally, differing state and territory policies may mean that the implementation and uptake of the Good Sports programme may vary between states. There is currently no national, uniform liquor licensing legislation; each state and territory has its own set of rules. This legislation defines how, where, when and to whom alcohol can be sold in each state. Similarly, there are inconsistencies between states in which bar staff are trained in RSA. Closely related to these issues is that in NSW, sports clubs are formally aligned with a licensed venue (e.g. a leagues club). These licensed venues sometimes sponsor sporting clubs and/or provide these clubs with alcohol and/or a place to consume alcohol. All these variations need to be considered when evaluating the programme in various states. Further, if the programme is implemented in other countries, it would also need to assess sports commonly played in those countries and examine whether there are different sporting and cultural effects associated with the impact of the programme.

8.6 Conclusion

Overall, this PhD has shown consistent and strong evidence for an association between various measures of the adoption of the Good Sports programme and lower levels of self-reported alcohol-related behaviour in community sports clubs—namely risky drinking and drink driving. As 26% of the Australian population (approximately 22.5 million) are involved with community sports clubs (ABS, 2010), the evidence reported in

this PhD strongly suggests that the Good Sports programme should be further evaluated for its potential to improve the health and quality of life for a substantial proportion of the population. Further, the evidence presented here has provided information about risk factors for risky drinking and drink driving; information that can be used immediately to monitor alcohol-related behaviour in community sports clubs.

The evidence of the four studies presented in this PhD does not demonstrate causality; however, overall, none of the evidence contradicts the possibility of a causal effect. In keeping with Flay's (1986) stages of evaluation for large-scale health-promotion interventions, the evidence presented is a signal to funding bodies to continue investing in the Good Sports programme, and a signal to research bodies to fund a higher level evaluation of the programme. The evidence presented here supports the theory that environmental strategies are associatedwith lower levels of harmful alcohol-related behaviour, especially in populations. It also supports the theory that multiple strategies are more effective than single or few strategies. It is therefore clear that an efficacy trial is justified, and should be the next stage of evaluation for the Good Sports programme.

Appendix A: Survey Instrument

The following is a copy of a plain language statement, and examples of questions used as part of the data collection process

MONASH University

ADF Australian Drug Foundation · preventing drug problems ·

Social capital, health and alcohol-related behaviours in sports clubs

The Australian Drug Foundation (ADF) regularly does research with sports clubs. Your club has been randomly selected to take part in a study examining social capital, health, and alcohol-related behaviour in sports clubs. The study is being collaboratively undertaken by the Australian Drug Foundation, and Monash University. The chief investigator is Associate Professor Felicity Allen and the Co-researcher is Mr Bosco Rowland. The project is part of Mr Bosco Rowland's PhD.

Your views are very important and will help us to understand the views and experiences of sporting club members in your region. We would be very grateful if you would spend 15-20 minutes completing this survey. **For each returned survey from your club, your club will be entered into a raffle for a $2000 cash prize (e.g. 30 completed surveys, 30 entries into the raffle).** The winning club will be notified by mail. Your sporting association will be asked to circulate the details of the winning club via their newsletter.

All surveys are anonymous. Please do not write your name or any other identifying information on your survey. The results of this survey may be published in reports and journal articles; but only group trends will be reported, and no identifying information about clubs or their members will be published. If this study suggests a club has high levels of risky behaviour, that club will be notified. No individual can be identified when clubs are notified of risky behaviours.

All data from this survey will be stored in a locked cabinet, and access to the data will be limited to the Principal Investigators and Research Assistant. After five years, the surveys themselves will be shredded. If you decide to withdraw, where possible, any information you have provided will be destroyed, and will not be included in the analysis.

Participation in this survey is voluntary. Your completion and return of your survey means you consent to participate. It is important that your answers are an honest reflection of your views, not what you think others might say. There are no right or wrong answers to any of the questions in this survey. To participate, please complete the attached questionnaire and place it in the envelope provided, seal the envelope, and place it in the sealed return-box at your club. **In order to participate in this survey, you must be aged 18 years or over**.

While it is not expected that you should become distressed while completing this survey, if you do some toll-free counselling numbers are shown below. Your club will be informed of the results of this survey, and will be encouraged to share this with members via club newsletters.

If you have any queries or would like to be informed of the research findings, please contact Mr Bosco Rowland at the Australian Drug Foundation on 9278 8110 (phone); or 9328 3008 (fax)

Should you have any complaint concerning the manner in which this research is being undertaken **(Project No. 2005/958EA)**, please do not hesitate to contact Monash University Standing Committee on Ethics in Research Involving Humans at the following address:

The Secretary
The Standing Committee on Ethics in Research Involving Humans
PO Box No 3A
Monash University
Victoria 3800
Telephone +61 3 9905 2052 Fax +61 3 9905 1420
Email: SCERH@adm.monash.edu.au

Toll-free Phone Counselling Services

1. **Direct Line (Drug and Alcohol Counselling and Referral Service): 1800 888 236 (free call)**
2. **Family Drug help (Helpline and support for families/friends of individuals who use drugs and alcohol): 1300 660 068 (toll-free)**
3. **Family drug support (information and support for families affected by alcohol and drugs 1300 368 186 (toll-free).**

The club

The following asks you questions about your level of participation and involvement with your club. Please try and answer the questions as accurately as possible. **Please circle the most appropriate response, 1, 2, 3, 4, 5, or 6.**

1.	Do you help out as a volunteer at your club?	No, not at all	1	2	3	4	5	Yes, often (at least once a week) 6
2.	Have you attended a club function in the plast 6 months?	No, not at all	1	2	3	4	5	Yes, several (at least 3) 6
3.	Are you an active member of your club? (For example are you happy to assist with club events or functions?)	No, not at all	1	2	3	4	5	Yes, very active 6
4.	Are you on a management or organising committee for your club?	No, not at all	1	2	3	4	5	Yes, several (at least 3) 6
5.	In the past 3 years, have you ever been asked to help in dealing with an issue at your club?	No, not at all	1	2	3	4	5	Yes, frequently (at least 5 times) 6
6.	In the past 3 years, have you ever taken part in a working bee at your club?	No, not at all	1	2	3	4	5	Yes, very much 6
7.	Have you ever been part of a project to organise a new service for your club (eg. starting up a new team, or developing a facility)?	No, not at all	1	2	3	4	5	Yes, several times (at least 3) 6
8.	Can you get help from club members when you need it?	No, not at all	1	2	3	4	5	Yes, definitely 6
9.	If you were caring for a child and needed to go out for a while, would you ask a club member to help?	No, not at all	1	2	3	4	5	Yes, definitely 6
10.	Have you visited a club member in the last week?	No, not at all	1	2	3	4	5	Yes, frequently 6
11.	When you go shopping in your local area, are you likely to run into club members?	No, not much	1	2	3	4	5	Yes, nearly always 6
12.	In the past 6 months, have you done a favour for a club member who was unwell?	No, not all	1	2	3	4	5	Yes, frequently (at least 5 times) 6
13.	Do you feel part of the club community?	No, not all	1	2	3	4	5	Yes, definitely 6
14.	Are your clubmates also your friends?	No, not all	1	2	3	4	5	Yes, definitely 6
15.	In a general sense, do you feel part of the broader club?	No, not all	1	2	3	4	5	Yes, definitely 6
16.	Have you ever picked up other people's rubbish at your club?	No, never	1	2	3	4	5	Yes, frequently 6
17.	Do you go outside your local community to visit other club members?	No, not much	1	2	3	4	5	Yes, nearly always 6
18.	If you needed information to make an important decision, would you approach another club member to help you find that information?	No, not at all	1	2	3	4	5	Yes, definitely 6
19.	If you disagree with what the majority of club members agree on, would you feel free to speak out?	No, not at all	1	2	3	4	5	Yes, definitely 6

20. If you have a serious dispute with a club member are you willing to seek help to sort this out?	No, not at all 1	2	3	4	5	Yes, definitely 6
21. At your club, do you take the initiative to do what needs to be done even if no-one asks you to?	No, not at all 1	2	3	4	5	Yes, definitely 6
22. In the past week at your club, have you helped out another club member, even though it was not officially your duty to do so?	No, not at all 1	2	3	4	5	Yes, several times (at least 5) 6
23. Do you feel physically safe at your club?	No, not much 1	2	3	4	5	Yes, very much 6
24. Do you agree that most people can be trusted at your club?	No, not much 1	2	3	4	5	Yes, very much 6
25. Does your club have a reputation for being physically safe?	No, not at all 1	2	3	4	5	Yes 6
26. In a broad sense, does your local club feel like a second home?	No, not at all 1	2	3	4	5	Yes, definitely 6
27. Do you feel your involvement in the club is valued by other club members?	No, not much 1	2	3	4	5	Yes, very much 6
28. Is the club an important part of your life?	No, not much 1	2	3	4	5	Yes, very much 6
29. Do you think that multiculturalism in your club makes it a better place?	No, not at all 1	2	3	4	5	Yes, definitely 6
30. Do you enjoy being part of a club that incorporates people of different lifestyles?	No, not at all 1	2	3	4	5	Yes, definitely 6
31. Over the week, do you choose to have dinner/lunch with particular club members?	No, not much 1	2	3	4	5	Yes, nearly always 6
32. In the past week, how many phone conversations have you had with other club members about anything related to the club (e.g. other members, activities, game, etc.)?	None 1	2	3	4	5	Many (at least 6) 6
33. How many club members did you talk to at the last club match/game?	None 1	2	3	4	5	Many (at least 10) 6

34a. Please write approximately how many club members you talked to at the last club match/game?

_____ (please write number)

34b. Please write approximately how many phone conversations you had in the past week with other club members about anything related to the club (e.g. other members, activities, game, etc.)?

_____ (please write number)

Your Health

36. What is your age in years?

_____ years

37. What is your height? *Please estimate your height if you are unsure*

_____ metres _____ cm	**OR**	_____ ft _____in

38. What is your weight? *Please estimate your weight if you are unsure*

_____ kg	**OR**	_____ stone

39. What is your gender?

Male	1	Female	2

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you ***over the past week.*** There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

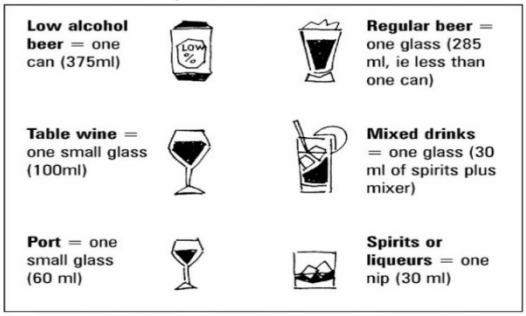
40. I found it hard to wind down	0	1	2	3
41. I was aware of dryness of my mouth	0	1	2	3
42. I couldn't seem to experience any positive feeling at all	0	1	2	3
43. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
44. I found it difficult to work up the initiative to do things	0	1	2	3
45. I tended to over-react to situations	0	1	2	3
46. I experienced trembling (eg, in the hands)	0	1	2	3
47. I felt that I was using a lot of nervous energy	0	1	2	3
48. I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
49. I felt that I had nothing to look forward to	0	1	2	3
50. I found myself getting agitated	0	1	2	3
51. I found it difficult to relax	0	1	2	3
52. I felt down-hearted and blue	0	1	2	3
53. I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
54. I felt I was close to panic	0	1	2	3
55. I was unable to become enthusiastic about anything	0	1	2	3
56. I felt I wasn't worth much as a person	0	1	2	3
57. I felt that I was rather touchy	0	1	2	3
58. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
59. I felt scared without any good reason	0	1	2	3
60. I felt that life was meaningless	0	1	2	3

Your Alcohol Consumption While at Your Club

These questions ask about your activities and behaviours **while you were at your sports club in the last 12 months**. This section is **not** concerned about what you have done while you have been away from the club during this period. Please bear this in mind when answering all the questions. There are no right or wrong answers, just what is applicable to you.

Please use the picture below to answer the following questions on alcohol

Examples of Standard Drinks:



**** Amounts of alcohol larger than those listed constitute more than one standard drink. Please consider this when answering the following questions on alcohol ****

61. How often **in the last 12 months** have you drunk the following amounts of alcohol **WHILST AT YOUR CLUB?** (Please circle one number for each row)

		Every day	5-6 days a week	3-4 days a week	1-2 days a week	2-3 days a month	About 1 day a month	Less often	Never
a)	**20 or more standard drinks a day?**	1	2	3	4	5	6	7	8
b)	**11-19 standard drinks a day?**	1	2	3	4	5	6	7	8
c)	**7-10 standard drinks a day?**	1	2	3	4	5	6	7	8
d)	**5-6 standard drinks a day?**	1	2	3	4	5	6	7	8
e)	**3-4 standard drinks a day?**	1	2	3	4	5	6	7	8
f)	**1-2 standard drinks a day?**	1	2	3	4	5	6	7	8

Please make sure you have circled only one number on each line of the above table.

61a. In the past 12 months, on typical occasions when you drank alcohol at your club, what is the average number of standard drinks you consumed?

_____ **standard drinks** (Please insert average number of standard drinks)

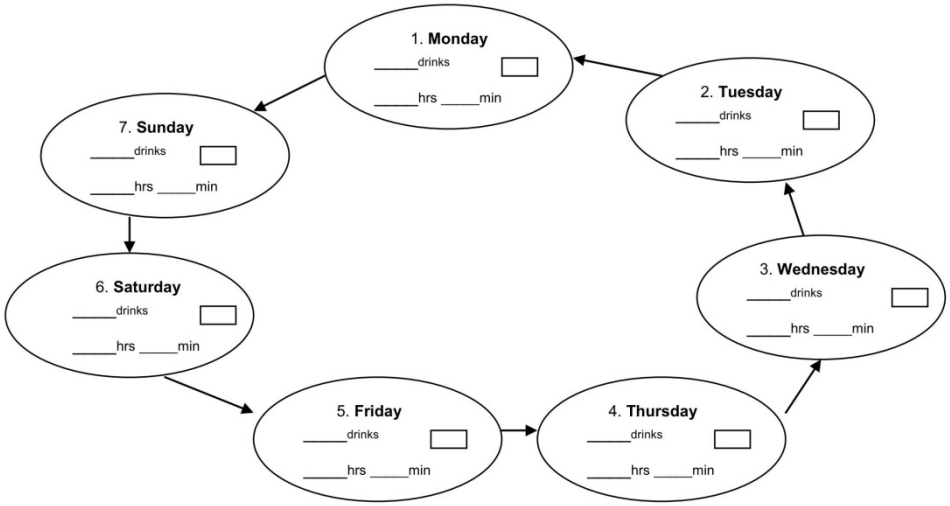
62. *This question involves a number of steps.* **Please follow the instructions below carefully.**

This question asks you about the number of standard drinks of alcohol you have drunk **AT YOUR CLUB** in the **LAST SEVEN DAYS**. It also asks **HOW MUCH TIME** you spent consuming alcohol at your club on these days.

You will need to think back over the past week to answer it.

a) First, **put a tick in the box** beside the day that was yesterday. When you complete the steps below, start filling out the spaces beginning with 'yesterday', and follow the arrows.
b) In the space provided in the circle, **write the number of standard drinks** you drank **AT THE CLUB** on that day (e.g. 7 drinks). If you didn't drink any alcohol, write '0' in all the spaces.
c) Please **write the length of time over which you consumed alcohol** on each day at the club (e.g. 3 hrs & 20 min.). If you did not drink any alcohol, write '0' in the appropriate spaces.

Please write an answer for every day of the week (tick the box for yesterday and estimate if you can't remember exactly how much).



63. Thinking again about the last seven days, did you drive home after consuming alcohol AT YOUR CLUB?

No	1	→ Go to Question 64
Yes	2	→ Continue at Question 63a.

63a. If Yes, which days did you drive home after consuming alcohol? (Please circle as many as apply, or circle N/A if not applicable)

a) N/A	b) Monday	c) Tuesday	d) Wednesday	e) Thursday	f) Friday	g) Saturday	h) Sunday
1	1	1	1	1	1	1	1

64. In the LAST 12 MONTHS, how many times have you been a designated driver for your club?

I don't drive	Never	Once	Twice (occasionally)	3 times (several times)	4-10 times (frequently)	11+ times (a lot)
0	1	2	3	4	5	6

65. In the last 12 months, if you have driven after drinking alcohol AT YOUR CLUB, how many 'standard' drinks (on average) would you have consumed? (Please circle only one number)

I never drive after drinking alcohol	1 s/drink	2 s/drinks	3 s/drinks	4 s/drinks	5 s/drinks	6 s/drinks	7 s/drinks	8 or more s/drinks

66. In the last 12 months, how often have you gotten drunk on alcohol AT YOUR CLUB and then driven a car? (Please circle only one number)

0 times	1-3 times	4-6 times	7-9 times	10 or more times
0	1	2	3	4

67. In the last 12 months, how often have you got drunk on alcohol AT YOUR CLUB and decided <u>not</u> to drive your car from the club? (Please circle only one number)

0 times	1-3 times	4-6 times	7-9 times	10 or more times
0	1	2	3	4

68. In the last 12 months, how often have you prevented someone who was drunk on alcohol from driving a car from your club? (Please circle only one number)

0 times	1-3 times	4-6 times	7-9 times	10 or more times
0	1	2	3	4

Alcohol-Related Consequences

69. **WHILST AT YOU SPORTING CLUB on how many occasions in the PAST 12 MONTHS did each of the following happen to you?** (Please circle one number for each statement)

In the past 12 months…		Never	Once	Occasionally	Several times	Frequently	A lot
a)	I was not able to remember what happened while drinking alcohol	0	1	2	3	4	5
b)	I got into an argument or fight because I was affected by alcohol	0	1	2	3	4	5
c)	I drank alcohol that affected my sporting performance	0	1	2	3	4	5
d)	I got into trouble with friends (they got annoyed with me) because I was affected by alcohol	0	1	2	3	4	5
e)	I got into trouble with my club because of drinking	0	1	2	3	4	5
f)	I had an injury because I had drunk too much alcohol	0	1	2	3	4	5

General Alcohol Consumption

70. The following questions are concerned about your general behaviour and the consequences of alcohol use in **every aspect of your life (e.g. at home, socially), not just at the club.** Please consider this when answering the following questions.

How often do you have a drink containing alcohol?

Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
0	1	2	3	4

72. **How many drinks containing alcohol do you have on a typical day when you are drinking?**

I do not drink	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
0	1	2	3	4	5

73. **How often do you have 6 or more drinks on one occasion?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

74. **How often during the last year have you found that you were not able to stop drinking once you had started?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

75. **How often during the last year have you failed to do what was normally expected from you because of drinking?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

76. **How often during the last year have you needed a drink first thing in the morning to get yourself going after a heavy drinking session?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

77. **How often during the last year have you had a feeling of guilt or remorse after drinking?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

78. **How often during the last year have you been unable to remember what happened the night before because you had been drinking?**

Never	Less than monthly	Monthly	Weekly	Daily or almost daily
0	1	2	3	4

79. **Have you or someone else been injured as a result of your drinking?**

No	Yes, but not in the last year	Yes, during the last year
0	1	2

80. **Has a relative, or friend, or a doctor, or other health worker been concerned about your drinking and suggest you cut down?**

No	Yes, but not in the last year	Yes, during the last year
0	1	2

81. **On average how many alcoholic drinks would you consume per day: _____ standard drinks.**

82. **On average how many alcoholic drinks would you consume per week: _____ standard drinks.**

83. In the last 12 months, how often did you use marijuana/cannabis?

Never	Everyday	Once a week or more	About once a month	Every few months	Once or twice a year
0	1	2	3	4	5

84. In the last 12 months, how often did you use OTHER illicit/illegal drugs?

Never	Everyday	Once a week or more	About once a month	Every few months	Once or twice a year
0	1	2	3	4	5

About you

85. What is your current occupation (please specify)?

_____

86. **Which of the following *BEST* describes your involvement at your club?** (You may tick more than one option)

Player	Supporter	Coach	Umpire/ Referee	Partner of player	Parent of player	Committee member	Other (please specify)
1	1	1	1	1	1	1	1

87. **How would you describe your current smoking status?** (please circle only one number)

I have never smoked cigarettes regularly	I am an ex-smoker	I currently smoke cigarettes once a week	I currently smoke cigarettes every day
1	2	3	4

88. In what competition / grade do you play/support?

Competition: _____ Grade: _____ N/A ☐

89. On what days do you TRAIN at your sporting club? (Please circle as many as apply)

a) Monday	b) Tuesday	c) Wednesday	d) Thursday	e) Friday	f) Saturday	g) Sunday
1	1	1	1	1	1	1

90. On what days do you PLAY/COMPETE at your sporting club? (Please circle as many as apply)

a) Monday	b) Tuesday	c) Wednesday	d) Thursday	e) Friday	f) Saturday	g) Sunday
1	1	1	1	1	1	1

91. What is the estimated distance from your home to your club?

I live _____ kilometres from my sporting club.

92. How do you usually travel from home to your sporting club? (please circle only one number)

Car (I am the driver)	Car (someone else drives)	Public Transport	Taxi	Motorcycle	Bicycle	Walk	Other (please specify)
1	2	3	4	5	6	7	8

93. **How do you usually travel from your sporting club to home?** (please circle only one number)

Car (I am the driver)	Car (someone else drives)	Public Transport	Taxi	Motorcycle	Bicycle	Walk	Other (please specify)
1	2	3	4	5	6	7	8

94. Which of the following best describes the highest level of education that you have completed (please only tick one box)

Year 9 or less	Year 10	Year 11	Year 12	Apprenticeship	TAFE College	University undergraduate	University postgraduate	Other (please specify _____
1	2	3	4	5	6	7	8	9

95. What is the postcode of the area in which you live?

96. What is your CURRENT marital status? (please circle only one number)

Married	Defacto or living with partner	Separated or divorced	Widowed	Never married or single	In a relationship but not living with partner
1	2	3	4	5	6

97. What is your CURRENT main work situation?

Working full time	Working part time	Casual employment	Household duties	Retired	Student	Looking for work	Other _____
1	2	3	4	5	6	7	8

98. What is your income, before tax, in the last financial year? If you are unsure, please estimate.

I earn _____dollars per year before tax (e.g. $47, 200 per year)

99. If applicable, what is the income of your partner, before tax, in the last financial year? If you are unsure, please estimate.

My partner earns _____ dollars per year before tax (e.g. $48, 500 per year)

100. **Do you have any children?**

Yes	No
1	2

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