The short and long-term consequences of adolescent alcohol use

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Key points:

1. Adolescent alcohol use is associated with a wide range of adverse short- and long-term outcomes, including increased likelihood of: accidents; risky sexual behaviour, sexually transmitted infections and pregnancy; sexual assault and violence victimisation and perpetration; obesity; and use of other substances.

2. Higher levels of alcohol use or alcohol abuse/dependence in adolescence are associated with more unfavourable outcomes.

3. Earlier onset of alcohol use is associated with increased risk of both short- and long-term adverse outcomes than later onset.

4. Several methodological considerations arise in the study of alcohol use in adolescence, including: ascertaining the extent to which alcohol use per se plays a causal role in outcomes; the accuracy of measurements concerning timing of onset of alcohol use; and characteristics of the sample being studied.

Introduction

In recent years there has been increasing concern about the short- and long-term effects of alcohol use amongst adolescents. In particular, there has been an increased focus on the effects of problematic drinking patterns, including binge drinking, amongst young people (Courtney and Polich 2009; Stolle, Sack et al. 2009). Studies have suggested that problematic drinking patterns such as binge drinking have been steadily increasing over a number of years in Western countries, and governments and health authorities in many locations have taken a variety of steps to address the public health threats posed by excessive alcohol intake (Courtney and Polich 2009; Stolle, Sack et al. 2009).
One particular aspect of this issue is the extent to which problematic drinking has special consequences for adolescents and young adults. It is clear that excessive alcohol use is a feature of adolescent and young adult behaviour in many Western societies (Jernigan 2001), and it has been argued that the consequences of excessive alcohol intake may be particularly severe when onset occurs during adolescence (Grant, Stinson et al. 2001). For example, chronic excessive alcohol intake may have greater effects on the brain development of adolescents, leading to increased risks of subsequent health and behavioural problems (De Bellis, Clark et al. 2000). (see Chapter 5)

A further feature is that adolescence is generally associated with increased risk-taking behaviour across a range of domains, irrespective of the effects of alcohol (Steinberg 2004). While excessive alcohol use may be viewed as one of several forms of risk-taking behaviour, it could also be argued that the normative increased risk-taking of adolescents is further exacerbated by the disinhibiting effects of alcohol (Spirito, Jelalian et al. 2000).

The purpose of the present chapter is to summarise the findings on alcohol use, particularly the effects of excessive or problematic alcohol use, on psychosocial outcomes amongst adolescents. This will be done through a review of the literature and by examining data from the Christchurch Health and Development Study (CHDS). The CHDS is a longitudinal study of a birth cohort of 1265 New Zealanders born in Christchurch in mid-1977 (Fergusson, Horwood et al. 1989; Fergusson and Horwood 2001). Data from the CHDS is of particular interest not only because of the prospective nature of the study, but also because the cohort is drawn from a Western country that is frequently considered to have a “drinking culture”, which encourages early and excessive alcohol consumption amongst young people (Alcohol Action NZ 2009). Finally, we will also examine methodological issues and briefly explore directions for future research.

**Accidents**
One of the primary dangers of alcohol use for adolescents is the risk of accidents. For example, in Australia between 2003 and 2006, of all alcohol-related deaths among 13-25 year olds, 60% were unintentional. Of these, 79% were due to motor vehicle accidents, and 9% due to alcohol poisoning (National Coroners Information System (NCIS) 2008). Numerous studies have shown that alcohol use, abuse and dependence amongst adolescents is associated with increased risk of a variety of accidents, including: pedestrian accidents (Istre, McCoy et al. 2007); falls (Lee 2008); drownings (Heninger and Hanzlick 2008); burns (Miller, Levy et al. 2006); crush injuries (Heather 1994; Miller, Levy et al. 2006); injuries sustained as a result of fights (Lee 2009); and other miscellaneous accidents (Heather 1994). However, the vast majority of research on alcohol-related accidents amongst adolescents concerns motor vehicle accidents (Bingham, Shope et al. 2009; Hingson and Zha 2009; Roudsari, Ramisetty-Mikler et al. 2009); estimates have suggested that alcohol can be attributed as a cause of such accidents in as many as 50% of cases (Hingson, Hereen et al. 2005).

Data from self-reports and simulation studies suggest that adolescent drivers are at greater risk of motor vehicle accidents than are drivers in any other age group (Clarke, Ward et al. 2005) for several reasons, including:

- greater risk-taking associated with the adolescent period of development (Clarke, Ward et al. 2005);
- insufficient levels of driving experience and skills (Clarke, Ward et al. 2005; Ferguson, Teoh et al. 2007);
- and insufficiently developed cognitive skills specific to driving (National Research Council Institute of Medicine and Transportation Research Board 2007; Dahl 2008).

These risks are compounded when adolescent drivers are under the influence of alcohol (Dahl 2008; Bingham, Shope et al. 2009; Zakletskaya, Mundt et al. 2009). Additionally, morbidity and mortality due to adolescent alcohol-impaired driving is greater than what would be predicted by an
additive effect of alcohol-impaired driving and adolescent driving ability and behaviour (Peck, Gebers et al. 2008).

Data from the CHDS also suggest that alcohol played a key role in increasing the risks of adolescents being involved in motor vehicle accidents. For example, Horwood and Fergusson (Horwood and Fergusson 2000) found that by age 21, rates of active motor vehicle collisions in which the driver could be held at fault were 2.5 times higher amongst those who scored in the highest 6% on a measure of alcohol-impaired driving than amongst those who reported no alcohol-impaired driving. Control for potentially confounding factors, including driver behaviour, attitudes toward driving, and a range of factors related to family background and individual characteristics and behaviour reduced the magnitude of the association, but it remained statistically significant. However, a further study of the same cohort (Fergusson, Horwood et al. 2008) that focussed in part on alcohol-impaired driving behaviour during the period 21-25 years found that while those who reported driving under the influence of alcohol more than 21 times were 1.94 times more likely to be involved in an active motor vehicle collision, this association was not statistically significant. That is, the strength of the statistical link between self-reported driving under the influence of alcohol and active motor vehicle collisions was too weak to be considered reliable. The reasons for this relatively weak finding may have been that: a) the overall rate of self-reported alcohol-impaired driving had decreased during the 21-25 years age period, in comparison to the period prior to age 21; for example, 53% of the sample reported no alcohol-impaired driving prior to age 21, whereas nearly 73% of the sample reported no alcohol-impaired driving during the period 21-25 years; and b) the overall rate of active motor vehicle collisions also decreased during the period 21-25 years, relative to the period prior to age 21. These data suggest that links between alcohol-impaired driving and active motor vehicle collisions may weaken as drivers become more mature and experienced, and in particular highlight the dangers faced by adolescent drivers who are alcohol-impaired.
Risky sexual behaviour, sexually transmitted infections and pregnancy

An important issue is the extent to which alcohol use may be associated with increased rates of risky sexual behaviour, exposure to sexually transmitted infections (STI), and pregnancy (Halpern-Felsher, Millstein et al. 1996; Cooper 2002). Research suggests that higher frequencies of alcohol consumption are associated with:

- increased risks of unprotected sex (Graves 1995);
- increased numbers of sexual partners (Gillmore, Butler et al. 1992; Santelli, Brener et al. 1998);
- increased rates of self-reported and medically-verified STI (Gillmore, Butler et al. 1992; Santelli, Brener et al. 1998);
- and increased risks of pregnancy (Gillmore, Butler et al. 1992; Naimi, Lipscomb et al. 2003).

In addition, higher frequency and greater levels of alcohol intake are also associated with increased risks of abortion amongst adolescent females (Prager, Steinauer et al. 2007).

There are two main explanations for the links between increasing levels of alcohol use and increased rates of risky sexual behaviour and consequences of risky sexual behaviour. First, the acute intoxicating effects of alcohol may increase impulsivity and cause disinhibition, altering normal patterns of sexual behaviour and contraceptive use (Parks, Hsieh et al. 2009). Alternatively, both higher alcohol intake and higher rates of risky sexual behaviour reflect a general underlying predisposition to engage in reckless, impulsive behaviour (Halpern-Felsher, Millstein et al. 1996), and it may be possible that a more general predisposition to recklessness explains the links between alcohol intake and risky sexual behaviour.
What is somewhat less clear, however, is the extent to which increasing levels of alcohol use may be related to the consequences of risky sexual behaviour amongst adolescents, and in particular pregnancy. While several studies have shown links between increasing alcohol use and increased risk of pregnancy, other studies have found that increasing alcohol use was associated with decreased risk of pregnancy, possibly due to alcohol’s interference with fertility (Jensen, Hjollund et al. 1998). This issue was examined recently using data from the CHDS, in order to determine the extent to which patterns of alcohol consumption were related to increased risks of pregnancy amongst female cohort members.

The CHDS has collected extensive data on sexual behaviour and pregnancy amongst female cohort members, and has examined the associations between alcohol consumption and rates of pregnancy (Fergusson, Boden et al. 2009). During the period 15-18 years, adolescent females reporting five or more symptoms of alcohol abuse/dependence had relative risks of pregnancy that were approximately 1.45 times higher than females who reported no symptoms of alcohol abuse/dependence, although this association was not statistically significant. One possible reason for this finding, however, is that contemporaneous measures of alcohol abuse/dependence symptoms and pregnancy may be sensitive to the fact that pregnancy tends to reduce or eliminate alcohol consumption by females, which could attenuate the observed associations. Indeed, using the same data on alcohol abuse/dependence symptoms in women, but instead using a lagged modelling approach in which alcohol problems in one time period were linked to pregnancy in the subsequent period, there was a significant (p < .01) association between alcohol abuse/dependence symptoms during the period 15-18 years and risks of pregnancy during the period 18-21 years. Those women reporting five or more symptoms of alcohol abuse/dependence during the period 15-18 years had relative risks of pregnancy during the period 18-21 years that were approximately 2.55 times higher than women who reported no symptoms of alcohol abuse. The discrepancies between the contemporaneous and time-lagged findings for women in the CHDS cohort highlight the
importance of methodological issues, and in particular the accurate modelling of the time-dynamic association between alcohol consumption and pregnancy, in the study of the associations between alcohol consumption and risky sexual behaviour/pregnancy.

** Violence and sexual assault **

Alcohol is commonly believed to play a major role in violent assault. For example, in England and Wales, it was reported that over half of victims of violence perpetrated by a stranger judged the attacker to be under the influence of alcohol (United Kingdom Home Office 2008). There is a very large literature on the links between alcohol and aggressive and violent behaviour, one strand of which shows that adolescents who report higher levels of drinking are also more likely to have been involved in an incident of violence (Jernigan 2001).

Amongst adolescents, at least 30% of violent assaults (Bureau of Justice Statistics 2009), and approximately 15%-20% of sexual assaults (Howard, Griffin et al. 2008; McCauley, Conoscenti et al. 2009) occur under the influence of alcohol, although, as noted below, the accurate assessment of these figures is difficult (Ingemann-Hansen, Sabroe et al. 2009). Evidence suggests that risks of violent and sexual assault victimisation and perpetration increase as the level of alcohol intake increases (Mohler-Kuo, Dowdall et al. 2004; Howard, Griffin et al. 2008). Furthermore, adolescents may be at particular risk due to a lower level of experience with alcohol intoxication (that is, adolescents may become more intoxicated more quickly than intended), but also due to their exposure to situations in which binge drinking is more common (Mohler-Kuo, Dowdall et al. 2004; Cashell-Smith, Connor et al. 2007).

Evidence also suggests that the nature of the violent or sexual assault tends to vary with the extent of intoxication, perhaps due to the disinhibiting effects of alcohol (Abbey, Clinton-Sherrod et al. 2003). For example, adolescent females are at particular risk for date rape, in which unwanted sexual contact occurs in the context of a date or other social activity and by a perpetrator known to
the victim; again, alcohol use by both the victim and perpetrator has been implicated as a causal factor in a large percentage of cases of date rape (Rickert and Wiemann 1998). McCauley and Calhoun suggest that female adolescents who binge drink may underestimate both their general risk of sexual assault, while overestimating the extent to which they may be able to fend off a sexual assault while intoxicated (McCauley and Calhoun 2008).

Having suffered a violent assault or sexual assault has been shown to have pervasive effects on psychosocial adjustment amongst adolescents and young adults (Beckman and Ackerman 1995). In particular, sexual assault has been shown to have pervasive and lingering negative effects on mental health and sexual functioning (Plichta and Falik 2001; Waldrop, Hanson et al. 2007), including increased risk of depression, anxiety disorder, eating disorder, and PTSD, and being at increased risk of intimate partner violence and relationship instability. In addition, alcohol use moderates the relationship between sexual assault victimisation and later re-victimisation (Gidycz, Loh et al. 2007). The experience of guilt that sometimes accompanies sexual assault victimisation (Olasov Rothbaum, Foa et al. 1992) may be stronger or more salient for those individuals who were intoxicated with alcohol at the time the sexual assault took place (Abbey 2002).

Despite these links, however, ascertaining the magnitude of the relationship between alcohol use amongst adolescents and increased risk of violent and sexual assault is a complex issue, for a number of reasons. First, while it is clear that alcohol is associated with increased risk of violent and sexual assault perpetration, it is very difficult to determine accurately the magnitude of this risk, due to issues of underreporting assault victimisation (Abbey 2002). The issue of underreporting is particularly acute in the case of sexual assault. Second, it appears to be common that both the perpetrator and the victim in violent and sexual assault incidents have drunk alcohol prior to the assault (Connor, You et al. 2009), making it difficult to determine the effects of alcohol on the behaviour of the perpetrator and the victim respectively.
Obesity

The study of the links between alcohol and obesity in adolescents has been motivated by the fact that adolescent obesity in Western societies has increased significantly in recent years (Hedley, Ogden et al. 2004), a period that has also seen a concomitant increase in binge drinking among adolescents (Farke and Anderson 2007). Also, longitudinal studies of adults have shown that long-term high levels of alcohol use are associated with increased risks of overweight and obesity (Rissanen, Heliovaara et al. 1991).

Adolescents who report higher levels of alcohol consumption, including binge drinking, are at greater risk of being overweight or obese (Must, Bandini et al. 2008; Croezen, Visscher et al. 2009; Fonseca, Matos et al. 2009), though there may be gender differences—in terms of the extent to which alcohol consumption is associated with obesity amongst adolescents— with males being at greater risk (Barry and Petry 2009). In addition, links between alcohol consumption and obesity may be long-lasting; those who report higher levels of alcohol consumption and binge drinking in adolescence were found to be at greater risk of obesity and related health problems in early adulthood (Oesterle, Hill et al. 2004).

It should also be noted, however, that some studies have shown the opposite effect, with obese adolescents, and in particular females, reporting lower alcohol consumption (Duncan, Grant et al. 2009). This may be due to the fact that obese adolescents may have fewer friendships and social contacts, partly as a result of social withdrawal associated with obesity, which may afford fewer opportunities for peer interaction, and less exposure to situations in which alcohol is consumed.

When interpreting these data it is important to note that many studies linking alcohol consumption to obesity in adolescents have not taken into account the wide range of potentially confounding
factors, such as socio-economic status, impulsivity, and mental health disorders that may be related to both alcohol use and obesity.

**Alcohol as a gateway substance**

Is alcohol a “gateway” drug in relation to other substances, including tobacco, cannabis and other illicit drugs (Wagner and Anthony 2002)? Briefly put, the gateway hypothesis supports the existence of a developmental sequence of substance use in which the initiation of a particular substance increases the risk that an individual will go on to use other substances (Kandel 2002).

In the case of alcohol, several studies have examined whether alcohol consumption increases the risk that adolescents will go on to use other substances. In general, there has been some empirical support for the linkages between alcohol use and later cannabis and other illicit drug use, with a range of studies finding evidence that alcohol precedes the use of other substances and increases the risk of the use of other substances, particularly cannabis and other illicit drugs (Kandel, Yamaguchi et al. 1992; Willner 2001; Wagner and Anthony 2002). However, the extent to which alcohol is the substance that is most likely to initiate the gateway transitions is unclear. Some studies have suggested that either alcohol or tobacco might serve as the initiating substance in the gateway progression (Kandel, Yamaguchi et al. 1992; Yu and Williford 1992), while others have asserted that tobacco plays a stronger role than alcohol in initiating gateway sequences (Blaze-Temple and Lo 1992; Parra-Medina, Talavera et al. 1995). Attempts to model the links between alcohol use and tobacco use, in order to determine which substance plays a stronger role in initiating the gateway sequence, have produced equivocal results, suggesting that alcohol and tobacco use may arise as a result of common, underlying factors associated with both forms of substance use (Ritchey, Reid et al. 2001).
One important methodological issue arising from gateway drug studies is the fact that it is difficult to accurately ascertain the timing of onset of the use of various substances (Kandel 2002). In general, prospectively-collected longitudinal data provide the most reliable measurement of data concerning the timing of onset of various forms of substance use, provided that participants are followed up frequently enough to ensure that data concerning onset and frequency of use are accurate.

**Age of onset of use and consequences**

A further issue of interest is the extent to which consequences of alcohol use vary by the age at which the individual begins using alcohol, such that the initiation of alcohol use at earlier ages, or heavier levels of use during adolescence, may increase the risk of negative consequences. The accumulated evidence suggests that there is indeed a strong link between the age of onset of use and later consequences; earlier use of alcohol has been linked to an increased risk of a range of adverse outcomes. The most prominent being subsequent alcohol abuse/dependence; numerous studies have shown that those who begin using alcohol at earlier are at increased risk of alcohol abuse/dependence in adolescence and early adulthood, and of lifetime alcohol abuse/dependence (Gruber, DiClemente et al. 1996; Guo, Collins et al. 2000; Grant, Stinson et al. 2001). Furthermore, heavier levels of alcohol use at an earlier age are associated with more severe levels of alcohol problems in late adolescence and early adulthood (Bonomo, Bowes et al. 2004; McCarty, Ebel et al. 2004). Earlier initiation of use is also associated with increased risk of other adverse outcomes, including unintentional injury; alcohol-impaired driving; illicit drug use; mental health disorders; and convictions among others (Zakrajsek and Shope 2006; Viner and Taylor 2007).

One question that arises in examining the links between early onset of alcohol use and subsequent problems is the extent to which the adverse outcomes are causally related to the consumption of alcohol at an early age, or are more generally related to impulsive or reckless behaviour related to
both early alcohol consumption and later adverse life outcomes. Indeed, there has been some evidence that the links between early alcohol use and later outcomes may be attributable at least in part to an underlying “problem behaviours” factor (Warner and White 2003; Dubow, Boxer et al. 2008). However, a number of studies have shown that the links between early alcohol use and later adverse consequences persist even after controlling for a range of confounding factors, suggesting that the early use of alcohol may play a specific causal role in later problems (Grant, Stinson et al. 2001; Bonomo, Bowes et al. 2004; Viner and Taylor 2007).

Data from the CHDS have been used to examine the links between age of onset of alcohol use and patterns of alcohol consumption in earlier adolescence (Fergusson, Lynskey et al. 1994). In late childhood and early adolescence (ages 11-13), cohort members were asked to indicate the age at which they had first consumed alcohol. Amongst those who reported having used alcohol, the majority (67%) reported first using alcohol during the period 6-10 years of age. The findings suggested that, after adjustment for confounding factors related to family background and functioning, those who first consumed alcohol during the pre-school years (up to age 6) had odds of heavy, frequent, or problem drinking by age 15 that were 1.9 to 2.4 times higher than those who did not drink alcohol before the age of 13. The findings suggest that those who were raised in home environments with more permissive attitudes toward alcohol use, and who were exposed to alcohol at an earlier age, were at greater risk of developing problematic alcohol consumption patterns in mid-adolescence.

**Discussion and Conclusions**

While many questions remain, there are growing data showing that alcohol use in adolescence and early adulthood has considerable health and social consequences over and above those that would be expected. This can be summarised as follows:
1. Adolescent alcohol use is associated with a wide range of adverse outcomes, including: motor vehicle and other accidents; risky sexual behaviour, pregnancy, and STIs; victimisation by and perpetration of violent and sexual assault; obesity; and increased risk of the use of other substances;

2. There is a dose-response relationship between alcohol use and outcomes, such that higher levels of use are associated with greater severity of outcomes;

3. The increased risk of adverse outcomes is not limited to adolescence, but continues into adulthood;

4. Earlier onset of alcohol use is associated with greater levels of subsequent problems associated with alcohol use.

The weight of the evidence clearly shows that adolescent alcohol use is associated with a wide range of adverse outcomes in both the short- and long-term, and underscores the urgent need for the development and implementation of programmes designed to reduce adolescent alcohol use (Hingson, Assailly et al. 2004).

One of the difficulties in programme development and implementation is having a sufficient evidence base to underpin recommendations (Room, Graham et al. 2003). In general, in order to develop appropriate and cost effective interventions, it is necessary to have a strong understanding of the causal mechanisms underlying the associations between exposures and outcomes.

Unfortunately, the literature concerning alcohol use in adolescence, including some of the literature cited previously, is subject to a number of threats to validity that create difficulties in ascertaining the strength and direction of causal mechanisms. One key threat to validity is determining the extent to which the associations between alcohol use and outcomes can be accounted for by third or confounding factors. Some studies have, for example, provided evidence that at least some of the associations between adolescent alcohol use and later outcomes can be accounted for by common,
underlying factors, such as a general predisposition to problem behaviour. However, there has also been evidence to suggest that, after controlling for these factors, there remain persistent statistically significant links between adolescent alcohol use and later adverse outcomes. A second threat to validity is ascertaining the direction of causality. It could be argued that alcohol use and outcomes are linked in a reciprocal manner, such that alcohol use amongst adolescents increases the risk of adverse outcomes, and that increasing levels of adverse outcomes increase the level of alcohol use. A third threat to validity pertains to the timing of measurements in longitudinal studies. As noted above, evidence from the CHDS concerning the link between alcohol use and pregnancy, for example, suggests that the timing of questions regarding exposure and outcome, particularly when measured contemporaneously, may play a critical role in the estimation and interpretation of the associations between alcohol use and outcomes. Similarly, studies examining the gateway theory in regard to alcohol use may show inconclusive results due to the difficulty of measuring alcohol and tobacco use in children and adolescents, particularly in terms of determining the timing at which the use of each substance began. A final threat to validity is that many of the existing findings concerning alcohol use in adolescents have been derived from data obtained from clinical samples or special populations. Each of these threats to validity can be addressed via the use of prospective longitudinal data, obtained from representative birth cohorts, that includes repeated measures of exposure (alcohol use and related problems) and outcomes over time.

In addition, while the links between alcohol use in adolescence and later alcohol disorders has been extensively studied, the links between alcohol use in adolescence and other long-term outcomes is less well understood. In particular, it is unclear whether the links between adolescent alcohol consumption and later outcomes reflects processes in which these links may be mediated by the effect of early alcohol use on later alcohol use/alcohol disorders. Again, further research using prospective longitudinal data is required to ascertain the nature of these links.
While additional research is needed to elucidate the links between alcohol use and adverse outcomes amongst adolescents, it is clear that public policy concerning alcohol use by young people requires further development. In order to reduce the level of adolescent alcohol use, and to weaken the links between alcohol use and adverse outcomes, policies and programmes are required that will reduce the overall level of exposure to alcohol amongst adolescents, and that will reduce the level of harm amongst those adolescents already exposed to alcohol. While a number of different initiatives have been developed and implemented (Newton, Vogl et al. 2009; Stolle, Sack et al. 2009; Vogl, Teesson et al. 2009; Wenzel, Weichold et al. 2009), the high rates of alcohol use and associated adverse consequences amongst young people in western societies such as Australia and New Zealand suggest that a great deal of additional work is needed.

Future research on alcohol use amongst adolescents will need to focus on several key themes. These themes include:

- Strengthening the knowledge base concerning the casual links between alcohol use and adverse outcomes;
- Ascertaining the extent to which long-term risks of adverse outcomes are due to processes that link early alcohol use to increased risks of subsequent alcohol misuse;
- Empirical examination of the effects of various programmes and interventions that may be implemented to reduce adolescent alcohol use.

In summary, it is clear that adolescent alcohol use and its effects are a significant public health problem for western societies in the 21st century, with adverse effects occurring across a wide range of outcomes, and ranging from short- to long-term. Although there is already a considerable knowledge base concerning these issues, more focussed efforts are required in order to reduce the overall level of alcohol-related harm to the population that stems from adolescent alcohol use.


The Christchurch Child Development Study is a longitudinal study of a birth cohort of 1265 New Zealand children who have been studied over an 11-year period using data from multiple sources including parental interview, medical records, teacher questionnaires and direct testing of children. The article provides a review of the major lines of epidemiological research examined in the Study. These include: breast feeding and child health; parental smoking and child health; the effects of low level lead exposure; childhood asthma; nocturnal bladder control; the effects of early hospital admission; the distribution of child health services; and the consequences of private medical insurance. In addition a number of general topics (sample attrition, measurement error, individual differences and causal inference) relating to longitudinal designs are discussed briefly. It is concluded that the longitudinal design is a powerful and cost-effective method of gathering data for general paediatric epidemiological purposes but that research in this area would benefit from an increased use of emerging methods of statistical modelling. [References: 124]


This paper examines the relationships between age at first exposure to alcohol and four measures of drinking behaviour (frequency of drinking, typical and most amount consumed, alcohol-related problems) at age 15 years in a birth cohort of New Zealand children. There were small but consistent correlations (r = -0.10 to -0.16) between self-reported age at first
exposure to alcohol and the four measures of alcohol consumption. These associations remained statistically significant (p < 0.05) after control for a wide range of potentially confounding covariates including measures of family socio-demographic background, parental alcohol use and attitudes to alcohol use and early childhood behaviour. After control for these factors, children who had been introduced to alcohol before the age of 6 years were 1.9 to 2.4 times more likely to report frequent, heavy or problem drinking at age 15 years than children who did not drink alcohol before the age of 13. It is concluded that young people reared in home environments that have permissive attitudes to alcohol use and who are introduced to alcohol at an earlier age may be more vulnerable to alcohol-related problems in adolescence.


