Adolescent Risk-Taking: Peer Presence and the Validity of a Laboratory-Based Measure

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Abstract

From a public health perspective, adolescence is a very risky period of development. Morbidity and mortality rates double during adolescence (Dahl, 2004); this increase is due primarily to changes in behaviour. In particular, adolescents are more likely than adults to engage in dangerous driving, unprotected sex, excessive alcohol consumption, drug taking, delinquency, and other high-risk behaviours. What is it about the adolescent period that makes people take more risks? Some researchers have hypothesised that changes in the adolescent brain contribute to the incidence of risky behaviour. Other researchers have developed psychosocial models to explain adolescent risk-taking, including examining the roles of personality and peer influence on adolescent risk-taking. The overarching goal of the present thesis was to further explore the effect of peer presence on risk taking measured using a laboratory-based task, Chicken. To do this, we recruited adolescent (12 – 16 year olds) and adult (23 – 49 year olds) participants to bring two same-age, same-sex friends in with them to the laboratory to play Chicken. Our results showed no significant difference between adolescent and adult risk scores when playing the Chicken game in front of their peers. Our Chicken data were highly consistent with Gardner and Steinberg’s (2005) data for their White (Caucasian) samples. Additionally, we found significant age- and sex-related differences on real-life risk behaviour as measured on the Life Experiences Questionnaires. Adults had higher LEQ scores than did adolescents; there was also a significant interaction whereby adolescent females scored higher than adolescent males, but this trend was reversed for adults. Our results are discussed with a view to questioning the validity of Chicken and identifying a potential downward trend in adolescent risk taking.
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From a public health perspective, adolescence is a very risky period of development. Morbidity and mortality rates double during adolescence (Dahl, 2004); this increase is due primarily to changes in behaviour. In particular, adolescents are more likely than adults to engage in dangerous driving, unprotected sex, excessive alcohol consumption, drug taking, delinquency, and other high-risk behaviours. For example, in 2008, New Zealand drivers who were 25 years old and younger were involved in approximately 37% of all fatal road crashes (Ministry of Transport, 2009), despite comprising only 16% of all licensed drivers. Young drivers were also involved in 38% of all serious injury crashes, over-representing this age group in crash statistics. Road crashes are consistently the leading cause of injury and death among New Zealand adolescents (Drummond & Bowler, 1998; Kypri, Chalmers, & Langley, 2002).

In addition to dangerous driving, New Zealand adolescents also engage in other forms of risky behaviour, including risky sexual behaviour. For example, although the legal age of consent in New Zealand is 16, it has been estimated that 43.1% of males and 36.4% of females have sexual intercourse before their 16th birthday (Fenwicke & Purdie, 2000). New Zealand continues to have one of the highest adolescent pregnancy rates in the developed world, regardless of an overall drop in birth rates (Dickson, Sporle, Rimene, & Paul, 2000). According to the Christchurch Health and Development Study, by age 21, more than a quarter of all women studied had been pregnant at least once (Woodward, Horwood, & Fergusson, 2001).

New Zealand adolescents also report excessive alcohol consumption which frequently coincides with other dangerous risk behaviour. According to the Youth’07: The Health and Wellbeing of Secondary School Students in New Zealand Technical Report (Adolescent Health Research Group, 2008) 61% of surveyed high-school students currently
consumed alcohol with 69% of those students drinking three or more drinks in a usual session. Using the Alcohol Use Disorders Identification Test (AUDIT; World Health Organisation, 1992), one in four New Zealanders aged 16-17 years had potentially hazardous drinking patterns in 2007/8 (Ministry of Health, 2009). Alcohol consumption during adolescence is also associated with other risky behaviours. For example, according to the Youth’07 Report, adolescents who reported current alcohol consumption also reported having sex without a condom (14%), having unwanted sex (7%), and injuring themselves (22%), while drinking (Adolescent Health Research Group, 2008).

Although many individuals escape this period of risk-taking relatively unscathed, for others, engaging in risky behaviours during adolescence can have lifelong consequences. For example, most adult smokers start smoking and become addicted during their adolescent years (U.S. Department of Health and Human Services, 1994). Similarly, early onset of drug and alcohol use is the biggest predictor of future drug problems (Grant & Dawson, 1997). Research from the Dunedin Multidisciplinary Study has shown a link between persistent marijuana smoking initiated during adolescence and lifelong decreases in IQ (Meier et al., 2012). Finally, unplanned pregnancies and criminal behaviour in adolescence have detrimental consequences that span multiple generations and come at a high social cost (Child and Youth Mortality Review Committee, 2009).

The World Health Organisation defines adolescence as the period between 10-19 years of age (World Health Organisation, 2006). Around one fifth of the world population is 10-19 years old and, as such, has an increased rate of morbidity and mortality. Most risk behaviour emerges, then peaks around 17 years of age, and subsequently disappears (Moffitt, 1993). Why is this the case? What is it about the adolescent period that makes
people take more risks? One possibility has been linked to age-related changes in their brain.

Significant and dramatic brain development occurs throughout adolescence (Dahl, 2004; Spear, 2000). This development is characterised by both the establishment of new synaptic connections as well as the pruning of existing connections, ultimately refining brain structures. The brain areas that are affected most in adolescence include the prefrontal cortex, dopamine systems, and the limbic brain areas (Spear, 2000). The prefrontal cortex not only undergoes many significant changes including changes in density and functional connectivity through establishing and pruning connections, but structural connectivity changes also strengthen links to other brain areas.

How might changes in the brain lead to an increase in risky behaviour? The prefrontal cortex, which is maturing rapidly during adolescence and early adulthood, is an area of the brain involved in decision making (Crone & Van der Molen, 2004). Neuroimaging studies have indicated that prefrontal cortex activation occurs during decision making, particularly during decisions where individuals are uncertain. Furthermore, researchers have reported that adults with ventromedial prefrontal cortex lesions make poor real-life decisions, seemingly ignoring future consequences (Bechara, Damasio, Damasio, & Anderson, 1994). Given that damage to this area of the brain interferes with decision making, many have hypothesised that the immaturity of the prefrontal cortex during adolescence and early adulthood may increase risky behaviour by increasing poor decision-making.

Although there is ample evidence for developmental differences in decision making under real-world conditions, these differences also need to be verified through controlled laboratory experiments to quantify any significant impact of prefrontal lobe development
on risk-taking behaviours. In one line of research, decision-making differences have been quantified in the laboratory using the Iowa Gambling Task (IGT; Bechara et al., 1994). The IGT was designed to mimic real-life decision making by including salient consequences for a given decision. The IGT requires individuals to continually select cards from four decks. Individuals can select a card from any deck in any order. Some decks have large, usually monetary, rewards but they also have higher losses. These decks are disadvantageous overall because individuals end up with less reward. Other decks have low rewards but smaller losses leading to a net gain overall. The reward structure for each deck is not explicitly stated, so participants must learn over time what the different payoff schedules are and adjust their deck choice accordingly. Normal adults intuitively begin to select primarily from the low reward decks over time, avoiding the high punishment decks to improve their score. Adults with ventromedial prefrontal cortex lesions, on the other hand, continue to select cards from the large reward and large punishment decks, leaving them with a lower overall score. The IGT differentiates between decisions based on immediate rewards (choosing large reward decks despite future high losses) and decisions based on future consequences (choosing small rewards and avoiding the large penalty decks). Participants with damage to the ventromedial prefrontal cortex typically achieve low scores on the IGT, indicating poor decision-making based on immediate rewards (Bechara et al., 1994).

Given that prefrontal cortex damage in adults leads to poor decision-making, does the immaturity of the prefrontal cortex during adolescence yield similar deficits? If so, the immaturity of the prefrontal cortex may explain poor decision-making and increased risk-taking in adolescence. To test the notion that immaturity (rather than damage) to the prefrontal cortex might contribute to risky behaviour, Crone and Van der Molen (2004)
investigated decision-making differences between 10-12-, 13-15-, and 18-25-year-olds using the IGT. They hypothesised that the younger the individual, the more the individual would favour the disadvantageous decks due to an immature prefrontal cortex. The data confirmed their hypothesis: favourable choices on the IGT increased linearly as a function of age (Crone & Van der Molen, 2004). Adults (18-25) made significantly more advantageous decisions than did older adolescents (13-15), who in turn made more advantageous decisions than did younger adolescents (10-12). Adults’ performances on the IGT were not explained by increases in working memory or inductive reasoning ability but did correlate with age-related maturity of the prefrontal lobe. If prefrontal lobe immaturity fully accounted for increased risk taking, however, we would expect younger adolescents to engage in more real-life risk behaviours than adolescents and adults. Given that the propensity for real-life risk peaks around 17 years of age then decreases (Moffitt, 1993), either prefrontal cortex development does not fully account for increased risk-behaviour over the adolescence period or this task may not effectively replicate all of the factors that are involved in adolescent risk-taking.

In addition to changes in connectivity in the prefrontal cortex, neurotransmitter input also changes over the adolescence period. Neurotransmitters providing high prefrontal input throughout childhood decrease in input during adolescence (Spear, 2000). Both glutamate and gamma-amino-butyric acid (GABA) reduce to a fraction of their previous levels (Lewis, 1997). Concurrently, dopamine activity changes in the prefrontal cortex reach maximum input levels (Lewis, 1997). Research has linked dopamine to emotional processing, reactivity, and risk behaviour/novelty seeking in multiple species (Spear, 2000; Piazza, Rougé-Pont, Deminière, Kharoubi, Le Moal, & Simon, 1991; Dellu et al., 1996). Given
the links between dopamine and emotional processing and novelty-seeking, increased
dopamine activity may contribute to the peak in human risk-behaviour during adolescence.

Animal studies have offered some insight into dopamine-related developmental
differences in behaviour. For example, adolescent rats display more locomotion and
novelty-seeking behaviours than do adult rats; given this, exploratory behaviour is often
used as a model of risk taking in humans. Adolescent rats can be differentiated into high and
low novelty-seeking groups based on the amount of locomotion that they exhibit in a novel
environment. Lesions caused by the neurotoxin 6-hydroxydopamine disrupt dopamine
pathways and eliminate exploratory behaviour by adolescent rats (Dellu et al., 1996),
suggesting that dopamine activity influences novelty seeking. In an attempt to specify the
relation between dopamine and novelty seeking, Piazza and associates (1991) assigned male
Sprague-Dawley rats to one of two groups: high novelty-seekers and low novelty-seekers.
The rats were assigned to groups based on the amount of locomotion they exhibited over a
2-hour period that was measured using photoelectric cells placed in a novel cylindrical
corridor. Biochemical assays of high and low novelty-seeking rats revealed significant
differences in dopamine and dopamine metabolites. High novelty-seekers had significantly
higher dopamine metabolites in the nucleus accumbens and striatum than did low novelty-
seeking rats. Furthermore, dopamine metabolites were positively correlated with the
locomotor response to novelty.

Human adolescents, like adolescent rats, also undergo dopaminergic changes in
similar regions of the brain, for example, in the limbic system (Spear, 2000). The limbic brain
system is strongly involved in emotional behaviours and includes the nucleus accumbens,
implicated in the behaviour of high novelty-seeking rats and human anticipation of reward
(Bjork et al., 2004), and the amygdala, implicated in human avoidance behaviours (Spear,
Given that the prefrontal cortex is involved in controlling behaviour output, perhaps the differences in adolescent and adult risk behaviours stem from processes occurring in the limbic system before prefrontal cortex activation. Indeed, fMRI scans of cortex development over adolescence describe chronologically earlier refinement and dopamine changes in the nucleus accumbens than refinement and neurotransmitter changes in the prefrontal cortex. Thus, on the basis of these animal data and fMRI scans of human brain development, researchers have hypothesised that emotional, rather than cognitive, factors could more likely account for adolescent risk-taking behaviour.

Accordingly, there is ample evidence that adolescents can perform cognitively at levels matching adults when emotional factors are minimal. On a simple Go/No-go task requiring participants to respond as fast as possible to target letters (any letter other than X) and inhibit responding to a non-target letter (X), adolescents performed just as well as adults. Participants had to quickly press a key in response to every letter except the letter ‘X’. Target letters were presented on 75% of the trials, making inhibition on non-target trials more difficult. There were no significant age differences for misses or false alarms (Tamm, Menon, & Reiss, 2002, Rubia, et al., 2000). Indeed, plotting individual accuracy as a function of age showed that several adolescents performed better than did adults on the Go/No-go task (National Research Council, 2011). These data indicate that adolescents can inhibit responses as well as, and even better than adults, when the emotional demands of the task are minimal.

To investigate possible emotional factors of poor decision-making independently from cognitive control systems, the IGT task has subsequently been modified by requiring that participants consciously choose to pass or play each computer-selected card deck before they can move on to the next deck (Cauffman et al., 2010). Recall that previously,
participants’ self-selected their decks on the IGT, that is, they could choose from any deck at any time, could select from the same deck multiple times in a row, and could ignore or skip other decks. Typically in previous studies with the IGT, researchers recorded net scores, making it impossible to identify if the participants’ card choices reflected desires to choose from that deck, or desires to ignore or skip another deck. A higher score on the unmodified IGT could be reached by either increasing avoidance of a high punishment deck or increasing sampling of a low punishment deck over time. Recording only a net score potentially conceals differing decision strategies between adolescents and adults and, given limbic system development during adolescence, differing emotion-based strategies may well be operating. Modifying the IGT to measure a pass or play choice for each deck now enables separate measurement of approach (choosing a card from the deck) and aversion (skipping the deck without selecting a card) decisions for each deck type.

The choice to pass or play on each deck allowed Cauffman and associates (2010) to calculate an approach score by dividing the number of advantageous card selections by the number of advantageous card presentations and an avoidance score was calculated similarly with disadvantageous card selections. Significant differences were found between adolescents and adults on the pass or play version of IGT. Adolescents (14-17) had significantly higher approach scores than did adults (18-30). Adolescents learned faster than adults to sample advantageous card decks, reflecting their increased sensitivity to rewards, likely resulting from chronologically earlier development of the nucleus accumbens in relation to the prefrontal cortex. This reward sensitivity peaked mid-adolescence then disappeared, matching real-life risk behaviour epidemiology.

Crone and Van der Molen’s (2004) IGT findings focussed on net score differences between adults and adolescents. To compare their results to Crone and Van der Molen’s IGT
findings, Cauffman and associates (2010) calculated equivalent net scores by subtracting the number of disadvantageous plays from the number of advantageous plays. Net scores were still linear, replicating Crone and Van der Molen’s (2004) results so that, overall, adolescents still scored lower than adults. That is, while adolescents were more sensitive to rewards and made more advantageous plays, they still made more disadvantageous plays than did adults, leading to overall lower net scores, as measured by both Crone and Van der Molen (2004) and Cauffman and associates (2010). Although adolescents’ net IGT scores increased linearly as age increased, adolescents had different patterns of playing relative to adults, indicating different decision making processes.

Significant differences in reward sensitivity between adolescents and adults are especially interesting given that Cauffman and associates (2010) measured emotional factors of poor decision-making in a controlled laboratory setting where emotional stimuli were minimal and rewards and consequences were hypothetical. Although laboratory conditions have some distinct advantages, including control and measurement of relevant variables, the majority of adolescent risk-behaviours take place away from adult supervision in highly emotional, uncontrolled environments (Steinberg, 2004). Adolescent sensitivity to rewards and dopamine effects on emotional processing may be particularly influential outside standard laboratory conditions due to increased levels of emotionality in real life. Dopamine moderation of decision making may also explain how adolescents can outperform adults on some laboratory measurements (National Research Council, 2011). That is, adolescents can perform perfectly under controlled, low emotion conditions, but may fail on decision making tasks in highly emotional, real-life conditions.

One key difference between laboratory studies of adolescent risk and real-life risk behaviour is the lack of arousal. Sensation seeking, the personality trait of preferring novel,
diverse, and powerful experiences, has been associated with a number of risk-taking activities including dangerous driving, risky sexual behaviour, excessive alcohol consumption, drug taking, and other high risk behaviours (Zuckerman & Kuhlman, 2000). Zuckerman and Kuhlman (2000) further investigated the influence of personality on risk taking by developing a revised personality questionnaire assessing five personality factors: Impulsive Sensation Seeking, Neuroticism-Anxiety, Aggression-Hostility, Activity, and Sociability. The Impulsive Sensation Seeking, Aggression-Hostility, and Sociability factors all correlated with the composite real-life risk score of 260 University students. Clearly, seeking novel stimulation is an important factor in real-life risk engagement; however, many laboratory-based measures of risk-taking behaviour are not emotionally arousing, making their validity to real-world risk-taking questionable. To understand the mechanisms involved in age-related changes in risky behaviour, laboratory research needs to further mimic realistic real-life risk situations.

More recently, new experimental measures have been developed to measure risky behaviour that combine the control of a laboratory setting while also incorporating more realistic emotional arousal. One of these new experimental measures is a computer-based task called Chicken (Sheldrick, 2004). In Chicken, participants are required to drive a computerised car as close as possible to an invisible wall without crashing in order to gain points (Sheldrick, 2004). An on-screen traffic light is used to signify when the wall is approaching. The Chicken task revealed significant differences in risk taking as a function of age (Gardner & Steinberg, 2005). As age increased from adolescents (13-16) to young adults (18-22) to adults (24 and older), risky driving on the Chicken task decreased. The great thing about the Chicken task is that it represents a real-life risk – running a yellow light. To further
understand adolescent risk-behaviour, laboratory research needs to mimic real-life environments where adolescent risk-behaviour commonly takes place.

Another key feature in real-life adolescent risk-taking environments is the presence of peers. It is well recognised that adolescents spend more time with friends and less time with family. The primary influence on adolescents’ sense of identity and self-esteem shifts from high parental input to a larger peer input (Erikson, 1968). Adolescents also place greater importance on peer opinions and expectations than during childhood (Brown & Larson, 2009). Importantly, compared to adult risk-taking behaviour, adolescent risk-taking behaviour is much more likely to occur in the presence of peers (Warr, 2002). Individuals’ assessment of the importance of peer opinion decreases after 20 years of age, matching decreases in risk-taking behaviours.

Spending increased time with peers can have both positive and negative effects on adolescents. From a positive perspective, spending time with peers helps develop social skills and increases independence from parents in preparation for life as an adult. At the same time, however, an association with deviant peers is a strong predictor of risky behaviour (Ary, Duncan, Biglan, Metzler, Noell, & Smolkowski, 1999). For example, in an 18-month longitudinal study, researchers recorded the risk-taking behaviour of 523 adolescents (14-17 years old), including drug and alcohol use, sexual behaviour, and antisocial behaviour using a questionnaire. Based on structural equation modelling of the data, both poor parental monitoring and association with deviant peers strongly predicted individuals’ involvement in risk taking. These factors accounted for 46% of the variance in risk-taking behaviour. In another, similar study, Ary, Duncan, Duncan, and Hops (1999) obtained analogous results in a sample of 204 adolescents aged 11-15 years followed over a longer, 24-month period. An association with deviant peers had a significant direct effect on risk.
behaviours and this model accounted for 52% of the variance (Ary, Duncan, Duncan & Hops, 1999).

Aside from the influence of deviant peers, rejection from peers can also influence engagement in risky behaviour. Rejection, even via a computer game, can cause long lasting psychological discomfort. For example, Williams and his colleagues (2000) developed a computer-based programme called Cyberball to study ostracism in the context of the laboratory. Cyberball is an electronic ball toss paradigm where participants can be included or excluded from the game. In this paradigm, participants are required to toss an onscreen ball between themselves and two other computer players who the participants think are real people. The ostracism condition is achieved when the participant stops receiving the ball from the two on-screen players. Exclusion over a period of less than 4 minutes leads to lower self-esteem, decreases in feelings of control, meaningful existence, and belonging; and increased anger, sadness, and distress all measured by self-report after the game is completed (Williams, et al., 2000). These negative effects of ostracism in Cyberball are extremely robust and occur when the on-screen players are strangers (Williams, Cheung, & Choi, 2000), undesirable individuals (members of the KKK, Gonsalkorale & Williams, 2007) and even when the rejection occurs because of a computer glitch (Eisenberger & Lieberman, 2005). The negative effects of ostracism also occur even when ostracism from Cyberball is rewarded with money (van Beest & Williams, 2006). That is, participants report lower satisfaction and lower mood following exclusion despite the fact that they made more money.

Rejection following minimal levels of ostracism can lead to changes in behaviour to mitigate the experience of rejection. For example, following rejection within a laboratory environment, participants were much more likely to donate money to a stranger (Carter-
Sowell, Chen, & Williams, 2008). Participants were approached by a confederate after playing Cyberball and were asked to pledge money to the campus band through varying persuasive techniques. Rejected participants pledged much more than did participants who were not rejected in Cyberball, for all request techniques. Outside the laboratory, adolescents rejected by peers have been shown to increase their risky behaviour to regain the peer group’s favour (Dishion, Patterson, Stoolmiller, & Skinner, 1991). Research has also shown that aggressive externalising behaviours increase following rejection by peers (Boyer, 2006), and rejected adolescents are even more susceptible to the influence of deviant peers (Carter-Sowell, Chen, & Williams, 2008; Dishion & Piehl, 2008).

Researchers have also argued that when large groups of risky teenagers are together, this provides behavioural anonymity, decreasing the salience of negative consequences of risk taking (Drummond & Bowler, 1998). For example, in one study, children in groups at Halloween were observed stealing more candy than were children who trick or treated alone (Diener, Fraser, Beaman, & Kelem, 1976). Anonymous children in groups also stole more candy than did identified children in groups. The wider psychological phenomenon of deindividuation, where immersion in a group causes loss of individuality and control of behaviour, may increase the likelihood of engagement in risky behaviour during adolescence.

Despite these initial findings, more recent meta-analysis (Postmes & Spears, 1998) provides very little evidence for a relation between deindividuation and risky behaviour. Furthermore, meta-analysis has prompted a reconsideration of the relation between deindividuation and group behaviour. Rather than group immersion causing loss of individuality and control of behaviour, it has been argued that group immersion triggers a shift from personal identity to social identity within an individual. Group immersion then
increases behaviour consistent to the group norms and social context (Postmes & Spears, 1998). This social-identity clarification helps explain why, in the vast majority of group environments, such as music and sporting events and peaceful protests, groups successfully behave within societal norms and do not lose control of behaviour. Together with anonymity, a social-identity explanation of group behaviour forms an updated model of deindividuation: the Social Identity Model of Deindividuation Effects (SIDE; Reicher, Spears & Postmes, 1995). The SIDE model accounts for both antinormative and normative group behaviour by factoring in social identities. If a group has antinormative or risky group norms, immersion in this group maximises the expression of this identity within the individual. Likewise, if a group has normative group stereotypes then immersion in this group maximises the expression of this identity. Anonymity increases the salience of the shared group identity, again increasing the influence of group norms and stereotypes. This model explains the relation between affiliation with deviant peers and risk taking. Immersion in a group of deviant peers maximises the expression of deviant social identity within the individual and increases risk-taking behaviour.

One issue not currently accounted for by the SIDE model is the individual’s personal resilience and self-efficacy. That is, the individual’s capability to resist the shift to the group identity once immersed in a group. While the majority of adolescent risk-taking takes place in groups, we know that not all groups participate in risk taking and not all members of the risk-taking groups participate. It has been well documented that some individuals are able to ignore group pressure and remain autonomous (Asch, 1956). Asch (1956) conducted seminal research on independence in the face of group pressure. He found significant individual differences in the amount of conformity to group norms. In his classic experiment, group members rated which of three lines matched the length of another line.
Unbeknownst to one group member, all of the other group members were confederates who had been instructed to each announce the incorrect answer. The participant was then required to announce the participant’s answer in front of the group. A quarter of the participants managed to resist the group pressure to state the wrong answer, and announced the correct match on all the trials. What made these individuals able to resist? Further research on group behaviours requires an in-depth analysis of group dynamic and individual characteristics of conformity and resistance to group norms.

So, what influence do peers have on risk taking by participants in the laboratory? Several experimental studies have investigated adolescent risk-behaviour while peers are present in the laboratory. In 2010, Chein and associates examined the influence of peers on brain activity while participants made decisions. Adolescents (14-18 years old), young adults (19-22), and adults (24-49) were scanned using fMRI while they played a computer-based driving game, Stoplight. This game is very similar to Chicken; the main difference is the first person perspective. Participants played the game both alone and after being informed that peers were observing them onscreen in an adjacent room. In contrast to Chicken (Gardner & Steinberg, 2005), there were no significant differences in risk taking on Stoplight between adolescents, young adults, and adults when playing in the alone condition. Functional MRI scans showed an increase in the orbitofrontal cortex and ventral striatum (including the nucleus accumbens) activation when adolescent participants played in the peers condition compared to the alone condition (Chein, Albert, O’Brien, Uckert, & Steinberg, 2010). That is, the presence of peers increased brain activation in places not already significantly activated during risky decision-making. This finding was only true for adolescents. The ventral striatum is associated with reward sensitivity, suggesting that the presence of peers is rewarding to adolescents and may sensitise engagement in riskier behaviour.
Gardner and Steinberg (2005) also examined the influence of peers on risk taking using the Chicken task. Recall, Gardner and Steinberg found that adolescent participants played the game with more risk than did young adults, who in turn played the game with more risk than did adult participants, when playing alone. Moreover, those who played the game with peers present were far more risky than those who played the game alone. This peer effect was more pronounced for adolescents than young adults and adults. Results like these have been used to argue that peers exert a particularly powerful influence on risk-taking behaviour during adolescence (Boyer, 2006; Gardner & Steinberg, 2005).

Unfortunately, there are a number of problems with Gardner and Steinberg’s (2005) study that limit the conclusions that can be drawn from their data. For example, participants’ scores on the Chicken task were never validated against real-life risk behaviour. Despite the realistic premise of the risk involved in running a yellow traffic light, further research is required to determine whether performance on the Chicken task actually predicts self-reported real-life risk behaviour by adolescents; preliminary data from our lab suggests that it may not (Sim, 2008). In addition to potential problems with the validity of the Chicken task, Gardner and Steinberg’s conclusions about the effect of peers is further complicated by the way in which the peers were recruited. In their study, adolescent participants were randomly assigned into groups with peers they were assumed to know by recruiting all participants from the same location. Meanwhile, young adults and adult participants selected their own two peers to participate in the study with them. There were no measures to assess group identity in any of the age groups, raising the possibility that group identity with the peers, rather than age per se, may have been a factor in the results. Variation in score due to group identity levels is exactly what the SIDE model of group behaviour would predict.
Alternatively, it is also possible that when tested with less familiar peers (i.e., not close friends), the adolescents in Gardner and Steinberg’s study may have behaved in a more risky manner in an attempt to enhance their group affiliation and gain acceptance (cf., Branscombe & Wann. 1994; Noel, Branscombe, & Wann, 1995). That is, age-related differences in the nature of the peer group, again rather than age per se, may have contributed to their greater levels of risk taking. Finally, Gardner and Steinberg did not measure the social interaction between participants and their peers while they were playing the game. Peer behaviour during the game was not reported, so it is unclear how exactly the peers affected the participants’ play. For example, adolescent peers may be more prone to encouraging risky behaviour during the game while adults may just sit quietly and watch. Without an explicit measure of peer behaviour, it is impossible to determine whether increased risk-taking by the adolescents tested with peers was due to a developmental increase in susceptibility to peer pressure or to a developmental difference in the nature of the peer pressure per se. That is, it is entirely possible that adults who are confronted with peers encouraging them to behave in a risky way might succumb to this pressure as well (e.g., Haslam & Reicher, 2012).

With these factors in mind, the overarching goal of the present research was to further explore the effect of peers on risk taking in a laboratory-based task. The primary difference between our procedure and that used by Gardner and Steinberg (2005) is that both adolescents and adults were required to bring two friends of the same gender along to participate in the study to serve as their peer group during the task. All participants played Chicken while their peers were in the room. If adolescents are more susceptible to simply the presence of peers, we hypothesised that the adolescents would take more risks than adults on the Chicken task.
To further elucidate the effect of peers on performance in the Chicken task, we also assessed group identity among the peers in order to measure emotional commitment and sense of belonging to the peer group. We hypothesised that due to the heightened importance of peers during adolescence, adolescent participants would be more emotionally committed to their peer group and would report a greater sense of belonging to the peer group than would adult participants. We also measured resilience and self-efficacy; we predicted that participants who scored higher on personal resilience and self-efficacy would be less likely to succumb to the effects of peers on the risk-taking task. Furthermore, we directly measured the behaviour of the peers during the Chicken task to investigate possible differences in peer behaviour between adolescents and adults.

There were also a number of other specific aims of the research. First, we examined whether risk taking scores on the Chicken task predicted participants’ self-reports of their own real-life risk taking. To do this, participants also completed a real-life risk-taking questionnaire and we compared their scores on this measure to their scores on the Chicken task. If Chicken provides a valid measure of real-life risk-taking, then we should see some relation between the participants’ self-reports and their scores on the laboratory task.

Second, in an attempt to further validate the Chicken task, we also assessed the relation between measures of participants’ personality and their scores on the Chicken task. To do this, participants completed the Zuckerman and Kuhlman Personality Questionnaire – Short Form (ZKPQ-SF; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) and we compared their scores on this measure to their scores on the Chicken task. We hypothesised that performance on the Chicken task (as well as real-life risk-taking) would be predicted by Impulsive Sensation Seeking, Aggression-Hostility, and Sociability personality factors in both the adolescent and adult groups (Zuckerman & Kuhlman, 2000).
Method

Participants

A total of 132 participants (63 males, 69 females) were recruited in Dunedin, New Zealand to take part in the current study. Adolescents aged 12-16-years old ($M = 14.36$ years, $SD = 1.06$; 27 males, 39 females) were recruited through flyers, word-of-mouth, and a database of previous participants in research at the University of Otago. Adults aged 23-49-years old ($M = 28.30$ years, $SD = 5.64$; 36 males, 30 females) were recruited through flyers, word-of-mouth, and postgraduate links through the University of Otago. Participants were instructed to attend the experiment with two close friends of the same sex. Participants were recruited in this manner to ensure that all individuals were similarly affiliated with the other people in their group. Each participant was paid $10-15.00 for their participation. All participants were recruited and tested over a four-year period.

Measures

All participants completed assessments for risk-taking behaviour, group affiliation, and psycho-social measures.

Risk taking. Risk taking was assessed using a laboratory-based measure (Chicken) and two computer-administered self-report measures of real-life risk taking (Life Experiences Questionnaire and Prosocial Risk Questionnaire).

Chicken. First, we assessed risk-taking using a laboratory-based computer game, *Chicken* (Sheldrake, 2004). Participants earn points on Chicken by driving a third-person-perspective car across the screen as close to an invisible wall as possible without crashing into it. This game was developed by Gardner and Steinberg (2005) as a behavioural measure of risk.
All participants listened to instructions about how to play the Chicken game, viewed a simulation trial, and then played 10 test trials. Participants were instructed that, on each trial, they would be in control of a car travelling across the screen towards a brick wall that was hidden on the game screen. Traffic lights indicated when the car approached the wall. A green traffic light signified that it was safe to continue driving, a yellow light signified that the car was approaching the wall, and a red light indicated crashing into the wall. The crash was depicted by a visual image of the car crashing into the wall, coupled with a loud crashing noise. The length of time that the yellow light was displayed varied across trials, eliminating the ability of participants to determine the exact position of the wall on any given trial.

Players controlled the car by using the computer mouse to click on ‘stop’ and ‘go’ signs or by using the ‘s’ and ‘g’ keys on the computer keyboard. They were able to stop, and then subsequently restart, the car as many times as they liked during the green- and yellow-light phases. Participants accumulated points on the basis of the amount of time that the car was in motion during each trial. If the car was stopped before hitting the wall, points were added to the total score. Alternatively, if the car crashed into the wall, no points were awarded for that trial. Participants took turns playing the game; while each participant was playing, the other two participants were instructed to call out advice about how best to play the game.

For each trial, the computer recorded three dependent variables: 1) the length of time that the participant drove the car while the yellow traffic light was displayed (Runtime), 2) the number of times that the participant restarted the car (Restarts), and 3) the number of times that the participant crashed (Crashes). The points awarded during the game were displayed for participant incentive only.
Risk-taking questionnaires. We also assessed risk-taking behaviour using two risk-taking questionnaires. The first questionnaire was a self-report measure, the Life Experiences Questionnaire (LEQ; see Appendix A). This 3-part questionnaire assessed participants’ previous engagement in risk-taking behaviour over their lifetime. The LEQ was administered to participants in private by means of computer. The first part of the questionnaire comprised of a modified version of the Zuckerman and Kuhlman Life Experiences Questionnaire (ZK-LEQ; Zuckerman & Kuhlman, 2000). The ZK-LEQ assessed participants’ degree of participation in the following areas of risky behaviour: tobacco smoking, drug use, sexual behaviour and vehicle use.

The second part of the LEQ consisted of a modified version of the Self-Report Early Delinquency scale (SRED; Moffitt & Silva, 1988) which was designed to capture self-reports of illegal and antisocial behaviours from New Zealand adolescents. The Modified Self-Report Early Delinquency scale (M-SRED) assessed participants’ involvement in the areas of animal cruelty, fighting, gambling, school delinquency, theft, trespassing, and vandalism.

The final part of the LEQ consisted of the Alcohol Use Disorders Identification Test (AUDIT; World Health Organisation, 1992) which is designed to assess a respondent’s level of alcohol use. The AUDIT is a screening questionnaire which aims to identify individuals who display a pattern of alcohol consumption and alcohol-related behaviour that is hazardous to their personal health.

The second questionnaire that we used to assess risk-taking behaviour was another self-report measure, the Prosocial Risk Questionnaire (PRQ; Graham, 2010). The PRQ measured participation in potentially risky activities that are perceived as being more socially acceptable. It comprised of three questions about participation in activities such as contact sports (team or individual) as well as adventure sports or any recreational activities.
with a high risk of injury (see Appendix B). A total PRQ score was calculated for each participant by summing the number of activities that the participant reported engaging in.

**Group affiliation.** Participants completed 3 measures of group affiliation that included questions regarding their identity and emotional commitment to their experimental group.

The four-item identity subscale from the Collective Self-Esteem Scale (CSES-I; Luhtanen & Crocker, 1992) was administered to measure group identity. The CSES-I consisted of the items, “Overall, being a member of my group has very little to do with how I feel about myself”; “Being a member of my group is an important reflection of who I am”; “Being a member of my group is unimportant to my sense of who I am”; and “In general, being a member of my group is an important part of my self-image.” Participants rated these items on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Appendix C). The CSES-I has high Cronbach’s alphas, adequate test-retest coefficients, and correlations with other measures of collective self-esteem (Luhtanen & Crocker, 1992). Ratings on the negatively-worded items were reversed scored and then averaged with the other ratings to give a mean CSES-I score for each participant.

Second, emotional commitment to the group was measured using the three-item ‘commitment to the group’ subscale of the Social Identity Scale (SIS-E; Ellemers, Kortekaas & Ouwerkerk, 1999). The SIS-E consisted of the items, “I would like to continue working with my group;” “I dislike being a member of my group;” and “I would rather belong to a different group.” Participants rated these items on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Appendix D). The negatively-worded item ratings were reversed scored and then averaged with the other rating to give each participant a mean SIS-E score.
Finally, participants also completed a modified version of the Group Identification Measure (GIM; Doosje, Eloper, & Spears, 1995). Emotional belonging to the peer group was assessed with four items rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) (Appendix D). The items were modified from the GIM by substituting the wording “psychology students” for “the group I came with today.” The modified version (M-GIM) consisted of the items, “I see myself as a member of the group that I came in with today;” “I am pleased to be a member of the group that I came in with today;” “I feel strong ties with the people I came in here with;” and “I identify with the people I came here with.” Ratings were averaged across the items to give each participant a mean M-GIM score.

**Psycho-social factors.** Four measures of personality were administered including a personality questionnaire, a self-esteem measure, a resilience scale, and a self-efficacy scale.

**Zuckerman and Kuhlman Personality Questionnaire - Short Form.** Participants also completed the Zuckerman and Kuhlman Personality Questionnaire – Short Form (ZKPQ-SF; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) on the computer. The ZKPQ-SF consists of 35 true/false items such as “I am an impulsive person” and produces five personality ratings: Impulsive Sensation-Seeking (ImpSS), Neurotism-Anxiety (N-Anx), Aggression-Hostility (Agg-Host), Activity (Act), and Sociability (Sy) (see Appendix E for all items). Previous research has indicated that a high risk-taking personality type is characterised by high scores on the Impulsive Sensation-Seeking, Aggression-Hostility, and Sociability categories (Zuckerman & Kuhlman, 2000).

**Single-item self-esteem scale.** Individual self-esteem was measured using the Single-Item Self-Esteem Scale (SISE: Robins, Hendin, & Trzesniewski, 2001). The SISE consists of the item, “I have high self-esteem.” Participants rated this item on a 5-point scale ranging from
1 (not very true of me) to 5 (very true of me). The SISE has high convergent validity with longer forms of self-esteem assessment, such as the Rosenberg Self-Esteem Scale (Rosenberg, 1965; Robins et al., 2001). In the present study, the SISE was provided to respondents as the final item of the ZKPQ-SF (see Appendix E).

**Resilience scale.** Resilience at the time of the study was measured using Wagnild and Young’s Resilience Scale (RS; 1993). The 15 items were rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Items were positively worded and included statements such as, “I usually take things in my stride” and “My life has meaning.” (Appendix F). Item ratings were averaged to give each participant a mean RS score.

**Self-Efficacy scale.** Self-efficacy was measured using the Self-Regulatory Efficacy subscale from the Children’s Self-Efficacy Scale (Bandura, 2006). On the Self-Regulatory Efficacy (S-RE) subscale, participants were asked to rate their current degree of confidence on the items by recording a number from 0 (I cannot do at all) to 100 (Highly sure I can do) in terms of how they felt at that present moment. The S-RE consists of 8 items including “Resist peer pressure to smoke cigarettes” and “Resist peer pressure to have sexual intercourse.” (see Appendix G). We modified the S-RE by adding the item, “Resist peer pressure to do things that can get me into trouble with the law.” Item ratings were averaged to give each participant a mean Modified-S-RE (M-S-RE) score.

**Procedure**

Participants arrived in the laboratory in groups of three and provided informed consent. Adolescent participants under the age of 16 were also required to have signed parental consent before they could proceed in the study. Groups were instructed that each participant would play 10 trials of the Chicken game, and then they would be separated to answer 9 questionnaires. Participants were advised that they would all be paid $10/$15.00
for taking part and would also have the opportunity to earn chocolate on the basis of the group’s performance in the game. They were told that the higher their score on the Chicken game, the more chocolate they would receive. Because the amount of chocolate that they could earn would be based on the group score, participants were instructed to work as a team and help each other.

Before they completed the questionnaires, participants were specifically reminded that their names would not be associated with their questionnaire responses and that data tracking was carried out through arbitrarily-assigned participant numbers. Participants were also told that they would not be identified no matter what information they gave in the questionnaires and were asked to answer as honestly as they could. Once completed, participants were thanked for their time, paid, and given flyers to recruit other participants.

**Coding**

All participants were video- and audio-recorded while they played Chicken. To examine the degree of peer influence that participants exerted over one another, each experimental session was watched and coded by two independent coders. For each player, on each trial, the coders recorded whether the other two members of the group encouraged risky play by saying things like, “Keep going” or “get to 200 points.” Inter-coder observed agreement was 75% ($\kappa = 0.69$). We then calculated a Peer Influence score for each participant by totalling the number of trials on which he or she received feedback encouraging risky play. A high peer-influence score corresponded to a greater amount of encouragement to take risks while playing Chicken. A low peer-influence score corresponded to a lesser amount of encouragement to take risks while playing Chicken. We also calculated an Affirmation score for each participant by summing the number of times
per trial that the player requested feedback from their group members (e.g., *Is that OK? Stop now?*).

To obtain composite score measures for the AUDIT and ZKPQ-SF measures, participants’ responses were all coded in line with the guidelines provided for each respective measure (AUDIT: World Health Organisation, 1992; ZKPQ-SF: Zuckerman et al., 1993).

Participants’ scores on the ZK-LEQ were obtained by allocating scores on a five-point scale ranging from zero to four for each section item. A score of four was given for high-end risk-taking, while a score of zero constituted no presence of risk-taking behaviour. For example, on item 114 (see Appendix A), participants were asked how often they had driven without a licence or broken the conditions of a learners or restricted licence. If participants answered ‘never,’ then they received a score of zero, as no risk was associated with this behaviour. Conversely, participants who responded ‘7 or more times’ received a score of four as there was deemed to be high risk associated with this behaviour.

The scoring of participants’ responses on the M-SRED was conducted in a similar manner to that of the ZK-LEQ, although the scale options differed in order to match the different item response options. For example, on one item, participants were asked if they had ever illegally damaged property, to which three response options were possible: ‘never,’ ‘yes – once,’ or ‘yes – more than once.’ These responses received scores of 0, 2, and 4, respectively.
Results

Demographic Summary

Demographic information was collected from each participant including information regarding the participant’s living arrangements, tertiary institution, employment details, and whether the participant had any children. Not surprisingly, the majority of adolescent participants lived with their parents with only two indicating that they stayed at a boarding house while at high school. Figure 1 provides a summary of the living arrangements of the 66 adult participants. As illustrated in Figure 1, most of the adult participants in this experiment were living with peers and almost a fifth were living with their partners. A small proportion owned their own homes or lived with their parents.

Figure 1. The proportion of adult participants who were living with peers, with partners, in their own homes, with parents, in education-affiliated hostels, without a fixed abode, or in other accommodation.

All of the adolescent participants attended high school. The majority of the adult participants attended University (60%), the others were employed fulltime (26%), were unemployed (6%), on a sickness benefit (6%), or attended polytechnic (2%). In addition to any study, 23% of the total sample also worked an average of 27.43 hours per week; the
actual hours worked per week ranged from 4.5 to 50 hours. Twelve participants indicated
that they were a parent.

Real-Life Risk-Taking Behaviour

**Descriptive statistics.** To examine participants’ real-life risk behaviour using their
scores on each of the individual real-life risk-taking measures (ZK-LEQ & PRQ), we conducted
a series of 2 (Age Group: Adolescents, Adults) x 2 (Sex: Male, Female) analyses of variance
(ANOVAs) over all dependent variables. We will only describe significant effects.

Table 1 provides a summary of scores for each of the ZK-LEQ measures. As illustrated
in Table 1, there were marked individual differences for several of the risk-taking
behaviours.

**Table 1.**
*Maximum Possible Values, Means (Standard Deviations), and Ranges of Participant Ratings
on the LEQ as a function of age group.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Adolescents</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Mean (Range)</td>
</tr>
<tr>
<td>ZK-LEQ Smoking</td>
<td>14</td>
<td>1.38 (2.90)</td>
</tr>
<tr>
<td>Other Drugs</td>
<td>16</td>
<td>0.58 (1.22)</td>
</tr>
<tr>
<td>Sexual Behaviour</td>
<td>12</td>
<td>0.21 (0.67)</td>
</tr>
<tr>
<td>Driving</td>
<td>24</td>
<td>0.92 (2.42)</td>
</tr>
<tr>
<td>Passenger</td>
<td>16</td>
<td>2.50 (3.24)</td>
</tr>
<tr>
<td>M-SRED Antisocial</td>
<td>40</td>
<td>3.86 (5.48)</td>
</tr>
<tr>
<td>AUDIT Alcohol</td>
<td>40</td>
<td>3.64 (5.45)</td>
</tr>
<tr>
<td>Total LEQ</td>
<td>162</td>
<td>13.09 (17.31)</td>
</tr>
</tbody>
</table>

**Alcohol.** An individual’s total score on the Alcohol Use Disorders Identification Test
(AUDIT; WHO, 1992) reflects his or her level of risk related to alcohol use. Figure 2 shows
individual participants’ scores on the AUDIT as a function of age group and sex. There was a main effect of age group, $F(1, 128) = 7.22, p = .008, d = 0.49$. Overall, the adults had higher AUDIT scores than did adolescents. There was also an Age Group X Sex interaction, $F(1, 128) = 7.88, p = .006, d = 0.57$. As shown in Figure 2, although adolescent females had higher scores on the AUDIT than did adolescent males, for the adults, the pattern was reversed; adult males had higher AUDIT scores than did adult females.

According to the World Health Organisation’s guidelines for the clinical interpretation of total AUDIT scores, 14% of participants reported medium-level alcohol problems (i.e., scored between 8 and 15); 5% scored between 16 and 19 which suggests counselling and monitoring for problem drinking is required; and 4% scored above 20
indicating that further diagnostic evaluation for alcohol dependence is warranted. In total, 23% of participants attained a score which would be indicative of a drinking problem as defined by the World Health Organisation. Table 2 provides a breakdown of scores indicative of a drinking problem across age group and sex. Adult males had the highest proportion of scores above 8 (42%) followed by adolescent females (21%).

Table 2. **Distribution of Scores Indicative of a Drinking Problem by Age and Sex.**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adolescents</strong></td>
<td>3 (11%)</td>
<td>8 (21%)</td>
<td>11 (17%)</td>
</tr>
<tr>
<td><strong>Adults</strong></td>
<td>15 (42%)</td>
<td>4 (13%)</td>
<td>19 (29%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18 (29%)</td>
<td>12 (17%)</td>
<td>30 (23%)</td>
</tr>
</tbody>
</table>

**Tobacco smoking.** The legal age of tobacco purchase in New Zealand is 18 years old. Figure 3 shows participants’ smoking score as a function of age group and sex. There was a main effect of age group, $F(1, 128) = 5.25, p = .024, d = 0.42$. Again, adults had higher scores than did adolescents. There was also an Age Group X Sex interaction, $F(1, 128) = 12.22, p = .001, d = 0.64$. As shown in Figure 3, although adolescent females had higher smoking scores than did adolescent males, for the adults, the pattern was reversed; adult males had higher smoking scores than did adult females. Overall, responses to the tobacco smoking questions on the ZK-LEQ revealed that 71% ($n = 94$) of the present sample had never smoked tobacco. A further 12% ($n = 16$) of participants indicated that, although they had smoked in the past, they were not currently smoking.
Figure 3. Individual participants’ scores on questions regarding smoking on the ZK-LEQ by age group and sex. Mean values for each group are represented by a horizontal line.

Drug use. An individual’s score on the drug-use section of the ZK-LEQ indicated how frequently over the past 12 months he or she had used specific drugs and how many different kinds of illegal drugs he or she had tried at least once. A high overall score indicated that the individual had tried a wide range of illegal substances and had used them frequently over the past year. Figure 4 shows participants’ drug-use score as a function of age group and sex. There were main effects of age group, \( F(1, 128) = 18.05, p < .0001, d = 0.77 \), and sex, \( F(1, 128) = 11.26, p = .001, d = 0.61 \); adult participants scored higher than adolescents, and male participants scored higher than their female counterparts. These main effects were qualified by a significant Age Group X Sex interaction, \( F(1, 128) = 16.50, p < .0001, d = 0.74 \); adolescent males had lower drug-use scores than did adolescent females,
but in the adult group, this trend was reversed and adult males scored higher than did adult females.

![Drug Use Graph](image)

**Figure 4.** Individual participants’ scores on questions regarding drug use on the ZK-LEQ by age group and sex. Mean values for each group are represented by a horizontal line.

Participants’ responses about drug use other than alcohol or tobacco (i.e., illicit drugs) indicated that 25% \((n = 33)\) had used marijuana or hashish during the last year, and approximately 18% of these individuals used marijuana or hashish once a week or more. Other drugs such as amphetamines, cocaine, heroin, LSD, ecstasy, and magic mushrooms were used by 9% \((n = 12)\) of participants, with 42% of those who had tried these drugs in the last year using them about once a month. Previously legal drugs, such as benzylpiperazine pills (BZP), nitrous oxide, or amyl or butyl nitrate were used by 14% \((n = 19)\) of participants in the last year and of those who had tried these substances, 11% used them once a month.
Sexual behaviour. Figure 5 shows participants’ score on questions regarding sexual behaviour as a function of age group and sex. There was a main effect of age group on sexual-behaviour scores, $F(1, 128) = 51.92, p < .0001, d = 1.31$. Not surprisingly, adults had significantly higher scores than did adolescents.

![Sexual Behaviour](image)

**Figure 5.** Individual participants’ scores on questions regarding sexual behaviour on the ZK-LEQ by age group and sex. Mean values for each group are represented by a horizontal line.

Half of the participants indicated that they had engaged in sexual intercourse (50%, $n = 66$), of these, only 8 or 12% were adolescents. Of the participants who indicated that they were sexually active, 36% had multiple sexual partners, and 9% had 5 or more sexual partners in the past 12 months. Responses to the birth-control and sexual-health questions revealed that 29% of those who had intercourse used a condom “rarely” or “never,” and 17% reported irregular use of any birth-control method.
**Vehicle use: Driving choices.** New Zealand has a graduated driver-licensing system where drivers must successfully complete a learner-licence phase, and then a restricted-licence phase, before a full licence is achieved. A total of 84 individuals, or 64% of the sample, identified that they had driven a vehicle on public roads. Figure 6 shows participants’ driving score as a function of age group and sex. There were main effects of age group, $F(1, 128) = 47.29, p < .0001, d = 1.25$; adults had higher driving scores than did adolescents, and of sex, $F(1, 128) = 5.64, p = .019, d = 0.43$; males had higher scores than did females. These main effects were qualified by a significant Age Group X Sex interaction, $F(1, 128) = 7.51, p = .007, d = 0.5$; adolescent males had lower driving scores than did adolescent females, but in the adult group, this trend was reversed and adult males scored higher than did adult females.

Almost one fifth of the sample (17%, $n = 14$) had broken their licence conditions more than 7 times. The driving behaviour of participants is also noteworthy with 29% indicating that they had driven at speeds in excess of 20 kmph over the speed limit more than 7 times, and 48% had run a red light at least once. Participants’ responses regarding alcohol and substance use prior to driving revealed that 31% of participants had driven after drinking more than the legal alcohol limit, and 16% had driven while under the influence of other drugs such as marijuana, amphetamines, or LSD.
Figure 6. Individual participants’ scores on questions regarding driving on the ZK-LEQ by age group and sex. Mean values for each group are represented by a horizontal line.

**Vehicle use: Passenger choices.** Passenger questions examined situations in which participants had been a passenger in a vehicle driven by an unlicensed, learner-, or restricted-licensed driver. Figure 7 shows participants’ passenger score as a function of age group and sex.
Figure 7. Individual participants’ scores on ZK-LEQ questions regarding being a passenger by age group and sex. Mean values for each group are represented by a horizontal line.

There was an Age Group X Sex interaction, $F(1, 128) = 15.54$, $p = .0001$, $d = 0.71$; adolescent males had lower passenger scores than did adolescent females, but in the adult group, this trend was reversed and adult males scored higher than adult females. A total of 76 individuals, or 58% of the sample, had been the passenger of an unlawful driver at least once, and 33% of those had done so 7 or more times. A number of risky behaviours were also reported when the participant was the passenger of an unlicensed, learner-, or restricted-licensed driver. For example, 71% of the participants had been a passenger in a vehicle exceeding the legal speed limit by at least 20kmph; 36% had been a passenger of a driver who had drunk more than the legal alcohol limit; and 29% had been a passenger of a driver under the influence of other drugs such as marijuana, amphetamines, or LSD.
**Antisocial behaviour.** Responses to the Modified Self-Report Early Delinquency scale (M-SRED) revealed antisocial or illegal behaviour amongst a proportion of the participants. Figure 8 shows participants’ antisocial behaviour score as a function of age group and sex. There were main effects of age group, $F(1, 128) = 11.47, p = .0009, d = 0.62$; adult participants had significantly higher antisocial behaviour scores than did adolescents, and of sex, $F(1, 128) = 5.49, p = .0207, d = 0.43$; male participants had significantly higher scores than did female participants. These main effects were qualified by a significant Age Group X Sex interaction, $F(1, 128) = 13.22, p = .0004, d = 0.66$; adolescent males had lower antisocial behaviour scores than did adolescent females, but in the adult group, this trend was reversed and adult males scored higher than did adult females.

Participants’ ratings on the antisocial behaviour scale indicated that 8% of the sample had been suspended or expelled from school; 38% had stolen something from a person or place; 21% had illegally damaged property; 17% had trespassed or broken into a car or building; 17% had fought in a public place; 7% had carried or used a weapon for the purpose of defending themselves or attacking others; 7% had thrown objects off a road over-bridge, or sabotaged a road or train track; 7% had been intentionally cruel to an animal; and 44% had gambled for money.
Figure 8. Individual participants’ scores on questions regarding antisocial behaviour by age group and sex. Mean values for each group are represented by a horizontal line.

**Life Experiences Questionnaire (LEQ) total score.** Figure 9 shows participants’ total scores on the LEQ (ZK-LEQ, M-SRED, & AUDIT). There were main effects of age group, $F(1, 119) = 20.09, p < .0001, d = 0.81$; adult participants had significantly higher LEQ scores than did adolescents, and of sex, $F(1, 119) = 4.81, p = .0302, d = 0.4$; male participants had significantly higher scores than did female participants. These main effects were qualified by a significant Age Group X Sex interaction, $F(1, 119) = 18.08, p < .0001, d = 0.77$; adolescent males had lower LEQ scores than did adolescent females, but in the adult group, this trend was reversed and adult males scored higher than did adult females.
Figure 9. Individual participants’ total LEQ scores by age group and sex. Mean values for each group are represented by a horizontal line.

**Prosocial risk-taking.** The next step in the analysis was to assess the degree of real-life risk-taking behaviour as reported by the participants on the Prosocial Risk Questionnaire (PRQ). Recall that on this questionnaire, participants were asked to indicate participation in potentially risky activities that might be perceived as being more socially acceptable. Participants’ responses on the PRQ revealed that 48% of the sample had taken part in at least one of the listed risky prosocial sports or activities. To give an example of the most popular activities; 59% of participants played contact sports (e.g., rugby, boxing, and karate), 35% had participated in extreme skiing/snowboarding, and 30% indicated they took part in mountain climbing/abseiling. Figure 10 shows participants’ PRQ score as a function of age group and sex. There was a main effect of sex, $F(1, 119) = 4.41, p = .0379, d = 0.38;$
male participants had higher PRQ scores than did female participants.

Figure 10. Individual participants’ scores on the PRQ as a function of age group and sex. Mean values for each group are represented by a horizontal line.

In summary, the results from the above analyses indicated that there were some high risk-takers in our sample. Males scored significantly higher on drug use, driving, antisocial behaviour, and prosocial risk. Adults scored higher on alcohol, smoking, drug use, sexual behaviour, driving, and antisocial behaviour. Interestingly, all of the significant interaction effects were in the same direction; adolescent females scored higher than adolescent males but for adults, this trend was reversed on the questions about alcohol, smoking, drug use, driving, passenger, and antisocial behaviour. We will return to this point in the general discussion.
Chicken

**Descriptive statistics.** Recall that for each Chicken trial, the computer recorded three dependent variables: 1) the length of time that the participant drove the car while the yellow traffic light was displayed (Runtime), 2) the number of times that the participant restarted the car (Restarts), and 3) the number of times that the participant crashed (Crashes). On each of the following figures, a higher score indicates greater risk-taking. The following figures show participants’ scores as a function of age and sex separately for each measure\(^1\).

*Figure 11. Participants’ Runtime scores (+1SE) on Chicken by age group and sex.*

---

\(^1\) One female and one male adolescent participants’ data were missing Chicken scores due to computer error.
Figure 12. Participants’ Restarts scores (+1SE) on Chicken by age group and sex.

Figure 13. Participants’ Crashes scores (+1SE) on Chicken by age group and sex.
The data shown in these figures were subjected to separate 2 (Age Group: Adolescents vs. Adults) x 2 (Sex: Male vs. Female) ANOVAs. There was no effect of age for any of the three measures (largest $F(1,119) = 1.35, p = .2477$). There were, however, significant effects of sex. As shown in Figures 11 and 12, males had significantly higher Runtimes ($F(1,119) = 14.48, p = .0002, d = 0.69$) and Restarts ($F(1,119) = 14.71, p = .0002, d = 0.7$) than did females. There were no interactions.

**Composite score comparison.** Next, we wanted to examine whether our Chicken data replicated Gardner and Steinberg’s (2005) findings with the same task. To do this, we calculated the same composite score that they used by averaging a participant’s z-scores on the Runtime and Restarts scales of the Chicken game. Figure 14 shows our data next to Gardner and Steinberg’s data for their White and Non-White ethnic groups. Recall that Gardner and Steinberg found significant differences between adult participants and adolescent participants when playing Chicken in groups. As Figure 14 shows, the significant difference between adolescents and adults was mostly due to very risky play by Non-White adolescents. Our data are highly consistent with Gardner and Steinberg’s data from a White sample.
Peer measures

Gardner and Steinberg (2005) argued that the age-related differences in Chicken performance were due to the presence of peers while the participants played Chicken. Recall that, unlike Gardner and Steinberg, we measured Group Affiliation (Collective Self-Esteem Scale – Identity, CSES-I, Social Identity Scale – Emotional Commitment, SIS-E, and Group Identification Measure, GIM), participants’ degree of confidence on resisting peer pressure (Self-Efficacy), and Resilience. We conducted separate 2 (Age Group) x 2 (Sex) ANOVAs for each peer measure.
Table 3 shows the mean scores for male and female participants on the Group Affiliation, Self-Efficacy, and Resilience measures. Females scored higher on the Group Identification Measure (GIM), $F(1, 119) = 4.69, p = .0324$, $d = 0.39$. There were no significant sex-related differences on any other measures of Group Affiliation, Self-Efficacy, or Resilience.

Table 3.  
*Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Male and Female Participants on the Group Affiliation, Self-Efficacy, and Resilience Measures.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males (n = 61)</th>
<th>Females (n = 62)</th>
<th>F</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group Affiliation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSES-I</td>
<td>4.32 (0.11)</td>
<td>4.39 (0.11)</td>
<td>0.09</td>
<td>.05</td>
</tr>
<tr>
<td>SIS-E</td>
<td>5.91 (0.15)</td>
<td>6.19 (0.09)</td>
<td>2.33</td>
<td>.28</td>
</tr>
<tr>
<td>GIM</td>
<td>5.74 (0.15)</td>
<td>6.20 (0.11)</td>
<td>4.69**</td>
<td>.39</td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td>79.80 (2.13)</td>
<td>84.89 (1.96)</td>
<td>2.68</td>
<td>.30</td>
</tr>
<tr>
<td><strong>Resilience</strong></td>
<td>5.37 (0.09)</td>
<td>5.35 (0.11)</td>
<td>0.08</td>
<td>.05</td>
</tr>
</tbody>
</table>

**$p < .01.$**

Table 4 shows the mean scores for adolescent and adult participants on the Group Affiliation, Self-Efficacy, and Resilience measures. Adolescents scored significantly higher on the Group Identification Measure (GIM), $F(1, 119) = 6.78, p = .0104$, $d = 0.47$; and significantly lower on the Resilience, $F(1, 119) = 9.41, p = .0027$, $d = 0.56$; measure than did adults. There were no other significant age-related differences on Group Affiliation, or Self-Efficacy measures. There were, however, significant interaction effects for Resilience, $F(1, 119) = 4.65, p = .0331$, $d = 0.39$; and Self-Efficacy, $F(1, 119) = 11.28, p = .0011$, $d = 0.61$. 

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The interactions were in the same direction; adolescent females scored lower than adolescent males on Resilience and Self-Efficacy, but for adults, this trend was reversed.

Table 4.
*Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Adolescent and Adult Participants on the Group Affiliation, Self-Efficacy, and Resilience Measures.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Adolescents (n = 61)</th>
<th>Adult (n = 62)</th>
<th>F</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSES-I</td>
<td>Mean: 4.45 (0.10)</td>
<td>Mean: 4.26 (0.11)</td>
<td>1.37</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>Range: 1.75-6.25</td>
<td>Range: 2-6.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIS-E</td>
<td>Mean: 6.13 (0.13)</td>
<td>Mean: 5.97 (0.12)</td>
<td>0.42</td>
<td>.12</td>
</tr>
<tr>
<td></td>
<td>Range: 2-7</td>
<td>Range: 2.33-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GIM</td>
<td>Mean: 6.24 (0.12)</td>
<td>Mean: 5.71 (0.14)</td>
<td>6.78**</td>
<td>.47</td>
</tr>
<tr>
<td></td>
<td>Range: 2.5-7</td>
<td>Range: 2-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>Mean: 84.11 (1.81)</td>
<td>Mean: 80.66 (2.28)</td>
<td>1.07</td>
<td>.19</td>
</tr>
<tr>
<td></td>
<td>Range: 33.11-100</td>
<td>Range: 22.22-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resilience</td>
<td>Mean: 5.15 (0.10)</td>
<td>Mean: 5.57 (0.09)</td>
<td>9.41**</td>
<td>.56</td>
</tr>
<tr>
<td></td>
<td>Range: 2.73-6.53</td>
<td>Range: 3.33-7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p < .01.

In addition to the Group Affiliation, Self-Efficacy, and Resilience measures, we also measured the behaviour of the peers while the participant played Chicken, calculating Peer Influence and Affirmation scores². The Peer Influence score reflected the amount of verbal influence from the group, with a high score corresponding to more encouragement to take risks and a low score corresponding to less encouragement to take risks. The Affirmation score reflected the number of times that the participant sought feedback from the group.

We conducted separate 2 (Age Group) x 2 (Sex) ANOVAs for each peer behaviour measure.

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² Four female adolescents, three female adults, and one male adult participant’s peer behaviour data is missing due to technical difficulties during the video- and audio-recording process.
Table 5 shows the mean scores for male and female participants on the Peer Influence and Affirmation measures. Female participants scored significantly higher on the Affirmation measure, $F(1,119) = 4.05$, $p = .0464$, $d = 0.37$, than did males.

Table 5.
Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Male and Female Participants on the Peer Influence and Affirmation Measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males (n = 61)</th>
<th>Females (n = 62)</th>
<th>$F$</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Influence</td>
<td>1.81 (0.22)</td>
<td>1.32 (0.22)</td>
<td>0.74</td>
<td>.16</td>
</tr>
<tr>
<td>Affirmation</td>
<td>0.74 (0.13)</td>
<td>1.11 (0.23)</td>
<td>4.05**</td>
<td>.37</td>
</tr>
</tbody>
</table>

**$p < .01$.**

Table 6 shows the mean scores for adolescent and adult participants on the Peer Influence and Affirmation measures. Adults scored significantly higher on the Affirmation measure, $F(1,119) = 14.03$, $p = .0003$, $d = 0.68$, than did adolescents. There were also significant interactions for both measures of peer behaviour: Peer Influence, $F(1,119) = 9.52$, $p = .0025$, $d = 0.56$; and Affirmation, $F(1,119) = 5.48$, $p = .0209$, $d = 0.43$. The interactions were both in the same direction; adolescent females scored lower than adolescent males on Peer Influence and Affirmations, but for adults, this trend was reversed and females scored higher than did males on Affirmations, and for Peer Influence the difference had disappeared.
Table 6.

Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Adult and Adolescent Participants on the Peer Influence and Affirmation Measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Adolescent (n = 61)</th>
<th>Adult (n = 62)</th>
<th>F</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Influence</td>
<td>1.4 (0.21)</td>
<td>1.73 (0.23)</td>
<td>2.22</td>
<td>.27</td>
</tr>
<tr>
<td>Affirmation</td>
<td>0.49 (0.11)</td>
<td>1.35 (0.23)</td>
<td>14.03**</td>
<td>.68</td>
</tr>
</tbody>
</table>

**p < .01.

**Personality**

Next, we examined whether there were age-related or sex-related differences in participants’ scores on each of the personality measures. We again conducted a series of 2 (Age Group) x 2 (Sex) ANOVAs over all dependent variables. Table 7 shows the mean scores for male and female participants on each scale of the Zuckerman-Kuhlman Personality Questionnaire – Short Form (ZKPQ-SF), and the self-esteem measure. Males scored higher on one of the ZKPQ-SF measures, Activity, $F(1,119) = 6.30, p = .0134, d = 0.46$; and the self-esteem measure, $F(1,119) = 4.13, p = .0443, d = 0.37$; than did the females. There were no other significant sex-related differences.
Table 7. Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Male and Female Participants on the ZKPQ-SF and the Self-Esteem measures.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Males (n = 61)</th>
<th>Females (n = 62)</th>
<th>F</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulsive Sensation-Seeking</td>
<td>2.85 (0.24)</td>
<td>2.85 (0.26)</td>
<td>0</td>
<td>.00</td>
</tr>
<tr>
<td>Neuroticism-Anxiety</td>
<td>2.62 (0.25)</td>
<td>3.16 (0.27)</td>
<td>2.46</td>
<td>.29</td>
</tr>
<tr>
<td>Aggression-Hostility</td>
<td>2.64 (0.25)</td>
<td>2.76 (0.26)</td>
<td>0</td>
<td>.00</td>
</tr>
<tr>
<td>Activity</td>
<td>3.98 (0.26)</td>
<td>3.16 (0.23)</td>
<td>6.30*</td>
<td>.46</td>
</tr>
<tr>
<td>Sociability</td>
<td>3.98 (0.27)</td>
<td>4.10 (0.31)</td>
<td>0</td>
<td>.00</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>3.62 (0.12)</td>
<td>3.21 (0.14)</td>
<td>4.13*</td>
<td>.37</td>
</tr>
</tbody>
</table>

* p < .05.

Table 8 shows the mean scores for adolescent and adult participants on each scale of the Zuckerman-Kuhlman Personality Questionnaire – Short Form (ZKPQ-SF), and the self-esteem measure. There was a significant difference between the adolescent and adult participants’ scores on the ZKPQ-SF Sociability, $F(1,119) = 4.49$, $p = .0361$, $d = 0.39$; and Aggression-Hostility, $F(1,119) = 8.85$, $p = .0035$, $d = 0.54$; scales with adolescents scoring higher than adults. There were no other significant age-related differences on personality, or on the self-esteem measure. The only significant interaction effect on the personality measures was for the Activity scale, $F(1,119) = 5.83$, $p = .0173$, $d = 0.44$; where adolescent males scored higher than did adolescent females but for adults, this difference between genders had disappeared.
Table 8.  
*Means (Standard Errors), Ranges, F-values, and Effect Sizes (d) for Adolescent and Adult participants on the ZKPQ-SF, and the Self-Esteem measures.* 

<table>
<thead>
<tr>
<th>Measure</th>
<th>Range</th>
<th>Adolescents (n = 61)</th>
<th>Adults (n = 62)</th>
<th>F</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impulsive Sensation-Seeking</td>
<td>0-7</td>
<td>2.87 (0.26)</td>
<td>2.84 (0.24)</td>
<td>0.01</td>
<td>.02</td>
</tr>
<tr>
<td>Neuroticism-Anxiety</td>
<td>0-7</td>
<td>2.80 (0.27)</td>
<td>2.98 (0.25)</td>
<td>0.52</td>
<td>.13</td>
</tr>
<tr>
<td>Aggression-Hostility</td>
<td>0-7</td>
<td>3.23 (0.26)</td>
<td>2.18 (0.23)</td>
<td>8.85**</td>
<td>.54</td>
</tr>
<tr>
<td>Activity</td>
<td>0-7</td>
<td>3.64 (0.23)</td>
<td>3.50 (0.27)</td>
<td>0.60</td>
<td>.14</td>
</tr>
<tr>
<td>Sociability</td>
<td>0-7</td>
<td>4.48 (0.29)</td>
<td>3.61 (0.28)</td>
<td>4.49*</td>
<td>.39</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>1-5</td>
<td>3.25 (0.13)</td>
<td>3.58 (0.13)</td>
<td>2.30</td>
<td>.28</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01.

Does Chicken Measure Risk Taking?

As described earlier, there has been very little validation of the Chicken task. In other words, the notion that this task provides a valid measure of real-life risk-taking is currently more an article of faith than a demonstrated fact. In the next section of the results, we attempted to establish the validity of the task by comparing it to other measures of risk-taking and to other variables that have been shown to predict risk taking (e.g., personality measures) in the same sample.

**Correlation analysis – personality, Chicken, and real-life risk behaviour.** First we assessed the relation between participants’ scores on Chicken, and the real-life risk-taking, and personality measures by calculating Pearson Product-Moment correlations between all measures. Figure 15 shows the relation between participants’ scores on the real-life risk-
taking measures (total LEQ & PRQ), personality (Sociability, Aggression-Hostility, Impulsive Sensation-Seeking, Neuroticism-Anxiety, & Activity), self-esteem, the Chicken composite score (recall that this encompasses the Runtime and Restarts measures) and the Crashes measure. A line between two variables indicates a significant correlation (see Appendix I for the complete correlation matrix).

Figure 15. Pearson product-moment correlations between participants’ scores on measures of real-life risk-taking (LEQ & PRQ), personality, self-esteem, and Chicken. *p < .05, **p < .01.

Figure 15 illustrates three important points. First, there was a significant positive correlation between participants’ scores on the LEQ and their scores on the PRQ, $r = .24$. That is, participants who engaged in more negative risk-taking behaviour also engaged in more positive risk-taking as well. Second, there was no significant correlation between participants’ scores on either the LEQ or PRQ and their score on any of the Chicken
variables. That is, there was no relation between participants’ self-reported level of real-life risk-taking and their score on a laboratory-based measure of risk taking. Finally, the variables that were significantly related to the LEQ score were the Sociability, $r = .21$, and Impulsive Sensation-Seeking, $r = .39$, personality measures; and Prosocial risk$^3$ (PRQ), $r = .24$. Prosocial risk was also related to Impulsive Sensation-Seeking, $r = .33$, and the Activity, $r = .26$, measures of personality. Participants who had a more social personality reported that they were involved in more problematic or antisocial risky behaviours (LEQ) and participants who had a more active personality were involved in more socially-accepted risky activities (PRQ). Participants with more impulsive, sensation-seeking personalities were involved in more antisocial risk behaviours and more socially-accepted risk activities. There were no significant correlations between the Chicken measures and any of the personality or real-life risk-taking measures.

**Correlation analysis – peer measures, personality, chicken, and risk taking.** Next we added in the peer measures to the correlation between scores on the chicken task, real-life risk-taking, and personality. Firstly, a composite personality score was calculated by averaging a participant’s scores on the Impulsive Sensation-Seeking, Aggression-Hostility, and Sociability scales of the ZKPQ-SF in line with current research indicating that these three scales all reliably correlate with real-life risk (Zuckerman & Kuhlman, 2000). Again, Pearson Product-Moment correlations ($p < .05$) were then calculated between all individual and composite scores. Figure 16 shows the relation between participants’ scores on the Chicken, personality, and real-life risk-taking measures updated with peer measures. A line between

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$^3$ Recall the difference between the LEQ measure and the PRQ measure: the LEQ measures potentially negative risk behaviours such as smoking, alcohol use, dangerous driving, and unprotected sex, whereas the PRQ measures potentially positive risk behaviours such as involvement in contact sport, vehicle racing, and adventure sports such as bungee-jumping and water-skiing.
two variables indicates a significant correlation (see Appendix I for the complete correlation matrix).

Figure 16 illustrates three important points. First, the only significant correlation that involved one of our measures of peer behaviour (assessed during the playing of the Chicken game) was between participants’ Peer Influence score and their score on the PRQ, \( r = -0.19 \). Recall that the Peer Influence score was calculated based on coder observations of the number of trials on which the participant received feedback encouraging riskiness. Second, in addition to the significant relation between of personality and Prosocial risk, Group Identification (MGIM) was also significantly related to the LEQ score, \( r = -0.18 \). That is, participants who identified more with their group were involved in less problematic or antisocial risky behaviours. Finally, Self-Efficacy (M-SRE) was also significantly related to LEQ scores, \( r = -0.26 \). Participants who rated themselves as better able to resist peer pressure on the Self-Efficacy measure were involved in less problematic or antisocial real-life risk behaviours.
While there was a significant correlation between Self-Efficacy and LEQ, a stronger significant positive relation existed between LEQ and personality (ZKPQ-SF, \( r = .29, p = .001 \)). Additionally, Self-Efficacy was also significantly related to personality (ZKPQ-SF, \( r = -.44, p < .001 \)), which suggested that the association between Self-Efficacy and real-life risk behaviour might be due to Self-Efficacy acting as an indicator of risky personality. In this case, it is important to ascertain whether Self-Efficacy as a measure, explains any unique variance in LEQ scores beyond that explained by risky personality (ZKPQ-SF).

To do this, we conducted a hierarchical regression analysis to test the differential prediction of Self-Efficacy and risky personality (ZKPQ-SF) for real-life risk-taking behaviour (LEQ). Our question here was whether Self-Efficacy would be uniquely predictive of real-life risk taking once risky personality (ZKPQ-SF), age, and sex were taken into account. Table 9 shows the results of this regression analysis.
Table 9.
**Hierarchical regression analysis for variables predicting real-life risk-taking behaviour as measured by the LEQ.**

<table>
<thead>
<tr>
<th>Block</th>
<th>Predictor Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Constant</td>
<td>-.87</td>
<td>.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>.05</td>
<td>.01**</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sex</td>
<td>-.28</td>
<td>.11*</td>
<td>-.18</td>
<td>.18**</td>
</tr>
<tr>
<td>2</td>
<td>ZKPQ</td>
<td>.47</td>
<td>.09**</td>
<td>.44</td>
<td>.19**</td>
</tr>
<tr>
<td>3</td>
<td>Self-Efficacy</td>
<td>-.03</td>
<td>.06</td>
<td>-.03</td>
<td>.001</td>
</tr>
</tbody>
</table>

\[ R^2 = .37** \]

*Note: Final β weights are reported throughout.*

* p < .05, ** p < .01.

In predicting real-life risk taking, the model was significant overall (R² = .37, p < .001).

However, most of the variance in LEQ was accounted for by age and personality. Self-Efficacy was not a significant predictor of real-life risk taking once age (B = .05, p < .001, R² = .18), sex (B = -.28, p = .011, R² = .18), and risky personality (B = .47, p < .001, R² = .37), were taken into account.

**Summary**

In the present study, we found no significant differences between adolescent and adult groups on the laboratory measure of risk, Chicken. Our Chicken data were highly consistent with Gardner and Steinberg’s (2005) data for their White (Caucasian) samples. We did find that adolescents were more committed to their participant group as evinced by the Group Identification Measure and sought fewer Affirmations than did adults. However,
participants’ scores on neither the Group Identification Measure nor the Affirmation scores were related to Chicken scores.

Additionally, we found significant age- and sex-related differences in real-life risky behaviour as measured on the LEQ. Adults had higher LEQ scores than did adolescents; there was also a significant interaction whereby adolescent females scored higher than adolescent males, but this trend was reversed for adults. The LEQ scores related to personality but not to Chicken scores. Interestingly, the Group Identification Measure and the Self-Efficacy scores both significantly related to the LEQ scores but these correlations were not as strong as the significant positive relation between LEQ and personality. Furthermore, Self-Efficacy was not a significant predictor of real-life risk-taking once age, sex, and personality were considered. Real-life risk taking was best predicted by age, sex, and personality.
Discussion

The overarching goal of the present experiment was to replicate and extend previous research on age-related changes in the effect of peers on risk-taking using a laboratory-based task. Specifically, we assessed the effects of peers on risk taking by adolescent and adult participants using a computer game called Chicken. In contrast to prior research with this task, we directly measured both group affiliation and the behaviour of the peers while participants played the game. In addition, we also examined the relation between participants’ performance on the Chicken task and their scores on measures of real-life risk engagement and measures of personality.

Chicken

The primary goal of the present study was to further explore the relation between the presence of peers and a laboratory-based measure of risk taking, Chicken (Gardner & Steinberg, 2005). Specifically, we predicted that adolescents would play the Chicken game with more risk, resulting in higher Chicken scores, than would adults. We based this prediction on the knowledge that Gardner and Steinberg found that some adolescents scored higher than did adults on Chicken. In contrast to prior research, however, there was no effect of age for any of the variables in the Chicken game. That is, we found no significant age differences in the length of time that participants drove the car, the number of times that participants restarted, and the number of crashes during Chicken. However, we did find a significant effect of sex. Male participants drove the car for longer and restarted more often than did females. Overall, when we calculated the same composite score used in Gardner and Steinberg, we found that our participants appeared to comparatively take no risks whatsoever while playing Chicken.
Consistent with the laboratory-based measure of risk taking, our participants also exhibited lower levels of self-reported risk-taking than did participants in previous studies (Graham, 2010; Pharo et al, 2011; Sim, 2008); this lower level of self-reported risk-taking might explain the lower risk scores on the Chicken game, but because Gardner and Steinberg’s (2005) Chicken data were not presented in conjunction with real-life risk-taking data, it makes it hard to distinguish whether they had riskier participants in their study or if Chicken is not a valid measure of real life risk taking. Consistent with the conclusion that Chicken does not measure risk, we found no correlation between participant’s scores on the Chicken game and their self-reported real-life risk-taking. Sim (2008) also found no correlation between these measures in another, independent sample of 13- to 17-year-olds. The results of these two studies raise questions about the validity of this particular paradigm.

Closer examination of Gardner and Steinberg’s (2005) findings also raise important questions about the validity of the task. When the significant age difference in play is broken down by ethnicity, the majority of the difference between adolescents and adults was due to extremely risky play by Non-White adolescents. The current study did not ask demographic questions on ethnicity. The general population of Dunedin according to the 2013 National Census is made up of 85% people who identify as the European ethnic group (Statistics New Zealand, 2013). Assuming our sample achieved a random reflection of the Dunedin population, we would likely have a majority of European participants (equivalent to the White definition used in the Gardener and Steinberg (2005) study). Perhaps our lower Chicken scores are to be expected then, but, because we did not measure ethnicity directly we cannot say for certain. In future research, it would be beneficial to include questions on ethnicity and assess risk taking as a function of ethnicity directly.
Aside from difference in the ethnicity of our sample, our results may be different from those reported by Gardner and Steinberg (2005) because of differences in the way in which peers were recruited. In the present study, peers were friends who came along to that study together, whereas Gardner and Steinberg assigned adolescents to groups. Perhaps Gardner and Steinberg’s results reflect increased risk-taking in adolescents only when in the presence of unfamiliar (or less familiar) peers. In prior research, researchers have shown that college students overestimate the engagement of their peers in behaviours such as alcohol, drug taking, and sexual behaviours (Martens, Page, Mowry, Damann, Taylor, & Cimini, 2006). This overestimation of peer behaviour also occurs in adolescents (Kandel, 1996). Perhaps in Gardner and Steinberg’s sample, the unfamiliar peers’ engagement in risky behaviour was overestimated by the adolescents and, as such, the adolescents played more risky to fit in with the unfamiliar peers. In terms of the SIDE model of group behaviour, overestimation of group norms could lead to overcompensating risk behaviour as the group identity is expressed. Indeed, in both college and adolescent samples, there was a relation between overestimation of peer behaviour and the individuals’ engagement in the same behaviour (Kandel, 1996; Martens, et al., 2006). That is, the greater an individual overestimated peer engagement in behaviour, the more that individual engaged in the same behaviour. Further research will be required to compare the group assignment of Gardner and Steinberg with self-selected groups to disentangle this potential effect of recruitment method.

Alternatively, our results may be different to those reported by Gardner and Steinberg (2005) due to the increased popularity and availability of video games between 2005 and now. Adolescents are now exposed to top line, realistic graphics in gaming platforms and Chicken is very basic graphics-wise. Exposure to quality graphics would likely
decrease interest and investment in the low-quality Chicken game and decrease motivation to perform well. The Chicken graphics fall short at even representing a current computer game realistically, let alone real-life. An updated Chicken game, improving graphics and game complexity, would provide a more dynamic measure of risk taking during game play.

Perhaps, however, the benefits of playing Chicken conservatively in the present study were more motivating than playing riskier. Participants in the present study were instructed that the higher their group score, the more rewards they would earn. Participants in the Gardner and Steinberg (2005) study, on the other hand, were paid $20 for their time regardless of their game score and were not offered any further rewards for high scores on the Chicken game. The limitations of Gardner and Steinberg’s procedure are two-fold. First, the procedure decreases the realistic representation of real-life risk environments. Minimal tangible consequences of playing the Chicken game in the Gardner and Steinberg version encourages risky behaviour during the game as there are no detrimental costs of gaining a low score. Second, participants in the Gardner and Steinberg study were not held accountable for their scores by the group. Given the increased peer importance during adolescence, and the collective reward dynamic in the present study, adolescent participants may have felt more pressure to play conservatively in order to not let their peers down.

On all three measures of group affiliation, the adolescents rated themselves as more affiliated to their group than did the adults. The difference on the Group Identification Measure (GIM; Doosje, et al., 1995) was statistically significant. Adolescents rated themselves higher on identifying, and feeling strong ties, with their group. As predicted, adolescents rated their group affiliation higher, reflecting the increased importance of peers during adolescence. This again emphasises how critical the difference in the recruitment of groups is in Gardner and Steinberg’s (2005) study and how greatly it limits the interpretation
of their results. Peers are very important to adolescents, even in a laboratory setting, and to assume that assigned groups are equivalent to self-selected groups is underestimating adolescent peer affiliation and introducing an important confounding variable to any study.

Significant adolescent ratings on group affiliation in the current study are also confirmation that the participants did, in fact, bring along friends. Peer effects during the laboratory task are thereby likely to be similar to the same peers’ effects on behaviour outside of the laboratory. This assumption could be confirmed in future studies by questioning the average amount of time spent with group members outside of school hours, or by building onto the Life Experiences Questionnaire by asking if the participant has engaged in the particular risky behaviour with one of the people in the participant group who accompanied them.

Interestingly, while Group Identification Measure (GIM) scores didn’t relate to Chicken scores, the GIM scores did correlate with the LEQ results. The higher the participant rated their identification with their group, the lower was their real-life risk-taking. This finding supports the SIDE model of group behaviour. The more affiliated the group, the more likely that group members will express their group identity. Given the low overall levels of real-life risk behaviours in the current study, it appears that the group norms will be low risk-taking and triggering the group identity will perpetuate these low levels of risk behaviours. It would be interesting to select future participants from a population of risky adolescents to confirm the SIDE model in abundantly risky groups. To isolate the SIDE model strength, however, an experimental paradigm would need to create a contrast between self-identity and group identity. In the current task, under the SIDE model, both salient self-identity and activated group identity would result in the same expressed behaviours in our low risk-taking sample.
Overall, our Chicken data highlight an urgent need to modernise and update this task, and to confirm any validation as a risk-taking measure. Adolescents did not play riskier than adults in the presence of peers, and this finding cannot be attributed exclusively to having a sample of low real-life risk-takers. Recall that previous research (Sim, 2008) found the same result even in a sample of higher risk-takers. Careful consideration should be given to investing further into this paradigm, or continuing research in this area with other validated computer software designed to measure risk taking in the laboratory, for example, the Balloon Analogue Risk Task (BART; Lejuez, et al., 2002). The BART significantly correlates with self-reported real-life risk-taking in adolescents and young adults (Lejuez, Aklin, Zvolensky, & Pedulla, 2003). Future research could consider measuring the effect of peer groups on BART performance.

**Peer behaviour**

In addition to group affiliation levels, we also investigated the behaviour of the peers themselves. Recall that we wanted to establish exactly what the peers were doing while the individual played the Chicken game and if peer behaviour could explain the high Chicken scores measured by Gardner and Steinberg (2005). To do this, we developed a rudimentary peer-behaviour measure where independent coders scored the transcripts of peer conversation during Chicken play for risk-encouraging statements. A high peer-behaviour score corresponded to a high number of trials in which players received encouragement to play more riskily on Chicken.

Despite the lack of age-related differences on Chicken, we did find age-related differences in peer behaviour, but in the opposite direction from what we might have assumed prior to the research. There was a surprising trend for adult peers to encourage risk taking more than adolescents did, although this did not reach conventional levels of
significance. Given the increases in risk taking during adolescence, we would expect adolescent peers to be more encouraging of risk taking. Alternatively, even if peers don’t explicitly exert pressure to engage in risk during adolescence, we still would not expect them to encourage risk less than adults. The composite Chicken score for our adolescent sample did in fact look more similar to Gardner and Steinberg’s (2005) findings for adolescents when playing alone. Perhaps the adolescent peers in the current study did not exert any verbal pressure to be risky and so it was as if our participants were playing the Chicken game alone.

There are several limitations of the basic measure of peer behaviour in the current study. First, the peer behaviour measure does not account for any discouragement of risk taking. Perhaps the adult peers encourage risk while the adolescent peers discourage risk, leading to converging Chicken scores. That is, adult peer risk encouragement may have negated their usual conservative play, increasing adult Chicken scores from those measured in Gardner and Steinberg (2005). Meanwhile, adolescent risk discouragement may have negated their usual risky play and lowered scores leading to a lack of age-related difference in Chicken scores in the current study. Unfortunately, without measuring discouragement of risk, we cannot be sure that there was no pressure to avoid risk among the adolescent peers. This potential limitation could be countered in future by recording participants playing the Chicken game alone as well, and then comparing the group Chicken score to the individual Chicken score to determine any change. Alternatively, future studies could manipulate the verbal input of peers somehow thereby exploring effects of both risk encouragement and discouragement on game scores.

Second, the peer-behaviour measure also did not account for silence during the game play, or alternatively any off-topic conversation. A zero score on the peer-behaviour
measure could reflect a completely silent task or a whole bunch of off-topic chatter. Perhaps the adolescent Chicken scores were lower than expected due to the lack of interest in the game caused by background peer conversation. A more comprehensive peer-behaviour measurement would help determine potential patterns between amount of conversation and concentration on the game.

Third, the peer-behaviour measure has not validated by other studies. Despite this, we would expect to see some differences in communication styles between adult and adolescent peers. Previous research has shown significant differences in adolescent language use when they were communicating with an unknown adult and a peer of their choice (Larson & McKinley, 1998). For example, adolescents used significantly more frequent, figurative language in conversation with the peer than with the adult. Future research should elaborate the peer-behaviour measure used in the current study and seek validation, or modify an appropriate conversation tool already established in other research.

As well as peer-behaviour scores, we also measured the number of times the player elicited feedback from their peers during Chicken (Affirmations). Again, independent coders tallied the number of times that a participant sought feedback (i.e. “Should I keep going?”). Again, there were age-related differences on Affirmations, adults asked for more feedback from their group than did adolescents. Perhaps our adolescent sample felt more secure in their group than did adults, as evidenced on the higher group identification scores, and as such, did not seek extra validation from the group. Affirmation scores were not related to Chicken scores or LEQ scores. Again, a more comprehensive, validated measure of conversation analysis may provide a more accurate picture of age-related differences in peer behaviour.
Real-life Risk Taking

Consistent with prior research from our laboratory, our participants engaged in risk-taking with marked individual differences across sections of the Life Experiences Questionnaire (Gardiner, 2012; Graham, 2010; Pharo et al, 2011; Sim, 2008). Males scored significantly higher on the drug use, driving, antisocial behaviour, and prosocial risk sections. Adults scored higher on alcohol, smoking, drug use, sexual behaviour, driving, and antisocial behaviour. Interestingly, the significant interaction effects for alcohol, smoking, drug use, driving, passenger, and antisocial behaviour sections were all in the same direction; adolescent females scored higher than did adolescent males but for adults, this trend was reversed. Relative to some prior research (Graham, 2010; Pharo et al., 2011; Sim, 2008), our sample overall had lower total LEQ scores. As shown in Figure 17, in the present study, participants reported lower risk-taking than in some previous studies. For example, Pharo and associates (2011) recorded mean total LEQ scores of 41.62 and 32.39 for adolescents and young adults respectively. Our mean total LEQ scores were only 13.09 and 30.85 for adolescents and adults, respectively. The study-to-study difference in LEQ scores only occurred in the adolescent samples. As shown in Figure 17, emerging adult and adult scores have been relatively stable over time. As shown in Figure 17, our LEQ scores are more similar to those reported by Gardiner (2012).

One possible explanation for our lower level of risk taking is that our adolescent sample encompassed a younger age range (12-16-year-olds) than in previous research; as such, the participants may not have been exposed to as many risk opportunities. The age-range of our sample alone cannot fully account for the differences. For example, Gardiner surveyed only 16- and 17-year-olds in 2012 and she also reported a lower overall LEQ score than in previous studies. Furthermore, Sim (2008) also included a younger sample of
adolescents (13-15) and reported much higher risk rates than we reported here. Another possible explanation for our findings is that adolescents purposefully underreported their risk taking. This explanation seems unlikely given that confidentiality was reassured and participants had been separated from their peers to answer the questionnaires, a procedure that is identical to that used in previous studies. Furthermore, the recruitment method used here was identical to that used in previous studies. Given the similarities in recruitment and procedure between the present study and previous ones, it is possible that more recent attention on the dangers of adolescent risk-taking may have contributed to a downward trend in the frequency of some risky behaviour. Further consideration of individual LEQ section results may help clarify and isolate any historical changes in behaviour.
Figure 17. Participants' total LEQ scores (+1SE) as a function of age and study.
**Driving behaviours.** Road crashes are consistently the leading cause of injury and
death among New Zealand adolescents (Drummond & Bowler, 1998; Kypri, Chalmers, &
Langley, 2002). Consistent with prior research, the participants in the present study engaged
in risky driving behaviours. Almost one fifth of the participants (17%) had broken the
conditions of a learner or restricted license more than seven times with 29% frequently
driving with excessive speed and 31% driving after drinking more than the legal alcohol
limit. Furthermore, 58% of the participants surveyed had been a passenger of an unlawful
driver at least once. A number of risky behaviours were also reported by passengers.
Overall, 71% of the participants had been a passenger in a speeding vehicle, and 36% had
been a passenger of a driver who had drunk more than the legal limit. New Zealand’s
graduated driver-licensing system sets a minimum criterion for a learner licence of 16 years
of age. The mean age of our adolescent sample was much lower than this, restricting the
likelihood that our sample had much experience or opportunity to engage in driving
behaviours. Despite the overall young age of our adolescent sample, they still participated in
risky behaviours involving vehicles, but in the present study, they were more likely to be
involved as passengers rather than as drivers.

The New Zealand government has recently announced proposed changes to the legal
limit of alcohol consumption for drivers (National Road Safety Committee, 2013). Currently
the legal blood-alcohol limit for drivers under 20 years of age is 0 mg and is 80 mg per 100ml
of blood for adults. Proposed changes include lowering the legal blood-alcohol limit to 50
mg for drivers over 20 years of age. Research has shown that there are marked differences
in performance in drivers registering 80 mg and 50 mg blood-alcohol levels including
significantly increased impairment of vision, perception, divided attention skills, steering
and braking abilities, and a 20% reduction in peripheral vision at the higher level (National
Road Safety Committee, 2010). The risk of a fatal crash for adults aged 20-29 years with a blood-alcohol level of 80 mgs is 50 times more likely than if they were sober. With a blood-alcohol limit of 50 mgs, this risk level reduces to 18 times more likely to crash than if they were sober (Keall, Frith, & Patterson, 2004).

On the one hand, our data suggest that one of the biggest problems with the proposed change to lower blood-alcohol limits might be non-compliance. Our data show that 31% of participants are already ignoring current legal blood-alcohol limits and driving after drinking over the limit. On the other hand, international evidence shows that reducing blood-alcohol limits actually increases compliance (National Road Safety Committee, 2010). This somewhat counterintuitive finding is apparently due to the fact that at lower levels of alcohol consumption, people are able to make better decisions about continuing to drink, deciding to drive, and arranging alternative transport. That is, in addition to perception and motor skill deficits, drivers with a blood-alcohol level of 80 mg are more likely to take risks such as continuing to drink and making the decision to drive (National Road Safety Committee, 2010).

In addition to surveying the most common antecedents of road crashes - alcohol consumption and travelling at speed, we also asked participants to answer questions about their prior drug use in relation to driving. Our sample reported driving under the influence of substances such as marijuana, amphetamines, or LSD (16%) and being a passenger of a driver under the influence of drugs (29%). These percentages mirror national survey results that one in three drug users reported driving while under the influence of drugs in the past year (Ministry of Health, 2010). While these figures are not as high as driving under the influence of alcohol, they are still unsettling given that drug use affects the coordination, concentration, and judgement abilities that are needed to successfully drive a motor
vehicle. Current New Zealand legislation does not permit random stopping of drivers for the purposes of drug testing, making it difficult to obtain reliable information about drug use within the driving population. Research on blood samples of deceased drivers indicated that, of the drivers that had substances in their blood, 48% of these had used more than one drug (including alcohol as a drug). Even without reliable epidemiology of drug use in New Zealand drivers, the government has recently begun a targeted advertising campaign to prevent driving while under the influence of drugs (New Zealand Transport Agency, 2013).

**Alcohol.** New Zealand adolescents also typically report excessive alcohol consumption with 61% of previously surveyed high-school students currently consuming alcohol and 69% of those drinking three or more drinks in a usual session (Adolescent Health Research Group, 2008). Using the Alcohol Use Disorders Identification Test (AUDIT; World Health Organisation, 1992) one in four New Zealanders aged 16-17 years had potentially hazardous drinking patterns in 2007/8 (Ministry of Health, 2010). Our sample reported nowhere near as much alcohol consumption. Our mean alcohol score was only 3.64 for adolescents, well below the score indicative of a drinking problem (8). Only 23% of the participants surveyed attained a score that would be indicative of a drinking problem as defined by the World Health Organisation. Indeed, plotting our results next to previous laboratory results indicates significantly less drinking (see Figure 18).
Figure 18. Participants’ AUDIT scores (+1SE) as a function of age group and study. The dotted line indicates the score (8) above which is indicative of a drinking problem as defined by the World Health Organisation.
Ideally our results would reflect a decrease in problematic adolescent alcohol consumption particularly as alcohol consumption is associated with engagement in other risky behaviours such as having unwanted sex (Adolescent Health Research Group, 2008). As shown in Figure 18, our results match recent research measuring adolescent alcohol scores at only 3.5 on the same measure (Gardiner, 2012). Further research is required to confirm any downward historical trends and explore why our local samples may not match previous local and national samples. Preferably further research into a possible decline in adolescent alcohol use would not rely solely on self-report measures, as our research did, in order to add further weight to the results.

Historically, drinking problems have been characterised as a male problem (Gomberg, 1982), but more recent research has demonstrated that the gender gap in alcohol consumption and hazardous drinking patterns is closing (Abbott-Chapman, Denholm, & Wyld, 2008; Adolescent Health Research Group, 2008; Keyes, Grant & Hasin, 2008; McPherson, Casswell, & Pledger, 2004). In New Zealand, nation-wide gender differences have been measured for drinking behaviours between 1995 and 2000 (McPherson, et al., 2004). There was significant diminishing of the gender gap, for ages 20–49 over the 1995 to 2000 period. That is, females aged 20–49 consumed more alcohol in the year 2000 than in 1995, while male consumption remained stable over this period. Meanwhile, gender differences in drinking behaviours for younger groups were already small in 1995. That is, alcohol consumption was already similar in males and females aged 14–19 years old, becoming even more alike by the year 2000. Unfortunately, this convergence resulted from increases in female drinking behaviour rather than decreases in male drinking behaviour (McPherson, et al., 2004).
There are a number of potential explanations for the increased historical convergence of drinking behaviours between males and females, including societal changes (increases in the number of women in workforces, education systems, and cohabitation), or increased access to alcohol. Following the 1989 Sale of Liquor Act in New Zealand, supermarkets began selling wine and the number of liquor licenses increased, thereby increasing access to alcohol. Furthermore, females are frequently targeted by marketing campaigns for alcohol products and there has been a surge in the development of drinks specifically designed to appeal to young female drinkers such as Ready-To-Drink (RTDs) alcohol and soft drink mixtures (Stirling, 2002). Increased access in supermarkets and targeted marketing are likely to have influenced the increase in drinking by females.

Correspondingly, comparing gender differences from our laboratory’s previous research reveals changes in the size of the sex differences. Figure 19 shows mean male and female AUDIT scores over successive projects. In 2008 and 2011, local research found significant differences between male and female drinking behaviour as measured by the AUDIT. That is, females had significantly lower AUDIT scores than did males. This significant difference disappeared in more recent research and in the current study. The good news here is that, in contrast to McPherson and associates (2004), the convergence between males and females was due to a decrease in alcohol consumption by both genders.
Figure 19. Participants’ AUDIT scores (+1SE) as a function of sex and study. The dotted line indicates the score (8) above which is indicative of a drinking problem as defined by the World Health Organisation. *$p < .05$, **$p < .01$.

Unfortunately, despite the decrease in consumption and overall gender convergence, in the present study, adolescent females had higher drinking scores than did adolescent males. Adolescent females also had the highest proportion of scores indicative of a drinking problem, after the adult males. The danger here is that perhaps instead of gender convergence, we are measuring the beginning of a reversing of the gender difference in alcohol consumption. That is, perhaps females are beginning to overtake males as the heaviest drinkers at younger ages, a practice that could then carry through until adulthood. Recall that early onset of drug and alcohol use is the biggest predictor of future drug problems (Grant & Dawson, 1997). Accordingly, adolescent girls may also be at increased risk of dangerous alcohol consumption due to historical changes in the age of puberty onset. Over the past century, onset of puberty
has steadily decreased so that in 2000, the average age of menarche in Western countries was only 12.5 years (Arnett, 2000), whereas previously in 1900, it was 15 years. Earlier puberty onset has been associated with increased time spent in the company of older peers, potentially increasing exposure to risky situations and encouraging activities like underage drinking (Caspi, Lynam, Moffitt, & Silva, 1993). In future studies, researchers should continue to monitor female adolescent drinking behaviour.

The societal cost of problematic female drinking behaviour is likely higher than male problematic drinking owing to gendered consequences such as unwanted sex, unplanned pregnancies, and other health risks such as Foetal Alcohol Syndrome. With this higher social cost in mind, education and preventative measures would benefit by an increased focus on female problematic drinkers. Fortunately, the New Zealand Government has recently addressed the wide availability of alcohol under the Sale and Supply of Alcohol Act 2012. This new Act allows communities to restrict the sale of alcohol in a number of ways including restricting the number of licenses, restricting operating hours, and making alcohol promotions that appeal to minors an offence (Ministry of Justice, 2012). Research into alcohol behaviours following this transition to monitor the effectiveness of these interventions and perhaps highlight additional room for improvement will further benefit New Zealanders.

Although overall drinking has declined, adolescent females had a higher proportion of scores indicating a drinking problem than both adolescent males and adult females. The previous historic gender discrepancies in alcohol consumption have been mirrored in current treatment and prevention programs. That is, treatment and prevention programs are overwhelmingly targeted to males. Supplementary interventions could include responding to
the female-oriented alcohol advertising by directly countering with increasing preventative and educational advertising targeted to the female population. For example, preventative advertising could highlight biological differences in reactions to alcohol. Females metabolise alcohol differently to males and, in combination with smaller volumes of body water, causes females to have higher peak alcohol levels than males after equivalent doses of alcohol (Wilsnack, 2000). In a society where females are now encouraged to be equals to men as much as possible, education highlighting biological differences may help encourage females to not feel like they have to ‘be one of the boys’ and match male consumption of alcohol. Overall, given the historical increase in drinking among females and the high proportion of adolescent females at risk of a drinking problem in the current study, education and prevention programs must begin incorporating female-oriented treatment to reflect changing female drinking behaviours and hopefully prevent any long-term detrimental consequences.

**Antisocial behaviour.** In the current study, there was also a significant interaction between age and gender on antisocial behaviours. Female adolescents reported significantly more antisocial behaviours than did adolescent males, but for adults, this trend was reversed. The questions regarding antisocial behaviour were phrased to include any engagement in the activity over the participants’ lifespan. Other LEQ sections requested reports of engagement in the behaviour over the past 12 months. Despite this cumulative questioning, adolescent females still out-scored adult females. This observed difference may be due to recall error on the part of the adult females. It may be that adult females had forgotten taking part in antisocial behaviour and, as such, did not report true lifetime levels of engagement. To investigate this further, longitudinal measures of antisocial behaviour in the current sample
could identify if the current adolescent females consistently report antisocial engagement in years to come. Future studies could also access police records to help verify some self-reports of antisocial behaviours, minimising underreporting of behaviours.

It is also possible, however, that adolescent females are engaging in more antisocial behaviours than in previous years. In fact, there has recently been a rise in the number of young females prosecuted for violent crimes in New Zealand (Ministry of Justice, 2013). In 2005, females aged 10-16 years accounted for 19 percent of youths prosecuted for violent crimes, by 2012, this proportion had risen to 27 percent. The majority of female prosecutions in 2012 were for assault charges, followed by robbery charges (Ministry of Justice, 2013). Sadly, again, the gender gap seems to be closing through increases in female antisocial behaviour, instead of decreases in male antisocial behaviour. Furthermore, the potential costs of antisocial behaviour are greater for females than males. Antisocial females have more relationship problems and are more likely both victims and perpetrators of relationship abuse than are antisocial males (Cauffman, 2008). Antisocial females also tend to have children at a young age with increased risk of pregnancy complications, socioeconomic disadvantages, violent relationships, and less developed parenting skills than non-antisocial females (Cauffman, 2008). The impact of female antisocial behaviour on subsequent generations has a significant high social cost. Prevention and treatment programmes need to increase female-oriented care given the unique needs of this group, large social cost if left without support, and increased number of females engaging in antisocial behaviours.
Personality

Given that performance on Chicken, a laboratory measure of risk taking, was not related to real-life risk-taking or peer behaviour, was there any relationship between personality measures and risk taking? Recall that we hypothesised that self-reported, real-life risk taking would be predicted by the Impulsive Sensation-Seeking, Aggression-Hostility, and Sociability personality factors of the ZKPQ-SF (Zuckerman and Kuhlman, 2000). Indeed, the composite personality measure calculated from the three personality factors (Impulsive Sensation-Seeking, Aggression-Hostility, and Sociability) did significantly correlate with real-life risk-taking as measured on the LEQ. Furthermore, regression analysis confirmed personality as a significant predictor of real-life risk-taking, once age and sex were taken into account. Given the general stability of personality over the lifespan (Zuckerman and Kuhlman, 2000), the prediction of real-life risk-taking by personality factors suggests that any risk-taking interventions are likely to fail at curbing adolescent risk-taking behaviour. That is, personality traits leading to risk taking are stable so ignoring the drive to take risks will undoubtedly fail over time. The relation between personality and real-life risk-taking suggests that it would be more beneficial to increase provision of monitored pro-social risky activities, as a substitute to dangerous, antisocial risky activities.

However, our personality results far from mirror previous research findings in personality and risk taking. As anticipated, based on the expectation of high risk-taking in adolescence, adolescents scored significantly higher on the Aggression-Hostility and Sociability factors of personality than did adults. Interestingly, there was no significant difference between Impulsive Sensation-Seeking scores for adolescents and adults. Indeed, Impulsive Sensation-Seeking
scores were generally low, with a mean of 2.85 across both age groups. This again suggests that we may have a sample of inherently-low risk takers. Impulsivity and sensation seeking are strongly related to risk-seeking behaviours in multiple species (Dellu et al., 1996; Zuckerman & Kuhlman, 2000). Lack of a significant difference in Impulsive Sensation-Seeking scores combined with potentially lower access to risk due to the young age of the adolescent group sampled, possibly explains low reported risk engagement by the adolescent sample.

Narrowing our focus to individual factors of the ZKPQ reveals that only Impulsive Sensation-Seeking and Sociability significantly correlated with real-life risk, not the Aggression-Hostility factor as found in previous research (Sim, 2008; Zuckerman & Kuhlman, 2000). In this sense, we would argue that the composite score is not the best personality measure to use to predict risk behaviour. The regression model using the composite score including the Aggression-Hostility factor may have underestimated the variation in real-life risk-taking accounted for by personality. The implication of this possible underestimation is discussed further in view of the inclusion of self-efficacy in the regression model later.

Zuckerman and Kuhlman (2000) actually found that sex was not a significant predictor of risk when the Impulsive Sensation-Seeking factor was entered into the regression first. We did not explore this option in the current study. Given the significant interactions of age and sex in reported real-life risk-taking and the significant correlation between Impulsive Sensation-Seeking and real-life risk, perhaps the influence of sex may be secondary to risky personality in terms of predicting risk engagement. Further research to confirm changes in female risk-taking, together with personality measures, could investigate a regression model based first on
personality. This model would be appropriate given the closing of the gender gap in adolescent risk-taking behaviours measured in the current study.

A potential critique of the current study is the use of ZKPQ as a personality measure for both age groups when it has not been extensively used with adolescent samples previously. Anecdotally, multiple adolescents sought clarification of word meanings while completing the questionnaire in the current study. It could be presumed that there may have been others that didn’t understand questions but also didn’t seek clarification, potentially distorting their scores. Some studies have recognised this shortfall and simplified wording in light of their adolescent sample (Florsheim, Shiozaki, Hiraoka, Tiffany, Heavin, Hall, Teske, & Clegg, 2008). Further validation of the ZKPQ in adolescent populations should be sought before final interpretation of current research findings into relation between personality factors and risk taking.

Given the lack of a relation between Chicken and real-life risk-taking, it is not surprising that Chicken scores were also not significantly related to personality factors in the current study. Not only were Chicken scores not related to personality factors not typically associated with risk taking; Anxiety and Activity, Chicken scores were also not related to the personality factors that are strongly associated with risk taking; Impulsive Sensation-Seeking, Aggression-Hostility, and Sociability. So what exactly was Chicken measuring if not risk taking or risky personality? Is Chicken measuring some specific influence of peers? If lab-based risk-taking on Chicken isn’t related to personality than this could mean that the presence of peers may be swamping or overwhelming personality. Considering the stability of personality traits, overwhelming personality effects is unlikely and again suggests that Chicken is measuring little to do with real-life risk taking.
Resilience and Self Efficacy

In the current study, we found a significant difference in the ratings of personal resilience between adolescents and adults. Adolescents rated their personal resilience lower than did adults. This difference is to be expected given that adults have had much more life experience through which to develop resilience. We proposed that higher personal resilience would lead to lower risk-taking scores with the idea that resilient participants would be better equipped to resist any peer pressure to engage in risk taking. In contrast, we found no relation between resilience and risk taking on the Chicken measure or on the LEQ. The absence of a relation between resilience and risk suggests that perhaps personal resilience has little to do with engagement in risk behaviours. Resilient participants may be just as happy to take or avoid risks whether peers encourage this behaviour or not.

Given that resilience does not relate to risk taking, how can we use this information to prevent the potentially harmful side effects of adolescent risk-taking? While personal resilience has benefits in other areas, such as successfully adapting after a major life event (Wagnild, 2009), the current study findings are in line with research identifying that education programs which aim to build resilience and empower the individual to 'just say no' to taking risks show no significant long-term effects (Werch, 2002). Furthermore, a meta-analysis of drug prevention programs actually found a significant increase in drug and alcohol use in some individuals following prevention program completion (Werch, 2002). Within these programs, time and resources spent building resilience is likely to be a waste of both. Further development of drug and alcohol prevention and education programs should incorporate other, validated techniques instead of resilience building. Further evaluation of current prevention programmes should also
attempt to elucidate the factors that lead to some individuals increasing their drug and alcohol intake following the programmes.

We also predicted that participants who scored higher on self-efficacy would be less likely to succumb to the effects of peers on the risk-taking task. The self-efficacy questionnaire asked participants to rate their ability to resist peer pressure to engage in risky activities such as smoking, drinking, etc. A high score reflected a higher self-rated ability to resist peer pressure to engage in risky activities. Indeed, the higher the self-efficacy scores, the lower the number of crashes during the Chicken game. The relation between self-efficacy and Chicken is interesting given that the Crashes variable of Chicken was significant in previous studies (Gardiner, 2012). This finding supports our hypothesis that higher self-efficacy would result in lower Chicken scores, however, given the lack of validity of Chicken, further research needs to investigate and corroborate this link.

Self-efficacy scores were also significantly related to the LEQ scores. That is, the higher a participant’s self-rated ability to resist peer pressure, the lower was the participant’s self-reported real-life risk behaviour. The LEQ questions about particular risk behaviours matched the same risk behaviours queried on the self-efficacy questionnaire, for example in the LEQ, participants were asked, “How often do you have a drink containing alcohol?”; correspondingly, in the self-efficacy questionnaire, participants were asked to rate their ability to “Resist peer pressure to drink beer, wine, or liquor.” Did participants who rated their ability to resist peer pressure to do a particular behaviour participate more often in the behaviour in real-life? Examination of the corresponding LEQ and self-efficacy questions on specific activities showed varying degrees of relation between rated ability to resist and reported engagement in
behaviour. For example, on the subject of alcohol, only male participants’ self-rated self-efficacy was related to their reported behaviour. The higher that males rated their ability to resist peer pressure to drink, the lower their drinking scores. Female adolescents exhibited a similar trend that approached significance ($r = -.30, p = .05$).

Interestingly, only adolescents’ self-efficacy on questions regarding illegal behaviours related to engagement in illegal behaviour on the LEQ; for adults, there was no similar relation. The higher that adolescents rated their ability to resist peer pressure, the lower their engagement in illegal activities in real life. We know that, compared to adult antisocial behaviour, adolescent antisocial behaviour is much more likely to occur in the presence of peers (Warr, 2002). The relation between self-efficacy and illegal behaviour in the current study suggests that the real-world association of peers and adolescent antisocial behaviour may not be simply due to an increased amount of time spent with peers during adolescence. The relation between self-efficacy and antisocial behaviour instead indicates a peer presence influence on engagement in illegal behaviour in adolescents and not adults. This interesting association warrants further research in this area with the goal to investigate potential causality and again highlights a potentially important contribution of peers to adolescent risk-behaviour.

There was also an interaction effect in the current study where adolescent females rated self-efficacy lower than adolescent males and this trend was reversed in adults. This finding perhaps reflects that adolescent females already reported higher levels of real-life risk-taking than adolescent males, and, as such, are less likely to resist risk engagement. Self-efficacy scores also had a significant relation with the composite personality measure. The higher the rating of resistance, the less risky were the personality scores. Further regression analysis identified that
the self-efficacy measure actually accounted for aspects of personality, rather than any unique variance of real-life risk taking. Given that our regression model used the composite score of personality, including the Aggression-Hostility factor that was not significant on its own, and likely underestimated the variation accounted for by personality, this measure of self-efficacy may be even less likely to account for any unique variation in real-life risk taking.

There are several factors which must be considered when viewing the self-efficacy results. First, it is impossible in the current study to tell if the ability to resist is influencing the behaviour, or if the lack of engagement in the behaviour is reflected in the self-efficacy ratings. That is, if the individual is already engaging in the behaviour, then they are likely not to bother resisting any peer pressure to engage in that same activity. Or, alternatively, perhaps self-efficacy does encourage less engagement in specific behaviours. It is impossible to imply causality from the questionnaire method in the current study and future exploration of this relation between self-efficacy and real-life risk behaviour would require methodology changes.

Second, there is no emotional stress from peers during the answering of the self-efficacy questionnaire. The participants were separated into different rooms to answer the questionnaires and, as we know, the mere presence of peers activates certain brain areas in adolescents but not in adults (Chein et al, 2010). That is, it may be far easier to state ability to resist on a hypothetical question while in a low emotion, solo environment. It would be interesting in future studies to measure self-efficacy on a questionnaire along with an experimental task designed to replicate peer pressure on behaviour. It may be that incorporating an emotional component to self-efficacy measurement changes results in adolescents but not adults.
Third, again it is impossible to determine causality between self-efficacy and personality due to the questionnaire method we used in the current study. If an individual has a risky personality, then they are not going to bother resisting peer pressure to engage in risk, and likewise if an individual has a non-risky personality, then they will find it easier to resist any peer influence to take part in an activity that they do not want to do anyway. Future research needs to use a unique measure of self-efficacy to tease out any relationship with risk taking above and beyond the influence of personality.

Conclusions

The current study adds to a growing body of research on laboratory-based measures of risk behaviour. In line with previous research, we found no evidence that the Chicken task measures risky behaviour. In the current study, we found no difference between adolescents’ and adults’ performance on Chicken with peers present. Furthermore, performance on Chicken was not related to real-life risk-taking or personality. Careful consideration needs to be given before utilising this task again to measure risk behaviour. The lack of validity of the Chicken task compromises the conclusions drawn in previous research and highlights the need for further development of laboratory-based measures. Development of a valid laboratory-based measure would be a valuable addition to the current body of research on risk taking. Not only could a valid laboratory measure quickly identify individuals at risk of antisocial risk-taking, but a laboratory-based measure could also measure the effectiveness of proposed interventions on risk taking.

Fortunately, our research did identify a potential decline in local adolescent risk behaviour. The current study, along with other recent local research (Gardiner, 2012), describes
a declining trend in adolescent engagement in risk behaviour. This declining trend suggests that perhaps adolescents are not in fact slaves to their immature brain. Presumably, the adolescents in the current study were undergoing the brain development typical of their age but yet still managed overall low risk-taking. Future research should first establish if there is indeed a significant declining trend in risk taking, and if this is independent of any change in adolescent brain development.

The current study did successfully identify some basic group affiliation and peer behaviour differences between adolescents and adults. Adolescents rated group affiliation higher than did adults, reflecting the age-related changes in social affiliation over adolescence. Adolescents also scored lower on risk encouragement and affirmation peer behaviour measures than did adults - an interesting difference given that risk behaviour peaks during adolescence. In fact, we predicted a difference in the opposite direction. That is, we expected adolescent peers to encourage risk and seek affirmation more often than their adult peers, given the age-related changes in social affiliation over the adolescent period of development. Future research needs to validate these peer behaviour measures before the effect of peers on risk taking can be defined. However, the measurement of significant differences warrants further research into environmental effects of adolescent risk-taking.


National Road Safety Committee. (2010). *Further information on the proposal to lower the adult drive limit to BAC 0.05*. Wellington, New Zealand: Author.


Appendix A

LIFE EXPERIENCES QUESTIONNAIRE (LEQ)

We are interested in exploring some of the life experiences of adolescents, and the relationships with their personality traits. The study is for research only, and we are only interested in group statistics not in personal records. You are guaranteed anonymity. No one but the researchers will have access to your records. But if, for any reason, you do not want to answer any or all of the questions below you don't have to. If you feel that you cannot answer any of the questions honestly, we would prefer that you do not answer them at all. If you feel that you can answer all of the questions, this would be very helpful to the research and we would be grateful for your participation. Answer each question by clicking on one of the options below it.

1. **A. Cigarette (Tobacco) Smoking:**
   What is your smoking status?
   0) Never smoked
   1) Used to smoke but quit
   2) Currently smoking but would like to quit
   3) Current smoker, have tried to quit and failed
   4) Current smoker and going to continue smoking

2. **At what age did you begin smoking?**
   4) 11 or younger
   3) 12-13
   2) 14-15
   1) 16-17
   0) 18 or older

3. **Were you aware of the health risks involved with smoking when you started?**
   0) No
   2) Yes

4. **How often had you smoked on school grounds as a student during school hours?**
   0) Never
   1) 1-2 times
   2) 3-4 times
   3) 5-6 times
   4) 7 or more times

5. **B. Other Drugs:**
   How often have you used marijuana or hashish during the past year?
   0) Never
   1) One or two times but did not continue
   2) About once a month
   3) About once a week
   4) More than once a week
6. How often have you used other illegal drugs such as amphetamines, 'P', cocaine, heroin, LSD, ecstasy, magic mushrooms, etc. during the past year?
0) Never
1) One or two times but did not continue
2) About once a month
3) About once a week
4) More than once a week

7. How many different kinds of illegal drugs have you tried at least once?
0) Never used any
1) 1
2) 2
3) 3
4) 4 or more

8. How often have you used legal drugs such as 'party pills', nitrous oxide, 'poppers' (amyl nitrate), etc., during the past year (not including personally prescribed medication or caffeine)?
0) Never
1) One or two times but did not continue
2) About once a month
3) About once a week
4) More than once a week

9. **C. Sexual Behaviour:**
   Have you ever had sex?
   Yes  No  (skips to 13.)

10. With how many different persons have you had sex with during the last 12 mont
0) 1
1) 2
2) 3
3) 4
4) 5 or more

11. When you have had sex, how often did (do) you or your partner(s) use some method of birth control (for example, condoms, pill, IUD, diaphragm)?
0) Always
1) Usually
2) Sometimes
3) Rarely
4) Never

12. When you have had sex, how often did (do) you or your partner(s) use a condom?
0) Always
1) Usually
2) Sometimes
3) Rarely
4) Never

13. **D. Driving:**
   Have you ever driven a vehicle (including motorbikes) on public roads?
   Yes  No  (Skips to 20.)
14. How many times have you driven without a licence, or broken the conditions of a learners or restricted licence (e.g., driven with passengers, or between 10pm and 5am, without someone who has been fully licensed for at least two years supervising)?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

15. Have you ever driven at a speed in excess of 20kmph over the legal speed limit (e.g., 71kmph is a 50kmph zone, or over 120kmph in a 100kmph zone)?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

16. Have you ever run a red light?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

17. How often have you driven a car after drinking more than the legal alcohol limit (the limit for drivers aged 20 years or younger is 0 standard drinks max)?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

18. How often have you driven after you have had four or more alcoholic drinks?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

19. How often have you driven while under the influence of other drugs (e.g., marijuana, amphetamines, LSD etc.)?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

20. How often have you been a passenger in a car with an unlicensed, or a learner/restricted-licensed driver who is breaking the conditions of their licence?
0) Never
1) 1-2 times
2) 3-4 times
3) 5-6 times
4) 7 or more times

21. How often have you been a passenger in a car with an unlicenced or learner/restricted-licensed driver travelling at a speed in excess of 20kmph over the legal speed limit?
   0) Never
   1) 1-2 times
   2) 3-4 times
   3) 5-6 times
   4) 7 or more times

22. How often have you been a passenger in a car with an unlicensed or learner/restricted-licensed driver who has drunk more than the legal alcohol limit (limit for 20yrs and under is 0 drink max)?
   0) Never
   1) 1-2 times
   2) 3-4 times
   3) 5-6 times
   4) 7 or more times

23. How often have you been a passenger in a car with an unlicensed or learner/restricted-licensed driver who was under the influence of other drugs (e.g., marijuana, amphetamines, LSD, etc.)?
   0) Never
   1) 1-2 times
   2) 3-4 times
   3) 5-6 times
   4) 7 or more times

24. E. Other Behaviours (Modified Self-Report Early Delinquency scale)
   For all of the below, have you ever...

25. 'wagged' school?
   0) No
   2) Yes - once
   4) Yes - more than once

26. been suspended or expelled from school?
   0) No
   2) Yes - once
   4) Yes - more than once

27. stolen something from a person or place (including shoplifting)?
   0) No
   2) Yes - once
   4) Yes - more than once

28. illegally damaged property (e.g., arson, vandalism, tagging)?
   0) No
   2) Yes - once
   4) Yes - more than once

29. trespassed or broken into a car or building?
   0) No
   2) Yes - once
   4) Yes - more than once

30. had a fight in a public place (not at home or school)?
   0) No
   2) Yes - once
31. carried or used a weapon for the purpose of defending yourself or attacking others?
   0) No
   2) Yes - once
   4) Yes - more than once

32. thrown objects off a road over-bridge, or sabotaged a road or train track?
   0) No
   2) Yes - once
   4) Yes - more than once

33. been intentionally cruel to animals?
   0) No
   2) Yes - once
   4) Yes - more than once

34. gambled for money?
   0) No
   1) Rarely
   2) Occasionally
   3) Often
   4) More than once a week

ALCOHOL USE DISORDERS IDENTIFICATION TEST (AUDIT)

This questionnaire has been developed by the World Health Organisation to assess alcohol consumption.

One unit of alcohol is: 1/2 pint average strength beer/lager OR one glass of wine OR one single measure of spirits. Note: A can of high strength beer or lager may contain 3-4 units.

Please select your honest answers to the following questions.

1. How often do you have a drink containing alcohol?
   0) Never
   1) Monthly or less
   2) 2-4 times a month
   3) 2-3 times a week
   4) 4 or more times a week

2. How many units of alcohol do you drink on a typical day when you are drinking?
   0) 1 or 2
   1) 3 or 4
   2) 5 or 6
   3) 7, 8 or 9
   4) 10 or more

3. How often do you have six or more units of alcohol on one occasion?
   0) Never
   1) Less than monthly
   2) Monthly
   3) Weekly
   4) Daily or almost daily

4. How often during the last year have you found that you were not able to stop drinking once you had started?
   0) Never
5. How often during the last year have you failed to do what was normally expected from you because of drinking?
[0] Never
[1] Less than monthly
[4] Daily or almost daily

6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?
[0] Never
[1] Less than monthly
[4] Daily or almost daily

7. How often during the last year have you had a feeling of guilt or remorse after drinking?
[0] Never
[1] Less than monthly
[4] Daily or almost daily

8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?
[0] Never
[1] Less than monthly
[4] Daily or almost daily

9. Have you or someone else been injured as a result of your drinking?
[0] No
[2] Yes, but not in the last year
[4] Yes, during the last year

10. Has a relative or friend or doctor or another health worker been concerned about your drinking and suggested you cut down?
[0] No
[2] Yes, but not in the last year
[4] Yes, during the last year
Appendix B

PROSOCIAL RISK QUESTIONS (PRQ)

35. Multiple Response: Please select the listed activities which you participate in.
If you do not participate in any of the activities listed here, simply click "continue" at the bottom of the screen.
1) Extreme skiing/snowboarding
1) Mountain climbing/absailing
1) Contact sports (e.g., rugby, boxing, karate) or sports with a high risk of injury
1) Mountainbiking or extreme skateboarding/biking
1) Racing any form of motorised vehicle (car, motorbike, 4x4 etc)
1) Adventure sports (bungy-jumping, skydiving)
1) Air sports (paragliding, parasailing etc)

36. Please describe any other activities or sports you participate in that might be perceived as "risky" or "thrillseeking" (meaning that they have a potential for serious injury)
If there are no others, just enter "none".

37. How often do you participate in activities or sports that might be perceived as "risky" or "thrillseeking"?
0) Never
1) Rarely
2) Sometimes
3) On a regular basis
4) As often as I can
Appendix C

Collective Self-Esteem Scale (CSES-I)

Please respond to the following statements on the basis of how you feel right now about the group you came with today using the following scale:

1=strongly disagree
2=disagree
3=disagree somewhat
4=neutral
5=agree somewhat
6=agree
7=strongly agree

1. Overall, being a member of my group has very little to do with how I feel about myself.
2. Being a member of my group is an important reflection of who I am.
3. Being a member of my group is unimportant to my sense of who I am.
4. In general, being a member of my group is an important part of my self-image.
Appendix D

Social Identity Scale - Emotional (SIS-E)
Please respond to the following statements on the basis of how you feel right now about the group you came with today using the following scale:

1=strongly disagree  
2=disagree  
3=disagree somewhat  
4=neutral  
5=agree somewhat  
6=agree  
7=strongly agree

1. I would like to continue working with my group.
2. I dislike being a member of my group.
3. I would rather belong to another group.

Modified Group Identification Measure (M-GIM)

Please rate your level of agreement with the following 4 statements using the following scale:

1=completely disagree  
2=disagree  
3=disagree somewhat  
4=neutral  
5=agree somewhat  
6=agree  
7=agree completely

1. I see myself as a member of the group that I came in with today.
2. I am pleased to be a member of the group that I came in with today.
3. I feel strong ties with the people I came here with.
4. I identify with the people I came here with.
Appendix E

ZUCKERMAN-KUHLMAN PERSONALITY QUESTIONNAIRE (ZKPQ)

Read each statement. If it is true or mostly true click "True" and if it is false or mostly false click "False". It is important that you respond to all of the answers, even if you are uncertain of your answer.

1. I am an impulsive person
   True False
2. I often feel unsure of myself
   True False
3. I can't help being a little rude to people I don't like.
   True False
4. I like to keep busy all of the time.
   True False
5. I am a very sociable person.
   True False
6. I enjoy getting into new situations where you can't predict how things will turn out.
   True False
7. I frequently get emotionally upset.
   True False
8. When I get mad I say ugly things.
   True False
9. I like to wear myself out with hard work or exercise.
   True False
10. I tend to be uncomfortable at big parties.
    True False
11. I prefer friends who are excitingly unpredictable.
    True False
12. I tend to be oversensitive and easily hurt by thoughtless remarks and actions of others.
    True False
13. I have a very strong temper.
    True False
14. When I do things I do them with lots of energy.
    True False
15. I tend to start conversations at parties.
    True False
16. I often get so carried away by new and exciting things that I don't think of possible complications.
    True False
17. I often think people are better than I am.
    True False
18. If people annoy me I do not hesitate to tell them so.
   True  False

19. I like to be doing things all the time.
   True  False

20. At parties, I enjoy mingling with people whether I already know them or not.
   True  False

21. I like "wild" and uninhibited parties.
   True  False

22. I often worry about things that other people think are unimportant.
   True  False

23. I am always patient with others, even when they are irritating.
   True  False

24. I lead a busier life than most people.
   True  False

25. Generally, I like to be alone so I can do things I want to do without social distractions.
   True  False

26. I would like to live a life on the move, with lots of change and excitement.
   True  False

27. I don't let a lot of trivial things irritate me.
   True  False

28. When people shout at me I shout back.
   True  False

29. I like complicated jobs that require a lot of effort and concentration.
   True  False

30. I probably spend more time than I should socialising with friends.
   True  False

31. I often do things on impulse.
   True  False

32. I often feel uncomfortable and ill at ease for no reason.
   True  False

33. When I am angry with people I do not try to hide it from them.
   True  False

34. I do not feel the need to be doing things all the time.
   True  False

35. I usually prefer to do things alone.
   True  False

36. I have high self esteem
   1  2  3  4  5

   Not very true of me    Very true of me
Appendix F

Resilience Scale

Use the scale outlined below to describe how you feel right now (even if you have felt differently at other times).

1=strongly disagree
2=disagree
3=disagree somewhat
4=neutral
5=agree somewhat
6=agree
7=strongly agree

1. When I make plans I usually follow through with them.
2. I usually manage one way or another.
3. I feel proud that I have accomplished things in my life.
4. I usually take things in my stride.
5. I am friends with myself.
6. I feel that I can handle many things at a time.
7. I am determined.
8. I have self-discipline.
9. I keep interested in things.
10. I can usually find something to laugh about.
11. My belief in myself gets me through hard times.
12. I can usually look at a situation in a number of ways.
13. My life has meaning.
14. When I am in a difficult situation, I can usually find my way out of it.
15. I have enough energy to do what I have to do.
Appendix G

Self-Efficacy Scale (M-SRE)

Rate your current degree of confidence by recording a number from 0 to 100 using the scale given. Please answer in terms of how you feel right now, i.e., at this moment in time, even if you have felt differently at other times:

0 10 20 30 40 50 60 70 80 90 100

*I cannot* Moderately *Highly sure*

*do at all* sure I can do I can do

1. Resist peer pressure to do things in school that can get me into trouble
2. Stop myself from skipping school when I feel bored or upset
3. Resist peer pressure to do things that can get me into trouble with the law
4. Resist peer pressure to smoke cigarettes
5. Resist peer pressure to drink beer, wine, or liquor
6. Resist peer pressure to smoke marijuana
7. Resist peer pressure to use pills (uppers, downers)
8. Resist peer pressure to have sexual intercourse
9. Control my temper
Appendix H

Demographic Form

Before you begin the following questionnaires, I’d like to know a little bit about you. You will not be identified by any of the information you give here as it is merely demographics information for statistical purposes.

Please answer as openly and honestly as you can for all questionnaires, you will not be singled out or judged on any of your responses.

1. Gender
   Male   Female

2. What age are you now?

3. Are you a resident of Dunedin?
   Yes   No

4. What type of accommodation do you live in?
   Flatting with friends   Living with parents   Living with partner
   Hostel/Hall of Residence   No fixed abode   Other

5. If other, please describe your current accommodation

6. What age were you when you left school?

7. What is your current employment situation? You can select all that apply.
   Polytechnic student   University student   On a benefit
   Apprentice   Unemployed   Other

8. What is your job?

9. How many hours do you work on average each week?

10. If you ticked ‘other’ as your employment situation, please describe (If you did not select ‘other’ please type “none” in the space provided).

11. Are you a parent?
   Yes   No
### Appendix I

#### Complete Correlation Matrix

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<th>Real-life Risk-taking</th>
<th>Chicken</th>
<th>Group Affiliation</th>
<th>Personality (ZKPQ)</th>
<th>Peer Behaviour</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosocial Risk</td>
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<td></td>
<td></td>
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<tr>
<td>Composite Score</td>
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<tr>
<td>Crashes</td>
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<td>-.01</td>
<td>.29**</td>
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<tr>
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<td>-.18*</td>
<td>-.13</td>
<td>.01</td>
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<td>.00</td>
<td>-.02</td>
<td>.24**</td>
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<tr>
<td>SIS-E</td>
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<td>-.20*</td>
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<td>-.10</td>
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<td>.30**</td>
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<td>.10</td>
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**p < .01, *p < .05