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FINAL REPORT

"A Population Health Perspective on Gambling."

Bryan Rodgers, Tanya Caldwell and Peter Butterworth

Contents

Executive summary

In recent years, a population health approach to gambling has brought about an expansion of the literature on prevalence of problem gambling in the general population, comorbidity with mental disorders and other problems, and quantification of the burden of problem gambling on society. These developments are similar to previous progress in relation to alcohol use. However, the most obvious difference between approaches in these two areas is that the gambling literature shows comparatively little interest in the measurement of gambling participation or the use of such measures in predicting social, psychological and health outcomes. As a consequence, there are no guidelines for responsible or safe gambling that mirror guidelines for responsible alcohol consumption. The gambling field has not adequately considered exposure to gambling at the individual level or assessed behaviours that pose risks for future problems. The concepts of risk and of pathological outcome have been viewed as part of the same continuum, rather than requiring independent conceptualisation and measurement.

The distinction between gambling participation and problem gambling is clear in the present research literature on the characteristics of gamblers and the known risk factors for problem gambling. The epidemiology of problem gambling is very different from that of gambling participation. There is some indication that factors predictive of *frequent* gambling are more similar to risk factors for problem gambling, but it is also clear that problems are not a simple consequence of gambling too often or for too long. We therefore need to understand factors that predict level of gambling activity as well as risk factors which convert non-problem gambling into problem gambling. The present study represents a part of this task. Its aims were formulated as four connected research questions:

(1) What demographic and socioeconomic factors are related to gambling participation and which are significant independent predictors?

(2) What demographic and socioeconomic factors are associated with how often people gamble and how much time they spend gambling?

(3) What demographic and socioeconomic factors are predictive of main gambling activity?

(4) What is the nature of associations linking psychological, social and health outcomes to frequency of gambling, time spent gambling, and main type of activity?

These questions were addressed using data from the PATH Through Life Project. This is a longitudinal study of three age cohorts in the Canberra region that were first interviewed when 20-24y, 40-44y, and 60-64y. Four years later, Wave 2 interviews were conducted with almost 90% of the Wave 1 participants, including questionnaire items on gambling participation in the

past year. These items covered frequency of gambling across all activities, type of main gambling activity, frequency of main gambling activity, and duration of sessions of main activity (excluding lottery games and buying scratch tickets). The study also collected a wide range of information on demographic and socioeconomic characteristics, social relationships, life events, mental health, common forms of substance use and physical health. The information used in this report was provided by respondents undertaking a self-complete questionnaire using a notebook computer. The analyses were based on 6,596 participants across the three age groups.

Analyses of predictors of gambling behaviour were conducted using a mixture of logistic, multinomial logistic, and analysis of variance models. These analyses identified the demographic and socioeconomic characteristics that were significantly associated with and independently predictive of gambling participation (monthly or more), days of gambling per month, hours spent gambling per month, and type of main gambling activity. Where permitted by statistical power, differences across age groups and between men and women were modelled and tested using appropriate interaction terms. Models predicting gambling days per month and hours per month were also repeated with the inclusion of dummy variables representing type of main activity to see whether this could mediate the predictive power of demographic and socioeconomic factors.

Analyses of social, psychological and health outcomes related to gambling days per month and hours per month were conducted using a combination of linear regression (with addition of quadratic terms) and lowess curve fitting for all dependent variables measured on continuous scales. The purpose here was to ascertain whether dose-response relationships could be represented as a linear form and to describe the shape of any departures from linearity. As there is no possibility of using multiple independent variables when fitting lowess curves, we initially used linear regression to estimate the effects of sex, age and education on each dependent variable and then used the residuals from these analyses as dependent variables for curve fitting. This effectively adjusts for those demographic predictors when investigating the relationship between level of gambling participation and each of the social, psychological and health outcomes. It was possible, given the sample size, to fit separate curves for those whose main activity was playing poker machines, those whose main activity was lottery games or scratch tickets, and for an 'other' group, covering betting on races and other sports events, keno, table games, card games and bingo. Additional logistic regression analyses were carried out for use of illicit substances in the 24-28y group.

In regard to the characteristics of people who gamble, this study has shown that:

- Sex, age and education are predictors of gambling participation.
- In middle-age, education is strongly related to frequency of participation amongst gamblers.
- Once sex, age and education are taken into account, few other demographic or socioeconomic factors are related to participation.
- Playing poker machines as a main gambling activity (relative to lottery games and scratch tickets) is more common in those with lower education. In young people, it is also associated with being male and not being married. In middle-aged people, it is associated with not owning or buying a home.
- Gambling days and gambling hours per month are related to sex, age and education irrespective of main type of activity.

In regard to social, psychological and health outcomes, most outcomes are significantly related to level of gambling activity, although measures of positive social support and childhood adversity are typically not. Significant relationships with days and hours per month gambling are predominantly of a monotonic nature – poorer outcomes are seen with increasing levels of participation. The only non-monotonic relationships (found for smoking and physical health) showed steeper gradients across lower levels of participation with a plateau at higher levels. In no instance, across many analyses, were recreational gamblers found to be better off than non-gamblers in respect of social, psychological or health measures.

Comparing across outcome measures, the strongest relationships with level of gambling activity were seen for smoking and alcohol consumption. Other highly significant and meaningful associations were found for recent stressful life events, depression, anxiety, and self-reported physical health. Relationships were less strong for the group who identified lottery games or scratch tickets as their main activity, but were still seen to some degree for depression, anxiety and alcohol consumption. The only other substantial difference across main type of activity was a much stronger association of cigarette smoking with gambling hours per month in poker machine players compared with the 'other activities' group.

This study indicates the value of measuring level of gambling participation on continuous dimensions. The results represent a useful first step in utilising such measures to help identify levels of responsible gambling; distinguishing risky levels that may lead to future problems.

Such an approach is complementary to the recent focus on defining and measuring problem gambling. It would add to opportunities for developing secondary prevention and health promotion strategies, with the goal of reducing the incidence of personal and social problems arising from gambling behaviour.

1. Introduction

Background

In recent years there have been significant attempts to bring a population health perspective to bear on gambling research and policy (Messerlian et al., 2005, Korn et al., 2003, Shaffer and Korn, 2002, Bondolfi and Ladouceur, 2001). This has contributed to a rapid expansion in the literature relating to problem gambling, including studies of prevalence in the general population (Shaffer and Hall, 2001), comorbidity with mental health disorders and (to a lesser extent) physical health (Petry, 2007, Petry et al., 2005, Shaffer and Korn, 2002, Pietrzak et al., 2005), and consideration of methods to quantify the burden of problem gambling at the population level (Eadington, 2003, Walker, 2003, Collins and Lapsley, 2003). As an introduction to the present study of (1) demographic and socioeconomic characteristics of gamblers and (2) social, psychological and health correlates of gambling participation in a general population sample, we compare and contrast approaches taken in the recent gambling literature with parallel developments in the literature on alcohol use, where population health approaches have a longer history.

There are many similarities in the literature relating to gambling and that applying to substance use, especially alcohol use. These similarities are seen in regard to research findings and to policy discussions, covering treatments for pathological conditions (sometimes labelled as 'addictions') and opportunities for prevention and early intervention. Criteria for the diagnoses of alcohol use disorders and for pathological gambling are found in the substance-related disorders and the impulse control disorders sections of DSM-IV-TR respectively (American Psychiatric Association, 2000). Pathological gambling is a relative newcomer to the classificatory scheme. It first featured in DSM-III in 1980 (American Psychiatric Association, 1980) and, since then, several of the diagnostic criteria have followed the form of the criteria for alcohol dependence. Currently, both disorders include features of tolerance, withdrawal, loss of control (including happening more often, persisting for longer than intended, or unsuccessful attempts to abstain or cut down), time spent in trying to obtain the substance/activity, and, of course, social or occupational consequences of the activity.

Within English-speaking countries, and many others besides, alcohol use and gambling are ubiquitous. Almost all people drink alcohol or gamble at some point in their lives and, at any point in time, the majority of people report having done so in the last 12 months. While there are regulatory frameworks for both activities, notably in regard to the minimum age of participation, both are widespread across jurisdictions. They each provide substantial revenue

for governments, either directly (e.g. profits from publicly owned lotteries) or through taxation, and they contribute to national economies as significant components of service industries. In 2004-05, government revenue and taxes from gambling (excluding GST) amounted to $4.45b (Australian Gaming Council, 2007b), representing 1.6% of all Australian taxes and 10.7% of state and territory taxes (Australian Bureau of Statistics, 2007). Alcohol taxation revenue for the same period amounted to $4.15b (excluding GST), representing 1.5% of all government taxes (Distilled Spirits Industry Council of Australia, 2006). In respect of the Australian national economy, gambling turnover in 2004-05 was estimated as being $142.8b (Australian Gaming Council, 2007b). The Australian population was estimated as losing $16.9b on gambling, equivalent to 3.05% of all disposable household income or $1097 per capita (Australian Gaming Council, 2007a).

The broader costs of problem gambling and problem drinking are, however, substantial and attempts have been made to quantify the resulting harm for individuals who are affected directly, the toll on their families, and the wider burden on society through funding of services and social and economic consequences. In Australia, the Productivity Commission (1999) estimated the 1997-98 annual cost of problem gambling to be between $1.8b (conservative) and $5.6b. These estimates included financial losses, reduced productivity, and crime, other legal, personal, family, and treatment costs. By comparison, the cost to the community of alcohol related problems for 1998-99 has been estimated at $7.6b (Ministerial Council on Drug Strategy, 2006).

For all these similarities, there is one striking difference between the conceptualisation of gambling behaviour and alcohol use that runs through the literature spanning research, policy and intervention. In the case of gambling, the focus on defining and measuring *problem* gambling has dominated recent discussion and thinking. While there have been many attempts to convey the idea that problem gambling should be viewed as a continuum, the concept has intrinsic features which constrain its utility. This arises from the fact that the envisaged continuum is typically restricted to a gradation of the component parts that constitute problem gambling, i.e. signs and symptoms. Whilst a parallel is found in measures of drinking problems, these are complemented by the use of other measures of drinking behaviour. The latter have taken several forms, the most commonly used being frequency of drinking, amount consumed on drinking occasions, and average consumption levels (e.g. per week). In recent times, measures of consumption on particular occasions have been aligned with the concept and definitions of binge drinking (Stockwell et al., 2002, Dawson et al., 2008).

Consumption levels and binge drinking are utilised not only in alcohol-related research but are also now the cornerstone of guidelines for responsible drinking, in Australia and elsewhere (National Health and Medical Research Council, 2001). There have been no comparable developments in regard to the conceptualisation, measurement, and recommended safe levels of gambling participation. If anything, the increased focus on problem gambling has seen a reduction in interest in other measures, such as frequency of gambling. Some research reports utilise the amount of money spent by individuals or households on gambling, either in cash terms or expressed as a proportion of total income or total expenditure (Worthington et al., 2007, Welte et al., 2004, Currie et al., 2006), but these constitute a small proportion of the literature. Consequently, gambling research and the application of research findings to policy and service delivery are restricted by the tools currently in common use. The development of strategies for prevention and early intervention in relation to alcohol utilise distinct concepts of risk on the one hand (i.e. thresholds for short-term and long-term risky drinking) and outcomes on the other hand (i.e. problems/pathology) whereas the equivalent concepts in relation to gambling have become one and the same thing.

The most evident and important constraints emanating from the failure to distinguish risk and problems in the gambling sphere are as follows.

- Where a categorical approach is taken to the definition of problems, the prevalence of pathological or problem gambling is typically low, e.g. between 0.5% and 5% depending on operational criteria (Shaffer and Hall, 2001). The corollary of this approach is that the majority of the population is assumed not to have difficulties or to be at risk of difficulties.
- Even if problem gambling is viewed as a continuum, its measurement is a combination of gambling behaviour and related outcomes. For example, the Canadian Problem Gambling Index (CPGI) includes an item on health problems arising from gambling, including stress and anxiety, so that any separate measure of comorbid anxiety will necessarily be correlated with the CPGI score. Such confounding of measures is problematic.
- Both empirically and conceptually, the gambling literature does not adequately address what would be labelled ‘exposure’ in other areas of epidemiology. We are not referring here to exposure at the ecological level, such as proximity to gaming facilities, but to exposure at the individual level such as frequency and intensity of gambling. These measures could provide the equivalent of drinks per week or frequency of binge drinking in the literature relating alcohol use to a wide range of health outcomes. Gambling research tells us little about dose-response relationships simply because independent measures of doses and responses are not fully developed and utilised.

Acceptance of these constraints does not carry any implication that measures of problem gambling are flawed. The instruments currently in use are, in fact, valuable and increasingly sophisticated indicators of the construct they were designed to measure and the rapid expansion of the research literature on pathological gambling (Dickerson and Baron, 2000) is a testimony to their contribution. Difficulties arise, however, if we expect these measures to achieve things they were not designed to do, notably to serve as indicators of individual exposure. What is needed is the complementary use of other measures of gambling participation, just as the literature on alcohol use has separate measures of drinking behaviours and problem drinking. At present, few studies report findings related to frequency or intensity of gambling behaviours, although it appears that such data are often collected. What gains might be expected if increased emphasis were placed on these additional measures? The following is not a comprehensive list but gives some examples of how research evidence could be enhanced in certain important areas.

1) Natural history of gambling behaviour and problems

Several studies have reported on continuities and discontinuities in problem gambling over time. Although the interpretation of these findings is contentious, the results overall indicate that problem gambling is more transient than has often been assumed (Abbott et al., 2004, Afifi et al., 2006, Slutske et al., 2003). However, such findings leave doubt as to whether changes over time reflect changes in individuals' gambling frequency and intensity or whether their underlying behaviour remains similar but the problems arising from it are responsible for change. We also have little empirical evidence to determine what level of gambling behaviour at one point in people's lives is indicative of the onset of problem gambling at a later point.

2) Predictors of gambling behaviour and problems

The current literature provides a wealth of evidence on risk and protective factors for development of gambling problems, covering demographic and socioeconomic factors, personality, mental health, risk-taking behaviour and other personal, family and neighbourhood characteristics. However, we typically do not know how much of these associations are due to influences on gambling participation and how much they arise from factors that convert non-problematic gambling into problem gambling. The use of separate measures of participation and problems can help determine at what stage of the process risk factors exert their influence.

3) Dose-response relationships

Many studies have investigated the co-occurrence of social, psychological and health outcomes with problem gambling, referred to as *comorbidity* in the instance of mental health problems. This body of research has shown that many other problems are associated with problem gambling, including substance use disorders, affective disorders, anxiety disorders and personality disorders. When problem gambling is assessed as a dichotomy, these research findings tell us little about the form of the relationship between such a measure and other outcomes. Furthermore, even if problem gambling is conceived of and assessed as a continuum, the nature of the measure precludes analyses of whether some levels of gambling participation might have neutral or even beneficial consequences for social and psychological wellbeing. The use of other measures of gambling behaviour, such as frequency, duration of sessions, and money spent on gambling, opens up the opportunity to investigate linear dose-response relationships, threshold relationships or other patterns of association.

The study reported here could not address all of the above topics but it was possible to make an initial contribution to some of these issues, specifically to the investigation of demographic and socioeconomic factors related to gambling participation and to the delineation of dose-response relationships between participation and other social, psychological and health outcomes. This was feasible using information gathered by the Canberra region PATH Through Life Project as part of its Wave 2 data collection. The information included questions on frequency of gambling in the past 12 months, main gambling activity, and time spent on main gambling activity (where appropriate). Before outlining the aims of the present study and presenting the findings, the following three sections summarise the relevant international research literature on (1) predictive factors for gambling, (2) relationships with other psychological, social and health outcomes, and (3) the significance of type of gambling activity.

Previous research on predictive factors for gambling

The following is a summary of the main research findings on demographic, socioeconomic and other factors related to gambling participation and problem gambling, emphasising characteristics that are most pertinent to the present study.

Many studies have reported differences between men and women in the likelihood of gambling participation and various levels of problem and at-risk gambling; the important issue is not whether there are statistically significant differences but how large the differences are. Large

scale general population studies in English-speaking countries and several European countries have found that men are more likely to gamble than women, but not strikingly so. Reworking figures from the National Gambling Survey (NGS) conducted by the Australian Productivity Commission in 1999, 82.8% of men and 80.3% of women had participated in at least one gambling activity in the past year (Productivity Commission, 1999). In the U.S. Gambling Impact and Behavior Study (GIBS) of 1998, 66.8% of men and 59.3% of women reported gambling in their lifetime (Potenza et al., 2006). The subsequent National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) conducted in 2001-2 reported a separate analysis on participants aged 60 years or more found that 35.5% of older men were gamblers compared with 22.5% of older women (Pietrzak et al., 2007). In the Canadian Community Health Survey (CHS) 2002, 78% of men and 73% of women had gambled in the past year (Marshall and Wynne, 2003). A Norwegian telephone survey found 74.5% of men and 62.7% of women gambled at least sometimes (including less than weekly) (Gotestam and Johansson, 2003).

When pathological or at-risk gambling is considered, sex ratios are more pronounced. The Australian NGS 1999 identified 2.53% of men and 1.63% of women to be problem gamblers (SOGS score of 5+). Lifetime pathological gambling in NESARC was 0.64% in men and 0.23% in women (Blanco et al., 2006), with a further 1.25% and 0.51% respectively identified as problem gamblers (Morasco and Petry, 2006). Adding in those with sub-clinical problems (i.e. any problem item endorsed) brought the totals to 7.43% for men and 3.48% for women (Blanco et al., 2006). The Canadian CHS 2002 used a graded classification of at-risk and problem gambling in the past year. The 6.1% of men and 3.5% of women falling into these categories were subdivided as: 3.5% and 2.1% respectively were low at-risk; 2.1% and 1.0% were moderate at-risk; and 0.5% and 0.4% were problem gamblers (Marshall and Wynne, 2003). In Norway, 0.21% of men and 0.09% of women were identified as pathological gamblers and a further 0.74% and 0.19% respectively as at-risk gamblers (Gotestam and Johansson, 2003). Combined problem and pathological gambling in a Swedish national survey was estimated at 6.3% for male *gamblers* and 1.8% for female *gamblers* (Volberg et al., 2001). The gamblers (lifetime) in this study comprised around 95% of the total sample.

Participation in gambling is not strongly related to age across most of the adult age span, but it typically declines after about age 65 (Marshall and Wynne, 2003, Pietrzak et al., 2007, Potenza et al., 2006, Desai et al., 2004, Productivity Commission, 1999). The Australian National Gambling Survey 1999 showed very little variation in gambling participation across age groups between 18 years and 64 years (82% to 85%) but the level dropped to 70% in those aged 70

years and over. The NESARC study showed a progressive drop in gambling from 31.7% of 60-69-year-olds to 15.5% of 90-100-year-olds (Pietrzak et al., 2007), although the absolute rates will be lowered and the gradient steepened by the longer survival of women which was not corrected for in these findings. It is more difficult to determine age differences at the younger end of the spectrum because studies of adolescents are typically conducted separately, using different sampling frames and often different questionnaire items from studies of adults. However, the Canadian CHS 2002 (Marshall and Wynne, 2003) included and reported on the 15-17 year age group and found substantially lower participation compared with those age 18-24 years (50% vs 73% in males and 34% vs 68% in females).

The pattern of *problem* gambling by age differs across studies. In the Australian NGS 1999, prevalence of problem gambling was higher in the 18-24 year group (4.1%) and the 25-29 year group (3.3%) than in the groups between 30 and 60 years (range 1.4% to 2.2%) and it was lower in older adults, falling to 0.4% of those aged 70 years or more (Productivity Commission, 1999). The U.S. NESARC sample provides estimates of disordered gambling (a combination of pathological and problem gamblers), showing very similar rates in adult age groups between 18 and 60 years (range 1.4% to 1.6%) and then dropping off to about 0.4% in the over 90s (Morasco and Petry, 2006, Pietrzak et al., 2007). For adolescents, estimates of problem gambling from meta-analyses consistently show *higher* prevalence compared with adults (Shaffer and Hall, 2001), contrasting with their lower participation rates mentioned above.

It should be kept in mind that age trends in cross-sectional surveys may reflect developmental age changes, cohort differences or a combination of both. At older ages, differential survival adds to observed cohort differences. Ideally, longitudinal studies would enhance information obtained from cross-sectional surveys, but gambling research is in its infancy in this regard.

Significant ethnic differences have been reported for gambling participation and problems, although it is difficult to generalise findings across countries for obvious reasons. In the Australian NGS 1999, about 70% of people who regularly spoke a language other than English at home were gamblers compared to 82% of others. Participation in Aboriginal and Torres Strait Islander people is estimated at 88% compared with 81% of non-Indigenous people. Estimates of problem gambling from the same survey are around 3.0% of those speaking a language other than English at home compared with 1.9% of others, and 3.3% of Indigenous people compared with 2.1% of non-Indigenous people. In the U.S. GIBS, participation was lower in African American people and somewhat higher in Hispanic people compared to the population as a whole (Potenza et al., 2006, Desai et al., 2004). However, whilst based on a

different sample, pathological and problem gambling in NESARC was of substantially *higher* prevalence in African American people and significantly *lower* in Hispanic people (Morasco and Petry, 2006). Of more direct relevance to the Australian context, the combination of problem and pathological gambling in the NESARC sample was 2.2% for people of Asian origin and 2.3% for Native Americans compared with 1.8% in the total population (figures not available for participation in these groups). In the Canadian CHS 2002, combined at-risk and problem gambling was reported for 18.5% of Aboriginal *gamblers* compared with 6.2% of non-Aboriginal *gamblers* (Marshall and Wynne, 2003). One review of five North American studies specifies odds ratios of between 2.2 and 4.98 for the prevalence of problem gambling in Aboriginal populations (relative to the non-Aboriginal population) and between 4.14 and 15.69 for pathological gambling (Wardman et al., 2001).

For the remaining demographic and socioeconomic factors reviewed here, it needs to be born in mind that the direction of influence is unknown. For example, a relationship between being divorced and problem gambling could reflect a causal effect of the former on the latter, a reverse-causation effect, or the impact of other common factors on both divorce and problem gambling. In general, gambling participation is elevated in groups with higher socioeconomic status. Gamblers are less likely to have poor education, less likely to be unemployed, and less likely to have low incomes than non-gamblers (Potenza et al., 2006, Desai et al., 2004, Gotestam and Johansson, 2003, Pietrzak et al., 2007). These trends are seen in the Australian National Gambling Survey 1999, although they are less pronounced than found in the U.S. In contrast to the relationship for participation, problem gamblers in Australia and the U.S. are more likely to have poor education and they have lower incomes (Desai et al., 2004, Pietrzak et al., 2007, Morasco and Petry, 2006, Productivity Commission, 1999). The relationship between problem gambling and employment status appears not to be reported from the U.S. NESARC study but, in Australia, those whose main source of income was unemployment benefit had an elevated risk of problem gambling (Productivity Commission, 1999). Problem gambling was not related to education or employment status in a Norwegian study, but only 12 problem gamblers were identified in this sample, compromising statistical power (Gotestam and Johansson, 2003). In Canadian and Swedish studies, problem and pathological gamblers were more likely to have low education compared with non-problem gamblers (Volberg et al., 2001, Marshall and Wynne, 2003).

Marital status is another factor examined across studies of gambling participation and problems. Findings for participation are not striking; showing that those in married or de facto relationships are somewhat less likely to gamble than others (Desai et al., 2004, Gotestam and

Johansson, 2003, Productivity Commission, 1999) and that this difference may be more evident in men than in women (Potenza et al., 2006). Problem gambling, however, is much more strongly related to not having a current spouse or partner and is particularly prevalent in the divorced or separated category in U.S. studies (Pietrzak et al., 2007, Morasco and Petry, 2006). In Australia, problem gambling is associated with single status as well as with being divorced or separated, and the strength of the former link could well be a reflection of the comparatively high level of problem gambling in younger Australians commented on above (Productivity Commission, 1999). Any association with widowhood is difficult to ascertain from the literature because of the sex ratio in this group, i.e. many more women than men. In a Swedish study, problem gambling amongst the gambling population was more strongly related to being unmarried than to separated or divorced status, but the very large numbers in the unmarried category suggests that this was based on a definition of legal marital status and therefore included many people who had lived in de facto relationships (Volberg et al., 2001).

Taking an overview of the literature on demographic and socioeconomic factors, the most obvious conclusion is that the epidemiology of gambling participation is very different from that of problem gambling. Aside of the decline in both participation and problems across older adult age groups, every other factor reviewed shows marked differential relationships for these two components of gambling behaviour. This review did not cover studies of factors related to level of participation, primarily because so little has been published on this. However, the Australian NGS 1999 provided useful comparisons of non-regular gamblers with regular gamblers (i.e. gambling at least once per week). The latter were more likely to be male, less likely to be middle aged, less likely to be married, and more likely to have poor education. This indicates that risk factors for more frequent participation are similar to those identified above as risk factors for problem gambling. However, this is unlikely to be the complete explanation of the factors predictive of problem gambling. A general population survey of South Australia carried out in 2001 reported on risk factors which discriminated problem gamblers from regular (i.e. fortnightly or more often) gamblers and many significant differences were found in bivariate analyses, including age, never being married, part-time employment, living in rented accommodation, and living in areas in the lowest SEIFA quintile (Gill et al., 2006). Problem gamblers did not differ from other regular gamblers in respect of sex or education.

The obvious gaps in the existing literature are: (1) the absence of studies that report on factors related to levels of gambling participation; and (2) the failure to utilise methods of multivariate analyses in models predicting gambling participation. On the second of these issues, the literature review of Australian research conducted by Delfabbro and LeCouteur (2003)

remarked on how little had been done by way of examining the statistical overlap between identified risk factors for problem gambling. Their view was that almost all risk factors would be non-significant once sex and age had been taken into account but some of the findings reported from the South Australia survey do not bear this out (Gill et al., 2006).

Previous research on comorbidity and psychosocial outcomes

In regard to mental health disorders, problem gambling has been linked with mood disorders, anxiety disorders, substance use disorders, and personality disorders. The most comprehensive view of these associations within a single study comes from the NESARC study. This survey identified 195 pathological gamblers in a total sample of 42,898 (lifetime prevalence of 0.42% by DSM-IV criteria, adjusted for design factors). Crude odds ratios for other types of disorder were 6.3 for any alcohol use disorder, 5.4 for any drug use disorder, 7.2 for tobacco dependence, 4.1 for any mood disorder, 3.4 for any anxiety disorder, and 9.1 for any personality disorder. Within categories of disorder, there were some notable variations. Particularly, a large difference found between alcohol abuse and alcohol dependence (ORs of 1.6 and 6.5 respectively), an especially strong link with mania within the mood disorders category (OR of 8.9), and variation within the personality disorder category (from 4.7 for obsessive-compulsive to 8.3 for both histrionic and antisocial personality disorders). There were several examples where associations were significantly stronger for women than for men, i.e. alcohol dependence, any drug abuse, tobacco dependence, major depressive episode, and generalised anxiety. It should be born in mind that the lifetime prevalence of pathological gambling was lower in women than men (0.23% vs 0.64%) and that it is common to find higher ORs for groups with lower baseline prevalence.

These findings confirm earlier general population surveys (Cunningham-Williams et al., 1998) and findings from studies of clinical samples. A high prevalence of gambling disorders has been found in patients receiving treatment for mood disorders and a high prevalence of mood disorders has been found in those being treated for gambling problems (review by Kim et al., 2006). The same pattern has been observed in relation to treatment for alcohol use disorders and other substance use disorders (reviews by Grant et al., 2002, Petry, 2007). These reviews and other studies indicate that the comorbidity linked with pathological gambling is found across locations, e.g with alcohol abuse and dependence in Korea (Cho et al., 2002), and there is no reason to expect a different pattern in Australia. Clinical studies in this country have identified high rates of personality disorders (Blaszczynski and Steel, 1998), substance use

disorders (Maccallum and Blaszczynski, 2002) and criminal behaviour (Blaszczynski and McConaghy, 1994) in people being treated for gambling problems (see Delfabbro and LeCouteur, 2003 for other studies). In general, comorbidity is observed across age groups (e.g. Pietrzak et al., 2007). One area that has produced less consistent findings is the association between gambling and suicidality, where null and significant results have been reported from studies of suicidal ideation and attempts (Cunningham-Williams et al., 1998, Feigelman et al., 2006, Newman and Thompson, 2003) and inconclusive findings have been reported for completed suicides (Shaffer and Korn, 2002).

High rates of partner's problem gambling were reported in a study of women presenting at a hospital Emergency Department who had experienced intimate partner violence (Muelleman et al., 2002) and very high prevalence estimates of problem gambling have been obtained from correctional populations (Shaffer and Korn, 2002). One study in the Australian Capital Territory (the area from which the sample used in this report was obtained) used the South Oaks Gambling Screen (SOGS) to identify gambling problems in adults attending correctional centres, including those on remand, serving community service orders or periodic detention, or on probation or parole (Lahn, 2005). SOGS scores of five or more were found in 34% of the sample, 16 times the prevalence in the Australian general population.

Several studies have reported poorer self-rated physical health in problem gamblers. This was confirmed recently in the NESARC sample but effect sizes for pathological gamblers were very small across measures from the SF-12 (Morasco and Petry, 2006). However, more substantial differences were reported for several specific conditions: tachycardia, angina, cirrhosis and other liver disease. These differences were substantially reduced but not fully accounted for when adjustment was made for behavioural risk factors, including substance use. The Canadian Community Health Survey 2002 reported that 22% of problem gamblers rated their health as poor or fair compared with 11% of non-problem gamblers (Marshall and Wynne, 2003).

When attention is moved away from measures of pathological gambling and the variously defined categories of problem or at-risk gambling, there is a paucity of evidence linking gambling participation to health and psychosocial outcomes in the general adult population. The majority of studies of this type have used either adolescent or older adult samples. Notable exceptions are a report from the St Louis site of the Epidemiologic Catchment Area Study (Cunningham-Williams et al., 1998) and two recent reports from the U.S. GIBS study (Desai et al., 2004, Potenza et al., 2006) that contrasted characteristics of non-gamblers and recreational gamblers as two discreet groups, after the exclusion of pathological and problem gamblers. The

St Louis study found a significantly higher prevalence of major depression, dysthymia, somatisation syndrome, antisocial personality disorder, alcohol use, alcohol abuse/dependence disorders, nicotine use and nicotine dependence in recreational gamblers compared with non-gamblers (Cunningham-Williams et al., 1998). Results for women in the GIBS study showed significantly higher levels of past year alcohol use and past year drug use in recreational gamblers (Potenza et al., 2006). Similar findings were reported for men with the addition of significant differences for alcohol abuse/dependence, other substance abuse/dependence, lifetime depression, and lifetime incarceration. (The latter showed elevated odds ratios in women also, but the much lower base rates for female incarceration meant that the difference was only statistically significant in men). Set against the differences in mental health, recreational gamblers were *more* likely to rate themselves as having good or excellent general health in the past year compared with non-gamblers but this was only significant in older age groups (Desai et al., 2004).

Two other reports focussing on recreational gambling in older adults confirm higher levels of alcohol use in gamblers (Levens et al., 2005, Vander Bilt et al., 2004) but no link was found with depressive symptoms (Levens et al., 2005, Vander Bilt et al., 2004). There was also a tendency for recreational gamblers to have better self-rated physical health. Studies of gambling participation (as distinct from problem gambling) in adolescent samples have reported consistent associations with use of legal (alcohol and tobacco) and illicit drugs (Vitaro et al., 2001) and also with conduct problems and delinquency (Barnes et al., 2005, Hardoon et al., 2004, Vitaro et al., 2001).

Summarising the literature on comorbidity and other psychosocial outcomes, it is very clear that there are strong associations between problem gambling and other mental health disorders which are reported for men and women, across age groups and in different geographical locations. Associations with physical health problems are less clear cut and are related, at least in part, to behavioural risk factors including substance use. There are few studies of the health and wellbeing of recreational gamblers, but these consistently show elevated substance use and substance use disorders in recreational gamblers compared with non-gamblers. Mixed findings have been reported for other aspects of mental health. It is possible that physical health is better in recreational gamblers for older age groups. One explanation for this that ill health in older people presents a barrier to participation in gambling activities, with the great majority of gambling taking place outside of the home.

The most evident gaps in the current literature are: (1) the paucity of studies relating levels of gambling participation to social, psychological and health outcomes; and (2) few attempts to adjust for demographic and socioeconomic characteristics of gamblers when reporting on outcomes.

Research on type of gambling activity

Although serious concerns have been expressed about the dangers attached to particular types of gambling activity (Dowling et al., 2005), there is very limited evidence from general population studies on (1) demographic and socioeconomic factors predicting preferred type of gambling activity, and (2) how type of activity is related to social, psychological and health outcomes. Of course, research in this area has to deal with the complexity of multiple combinations of gambling activity reported by individuals. The Australian NGS 1999 provided very basic comparisons between, (i) men and women and (ii) across age groups for participation in the past year by form of gambling, without concerning itself with the overlap between activities (Productivity Commission, 1999). While women were more likely than men to buy scratch tickets and to play bingo, all other activities were more common in men. However, most of these differences were small. All forms of gambling except bingo were less common in older people than those between 25 and 64 years. Those aged 18-24 years were less likely to play lotteries or buy scratch tickets but more likely to participate in other types of gambling than middle-aged adults. This was particularly evident for playing poker machines, casino table games, keno, betting on sports events, and (perhaps surprisingly) bingo.

The Canadian CHS 2002 provided a little more detail in that information on the age and sex of participants was considered together rather than separately (Marshall and Wynne, 2003). Overall, men were somewhat more likely to buy lottery tickets than women (78% vs 73%) and were also more likely to bet on horse races (5% vs 3%). Women, on the other hand, were more likely to play bingo (12% vs 5%). Younger people, compared with middle-aged adults, favoured instant win tickets, casino gambling, bingo, and most strikingly, video lottery terminals. Bingo did, however, retain its popularity in older adults when all other forms of gambling participation showed a decline with age.

It is to be expected that popularity of different gambling activities would differ between countries and regions within countries, reflecting variation in legislation, availability of products and cultural preferences. Nevertheless, notable similarities are seen between Canada and

Australia in the likelihood and frequency of participation across different types of gambling (Marshall and Wynne, 2003, Productivity Commission, 1999). For example, buying lottery tickets was the most popular and most frequently undertaken activity in the Canadian CHS 2002, as it was in the Australian National Gambling Survey, and buying instant win tickets was the next most popular activity in both surveys, although fewer Australians reported this as a regular activity (i.e. weekly or more often). Gambling in casinos (combining the playing of electronic and table games) is popular in both countries but does not yield high frequency of participation in either. Bingo, by contrast, is of much lower popularity in both countries but frequent playing is fairly common amongst those who do play (over 20% playing weekly or more). Betting on races and other sporting events is notably more common in Australia than Canada, with off-course betting being a feature of the former. Playing of electronic gaming machines (EGMs) is a particularly common form of Australian gambling activity, with 38.6% participation in the NGS 1999 and 11.4% of participants playing at least weekly. This is linked to a variety of venues where EGMs are located (clubs, pubs and casinos). Video lottery terminals placed outside of casinos present a similar opportunity for readily accessible and low-stake gambling in Canada but participation is substantially lower than for EGMs in Australia.

While there has been interest in participation levels across different types of gambling activity and evidence relating prevalence of problem gambling to type of activity (Marshall and Wynne, 2003, Productivity Commission, 1999, Delfabbro and LeCouteur, 2003), there has been little attempt to disentangle the role of level of participation from that of type of activity in leading to problem gambling or to other social and psychological difficulties. One U.S. study that did use a combination of factors for predicting number of symptoms of pathological gambling, identified certain activities that were independently predictive of symptoms, specifically buying lottery/scratch tickets, casino gambling, card game gambling, bingo and betting on sports events (Welte et al., 2004), but the total list of gambling activities does not translate readily into the Australian context (e.g. there was no separate category for EGMs). Data on problem gambling in the Australian NGS 1999 were presented for weekly players across activities (but this did not adjust for multiple activities) and also for players' favourite mode of gambling (but this did not adjust for frequency of playing). The findings indicate that risk of problem gambling is much lower for lottery games and instant scratch tickets, but it is difficult to interpret differences between other gambling activities from the figures presented (Productivity Commission, 1999).

When the broader literature on comorbidity and other psychological and social difficulties is considered, findings on type of activity come predominantly from clinical and convenience samples (Oliveira and Silva, 2001, Petry, 2003, Rodda et al., 2004). A lack of evidence from

general population studies applies as much to type of gambling activity as it does to frequency and other dimensions of gambling behaviour. Adding this shortcoming to the research gaps identified in previous sections gives the following list:

- multivariate prediction of gambling participation and type of activity;
- demographic and socioeconomic predictors of level of participation;
- social, psychological and health outcomes related to what has been termed 'recreational gambling' and, especially, dose-response relationships with level of participation;
- social, psychological and health outcomes related to type of gambling activity.

Aims

The aims of the present study reflected the gaps in the literature listed above. The key questions addressed were as follows.

(1) What demographic and socioeconomic factors are related to gambling participation and which are significant independent predictors?

(2) What demographic and socioeconomic factors are associated with how often people gamble and how much time they spend gambling?

(3) What demographic and socioeconomic factors are predictive of main gambling activity?

(4) What is the nature of associations linking psychological, social and health outcomes to frequency of gambling, time spent gambling, and main type of activity?

Findings related to questions 1 to 3 are presented in Chapter 3 and the findings related to question 4 are presented in Chapter 4. Throughout the analyses, attention is paid to whether associations may vary between men and women and across the three age groups investigated.

2. Study sample and methodology

The Path Through Life Project

The PATH Through Life Project is a community survey of 7,485 people initially aged 20-24y, 40-44y and 60-64y, living in the Australian Capital Territory and nearby Queanbeyan, Australia. The project, run by the Centre for Mental Health Research at The Australian National University, plans to study each cohort every four years for 20 years. Fieldwork for the Wave 1 data collection commenced for the 20-24y cohort in 1999, for the 40-44y cohort in 2000 and for the 40-44y cohort in 2001. Wave 2 data collection occurred after an interval of four years, i.e. 2003, 2004 and 2005 for the three age groups respectively.

The Australian Electoral Rolls were used as sampling frames for the three cohorts. Enrolment to vote is compulsory for Australian citizens with very rare exceptions (being of unsound mind, serving a prison sentence of five years or more, and having been convicted of treason or treachery). Initial contact with potential respondents was through a letter of invitation, sent to addresses provided by the Australian Electoral Commission.

At the time of the Wave 1 recruitment of the two younger cohorts, only decade age ranges were available from the Electoral Commission. Consequently, letters were sent to 12,414 people aged 20-29y, inviting participation of 20-24y olds. Of these, 5,058 were outside the required age range, 1,061 were known to have moved from the area, 2,190 were not found, 1,701 refused or had poor English, and 2,404 (58.6% of those identified and not out of scope) were interviewed. For the 40-44y olds, 9,033 were sent letters, 4,222 of whom were discovered to be out of the required age range, 280 were no longer in the area, 612 were not found, 1,389 refused or had poor English and 2,530 were interviewed (64.6% of those identified and not out of scope). A law change prior to the recruitment of 60-64y olds allowed the release of more specific age group information for this cohort. Letters were sent to 4,831 persons, of whom 34 were outside the required age range, 182 no longer lived in the area, 28 had died, 209 were not found, 1,827 refused or had poor English, and 2,551 were interviewed (58.3% of those identified and not out of scope).

The invitation letter notified potential participants that an interviewer would contact them. Those who accepted were visited at a convenient location, usually the participant's home, or less often came to the Centre for Mental Health Research. They each received an information

sheet outlining the purpose of the study, who would have access to the data, and what uses the information could be put to. Written consent was required before taking part in interview and testing procedures. Participants completed the main questionnaire themselves (including all items used in this report), directly entering their responses on a hand-held computer. The Human Research Ethics Committee of The Australian National University approved the study protocol.

The Wave 2 follow up attempted to contact all Wave 1 respondents who were still living in Australia. Successful interviews were completed for 2139 / 2404 (89.0%) of the original 20-24y olds (aged 24-28y at Wave 2), for 2354 / 2530 (93.0%) of the 40-44y olds, and for 2222 / 2551 (87.1%) of the 60-64y olds. The Wave 2 data collection included a self-completion questionnaire on notebook computers that was very similar to the Wave 1 questionnaire.

The total wave 2 sample consisted of 1,013 males and 1,126 females aged 24-28y, 1,103 males and 1,251 females aged 44-48y, and 1,147 males and 1,075 females aged 64-68y. Analysis was conducted using all participants with valid responses on the gambling items (6,596 of the 6,715 wave 2 participants). Amongst those with complete data on gambling, less than 1% of data were missing across other items and scales used in this report. Therefore the sample size varied minimally depending upon the items being investigated.

The PATH Wave 1 sample has been compared with Australian census data for Canberra-Queanbeyan residents across the corresponding age groups (Rodgers et al., 2005). The Census information was provided by the Australian Bureau of Statistics in respect of Australian Citizens aged 20-24y, 40-44y and 60-64y, who lived in Canberra and Queanbeyan in 2001. PATH information was appropriately weighted to represent the proportions of the six age by gender groups in the target population. PATH participants were similar to the target population in regard to marital status, but they were more likely to be employed, full or part time (79.1% versus 74.6%), and to be currently undertaking study (25.6% versus 21.3%). Although participants were representative of the target population in regard to degree level qualifications, they were more likely to report post-school qualifications at lower levels (66.2% versus 53.2%). This latter difference may be attributable (at least in part) to differences in the framing of questions on qualifications.

Measures

Almost all of the measures used for this report were taken from the Wave 2 interviews; the exception being the inventory covering retrospective reports of childhood adversity that was included at Wave 1 only.

Gambling

Three main facets of gambling were investigated: (1) gambling participation; (2) frequency of gambling across all activities; and (3) hours spent gambling on main activity. All PATH participants were given a list of gambling activities (shown in Appendix 1) and then asked whether they 'played any of these alone or in combination, more than once a month'. People who gambled at this level were distinguished from those who gambled less than monthly. Therefore, in this study, the terms 'gamblers' and gambling 'participation' refer to gambling more than once a month.

'Gambling frequency' across all activities was assessed by asking gamblers, 'Over the last year, thinking about any of the sorts of gambling listed, on approximately how many days each month would you gamble'. Responses were grouped into bands of '1-3 days per month', '4 days per month', and '5 or more days per month'.

'Hours spent gambling' was assessed by asking all gamblers to indicate which of the listed gambling activities they had played the most in the last 12 months (hereafter referred to as their 'main activity'), and the frequency (days per month) and the usual duration (hours/minutes) of their gambling sessions. The latter two measures were used to estimate how many hours per month participant's spent gambling on their main activity. All gambling questions are shown in Appendix 1.

Demographic and socioeconomic factors

Questions covered current marital status, highest completed qualifications, whether or not participants had a child residing with them on a full-time or part-time basis, employment status and residential tenure. Participants aged 64-68y were also asked how many hours voluntary work they were engaged in per week. Those who undertook at least one hour voluntary work per week were identified for this study. The categories of all measures are shown in Table 1.

Participants were asked four questions on financial stress, taken from the Australian Bureau of Statistics Household Expenditure Survey and also used in the HILDA Survey (Bray, 2001,

Butterworth and Crosier, 2006). They were: 'Over the last year did any of the following happen to you because of a shortage of money: (1) pawned or sold something; (2) went without meals; (3) was unable to heat home; and (4) asked for help from welfare/community organizations'. Participants who endorsed any of these items were identified as having experienced financial problems. Participants were also asked 'What is your main source of income' and then given a range of options. Participants reporting that their main source of income was from a 'government pension, allowance or benefit or 'Austudy' were distinguished from those endorsing other options including: (1) wage or salary; (3) child support; (4) superannuation/annuity; (5) own business or share in a partnership; (6) investments; (7) other income; and (8) no income.

Mental health and substance use

Goldberg's depression and anxiety scales were completed (Goldberg et al., 1988). Participants indicated whether or not they had experienced symptoms of depression and anxiety in the past month. The nine anxiety symptoms included feeling keyed up/on edge, worrying a lot, irritability, difficulty relaxing, poor sleep and headaches. The nine depression symptoms covered low energy, loss of interest, loss of confidence, hopelessness, and sleep and appetite disturbance. Good inter-item reliability was evident for the anxiety (α=0.81) and depression (α=0.79) scales in the PATH sample.

Participants completed the Alcohol Use Disorders Identification Test (AUDIT, Saunders et al., 1993). The quantity, frequency and binge drinking items ask how often participants have an alcoholic drink, how many standard drinks they consume on a typical day when drinking, and how often they consume six or more drinks on one occasion. In Australia a standard drink is defined as containing 10 grams of absolute alcohol (National Health and Medical Research Council, 2001). Responses to these items were combined to estimate quantity of alcohol consumed per week.

Participants were asked whether they currently smoked cigarettes, and if so, how many they usually smoked in a day. Participants who reported using cannabis, amphetamines (for non-medical purposes) or ecstasy in the past 12 months were also identified.

Physical health

The six physical health items from the Short Form Health Survey were used to assess physical health status (Ware et al., 1996). These items measured general health and the broad concepts of physical functioning in terms of role limitation, bodily pain, and disability over the previous

four weeks. The RAND scoring system was used to construct the physical health scale (Hays, 1998, Windsor et al., 2006), which is standardised to a mean of 50 with a standard deviation of 10. Lower scores indicate poorer physical health.

Social support and adverse life events

Positive support and negative interactions with family, friends and partner were measured using scales developed by Shuster et al. (1990). The items ask how often participants feel cared for by friends/family/partners, how often friends/family/partners express an interest in them, made too many demands, criticised or created tensions/arguments with them. The positive support scales ranged from 0 to 6, and the negative interaction scales ranged from 0 to 9.

At Wave 1, participants were asked 17 questions about particular adverse experiences in childhood up to age 16 years (Rosenman and Rodgers, 2004). Six items covered lack of affection, nervous or emotional trouble or depression, and trouble with drinking or other drug use in father and mother figures respectively, and two items covered conflict in the household and experience of parental divorce or permanent separation. Eight items covered experience of: neglect; a strict authoritarian upbringing; parental verbal abuse; humiliation, ridicule, bullying or mental cruelty from a parent (i.e. psychological abuse); witnessing physical or sexual abuse in the family; physical abuse by a parent; receiving too much physical punishment; and sexual abuse by a parent. One item inquired of growing up in poverty or financial hardship. Endorsed items were summed to form a childhood adversity scale.

At Wave 2, participants were asked if they had experienced any of 16 stressful life events in the past six months, e.g. a death in the family, an employment or relationship crisis occurring to themselves or their partner (Brugha and Cragg, 1990, Rodgers, 1996). The stressful life events scale was the sum of the number of events endorsed by participants.

Statistical analysis

A three-stage process was used to identify which demographic and socioeconomic factors were associated with gambling participation and frequency. First, logistic regression was used to explore factors associated with gambling participation (across all activities), adjusting for sex. Either predicted probabilities or odds ratios were reported from these analyses. Second, multinomial logistic regression explored characteristics associated with different gambling frequencies. Those gambling 1-3 days, 4 days and 5 or more days per month were contrasted

with those gambling less than monthly. Relative risk ratios (RRR) and standard errors were reported for all multinomial analyses. Third, analysis of variance was used to explore whether particular demographic and socioeconomic factors were linked to gambling frequency amongst those who reported gambling. The factors that were *independently* linked to gambling participation and frequency were then identified by simultaneously using significant demographic and socioeconomic factors as independent variables in each of the three analyses described above.

Analysis of variance was used to identify demographic and socioeconomic factors associated with hours spent gambling on main activity amongst gamblers (except those who reported that they mainly gambled on scratch tickets or lottery) adjusting for age and sex. Significant factors were then simultaneously entered as independent variables to determine which were independently associated with hours spent gambling.

Logistic regression was used to investigate whether demographic and socioeconomic factors were associated with specific types of gambling. Participants who mainly gambled on (1) poker/gaming machines, (2) races or sports events, (3) bingo and (4) 'other' activities were compared to those who mainly gambled on (5) scratch tickets or lottery games.

The strength and shape of the associations linking gambling frequency (across all activities) and hours spent gambling (on main activity) with social, psychological and health outcomes were explored using regression modelling. The shape of these associations was assessed by testing the significance of quadratic (squared) versions of the gambling measures in the regression models.

Lowess smoothing techniques were then used to graphically depict the strength and shape of the associations. Lowess (locally weighted polynomial regression) is a robust, non-parametric procedure initially developed by Cleveland (1979). The underlying principle behind lowess is that the dependent variable is smoothed as function of an independent variable (Cleveland and Devlin, 1988). The smoothed curve is created from combining a series of straight lines. These straight lines are estimated for each data point (on the x-axis) using linear regression (weighted least squares) on subsets of data. The traditional weight used for lowess (the tri-cube function) assigns a greater weight (and therefore importance) to data near the point whose response is being estimated and less weight (and therefore less importance) to points further away. The subsets of data used in each regression are identified using the 'k-nearest neighbour' technique, where the user determines the proportion of data to be used in each regression (Altman, 1992).

Therefore each regression uses a fixed strip on the x-axis defined by sample size and not by distance. Figure 1 demonstrates an example of this procedure. This graph shows three of the many local linear regressions underlying a final smoothed lowess curve.

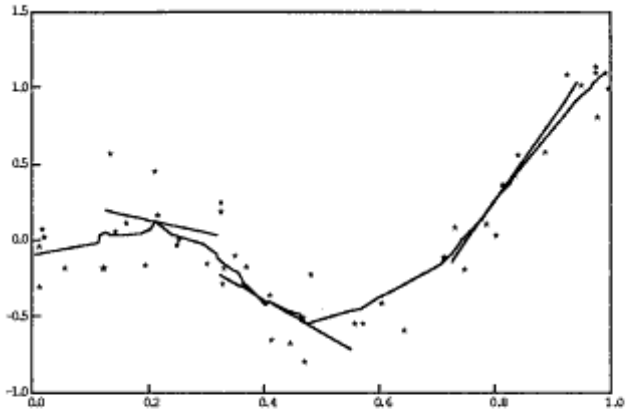

Figure 6. Running Linear Regression Estimate of the Curve y = t sin(2πt) + ε at Span = .1. The design points were generated from a Uniform (0, 1). The errors were generated from a Normal (0, .01). The local linear regressions are shown at three points along the curve.

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Figure 1: A depiction of the methods underlying localised linear regression Source: (Altman, 1992).

The associations linking gambling with social, psychological and health outcomes were all adjusted by age, sex and education. This was achieved by saving the residuals estimated from multiple linear regression analyses using dummy variables to represent all age, sex and education categories (including interactions) as the independent variables and social, psychological, and health variables as dependent variables. These residuals were then plotted against the gambling measures and lowess curves fitted to the data. For all lowess functions presented in this report, the bandwidth was set at 0.4, meaning that 40% of data were used in each localised regression.

Separate lines were plotted for all gambling activity (gambling frequency only), for participants whose main activity was poker/gaming machines (both gambling measures), for participants whose main activity was scratch tickets/lottery games (gambling frequency only) and for all activities excluding scratch tickets/lottery games (gambling hours only). It is possible that people who mainly gambled on scratch tickets or lottery games also gamble on other activities, and these other activities could account for their social, psychological and health outcomes. However, in this group there was no substantial difference in findings comparing plots using a

measure of frequency of gambling specifically on scratch tickets or lottery, and plots using gambling frequency across all activities.

Only a small number of people reported gambling more than 20 days (n=18), or more than 40 hours (n=20) per month. These participants were excluded from the regression and lowess analyses because we could not be sure our findings would be representative of people gambling at such high frequencies.

Initial investigations indicated that the interaction linking age and sex with frequency of gambling was significant (p=.027). Further investigation showed that some other characteristics associated with gambling frequency differed significantly across age groups. Therefore the analysis on gambling participation and frequency was undertaken separately for each age group, adjusting for sex. All other analyses were conducted collapsing across age groups, adjusting for age and sex.

The sample

Table 1 gives a description of the sample by age group. The bracketed categories in the table show where we collapsed categories for later analyses relating to particular age groups.

Table 1 shows that the proportion of people gambling more than once a month increased across age groups. The interaction between age and sex on likelihood of gambling was not significant (p>.522), indicating the increase across age groups was similar for men and women. After adjusting for age, men were more likely than women to report gambling more than once a month (OR 1.71, CI 1.54-1.90, p<.001). After adjusting for sex, the two older cohorts were more likely to report gambling than the 24-28y olds (44-48y: OR 1.72, CI 1.50-1.96, p<.001; 64-68y: OR 1.99, CI 1.74-2.28, p<.001).

Table 1 indicates that very few of the 24-28y olds were married, just over a third owned or were buying their own home and only 3% had less than five years of secondary school education. In contrast, two thirds of the older age groups were currently married, more than 85% owned or were buying a home, and one in five 64-68y olds had less than five years of secondary school education.

A greater proportion of 44-48y olds had resident children than the other cohorts. Financial problems and substance use were most frequent in the youngest age group whereas relying on government payments was most frequent in the oldest age group. Participants from a Non-English Speaking Background (NESB) ranged from 6% in the 24-28y olds to 11% in the 64-68y olds.

Table 1: Demographic and socioeconomic characteristics† of the sample [n (%)] by age group.

Characteristic	Age group 24-28y n=2109	44-48y n=2316	64-68y n=2171
Sex			
Men	999 (47.4)	1086 (46.9)	1120 (51.6)
Women	1110 (52.6)	1230 (53.1)	1051 (48.4)
Gambling (> monthly)	481 (22.8)	774 (33.4)	811 (37.4)
Marital status			
Married	557 (26.4)	1597 (69.0)	1608 (74.1)
Separated/divorced	57 (2.71)	421 (18.2)	311 (14.3)
Widowed	3 (0.14)	23 (0.99)	195 (9.0)
Never married	1490 (70.7)	274 (11.8)	56 (2.58)
Education			
<5 yrs secondary	64 (3.0)	218 (9.4)	421 (19.4)
5-6 yrs secondary	340 (16.1)	254 (11.0)	190 (8.8)
Trade/tech/apprenticeship/certificate	554 (26.3)	610 (26.3)	609 (28.1)
Assoc/undergrad diploma	218 (10.3)	233 (10.1)	223 (10.3)
Bachelors degree+	933 (44.2)	1001 (43.2)	728 (33.5)
Non-english speaking background			
No	1976 (94.3)	2122 (91.7)	1921 (88.6)
Yes	119 (5.7)	193 (8.3)	248 (11.4)
Residential tenure			
Owner-buyer	743 (35.3)	1975 (85.4)	1978 (91.2)
Private rental	778 (36.9)	186 (8.0)	50 (2.3)
Public rental	75 (3.6)	90 (3.9)	85 (3.9)
Parental/relatives residence	454 (21.5)	23 (1.0)	22 (1.0)
Other	58 (2.8)	39 (1.7)	33 (1.5)
Employment status (24-28y, 44-48y)			
Employed	1871 (88.8)	2082 (89.9)	
Unemployed looking for work	70 (3.3)	45 (1.9)	
Not in labour force	167 (7.9)	188 (8.1)	
Employment status (64-68y)			
Employed			545 (26.1)
NLF, regular volunteer			663 (31.7)
NLF, not a regular volunteer			884 (42.3)
Resident children	429 (20.3)	1718 (74.2)	306 (14.1)
Government pension/benefit	171 (8.1)	100 (4.3)	555 (25.7)
Financial problems	300 (14.2)	143 (6.2)	46 (2.1)

† The brackets encompass categories that were collapsed for age-specific analyses.

Table 2 shows gambling frequency by age and sex. This table shows the relatively large numbers for '4 days per month' which very likely reflects people who have a regular weekly gambling session. This is important because this frequency is often used as the threshold for defining 'regular gambling' (Productivity Commission, 1999) and it clearly makes a large difference as to whether this group is included in the definition or not. If they are excluded, the prevalence of regular gambling across age groups would be 12% in men and 6% in women, but if they are included it would be almost 25% and 16% respectively. It is an undesirable feature of an operationally defined characteristic that the prevalence is markedly different for such a small shift in the threshold defining it. Subsequent analyses were therefore conducted (using

multinomial logistic regression) which included those who gambled five or more days per month as a separate category from those who gambled four days per month.

The association between sex and gambling frequency was found to differ significantly across age groups (interaction p=.027). Specifically, the effect of being male on the relative risk of gambling five or more days a week over gambling less than monthly, was stronger amongst those aged 64-68y, than those aged 24-28y (interaction p=.024) or 44-48y (interaction p=.006). In view of these and other statistical interactions, and given the size of the sample available, the three age groups were investigated separately to identify the demographic and socioeconomic characteristics associated with participation and frequency of gambling.

Table 2: Gambling frequency [n (%)] across all activities, by age and sex.

	Gambling frequency across all activities			
Sex and age group	**<monthly**	**1-3 days p/mth**	**4 days p/mth**	**5+ days p/mth**
Men				
24-44, n=999	715 (71.6)	130 (13.0)	69 (6.9)	85 (8.5)
44-48, n=1086	664 (61.1)	130 (12.0)	174 (16.0)	118 (10.9)
64-68, n=1120	631 (56.3)	142 (12.7)	166 (14.8)	181 (16.2)
Women				
24-44, n=1110	913 (82.3)	93 (8.4)	48 (4.3)	56 (5.1)
44-48, n=1230	878 (71.4)	126 (10.2)	141 (11.5)	85 (6.9)
64-68, n=1051	729 (69.4)	124 (11.8)	135 (12.8)	63 (6.0)

3. Demographic and socioeconomic factors

Gambling participation and frequency across all activities in 24-28y olds

Three different analyses were undertaken to investigate the demographic and socioeconomic factors associated with gambling participation and frequency. The results from all three analyses are shown in Table 3 and are distinguished by column shading. The first (shaded) column shows the proportion (adjusted for sex) of 24-28y olds who gambled at least monthly across a range of demographic and socioeconomic characteristics. Being male, reporting financial problems, having resident children and lower levels of education were all associated with gambling. For instance 35% of participants with six or fewer years of secondary education reported gambling at least monthly, compared to 13% of participants with tertiary education. Compared to participants with no financial problems (22%), young adults with financial problems (29%) were more likely to be gamblers.

The centre four columns (unshaded) of Table 3 show the results from a series of multinomial logistic regressions using gambling frequency categories across all activities as the dependent variable. The reference categories for each independent variable are specified in the table and gambling less than monthly was used as the dependent variable reference category for all analyses. Table 3 demonstrates that the risk ratios for characteristics associated with gambling did not increase substantially or consistently across gambling frequency categories.

The final (shaded) column in Table 3 shows the mean days gambling amongst gamblers for each of the demographic and socioeconomic factors (adjusted by sex). Amongst gamblers, none of the demographic or socioeconomic measures was significantly associated with gambling days per month (on average).

Table 3: Demographic and socioeconomic factors associated with gambling more than monthly, gambling frequency, and mean days gambling per month (amongst gamblers) in 24-28y olds (adjusted by sex, n=2,109).

Characteristic	% (95%CI) who gamble > monthly	Gambling frequency [RRR (se)] across all activities				Mean (se) days gambling in gamblers†
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth	
Sex						
Men	28.4 (25.7-31.3)***	1.00	1.78 (0.26)***	1.84 (0.36)**	1.94 (0.35)***	4.35 (0.22)
Women	17.8 (15.6-20.1)	1.00	1.00	1.00	1.00	*4.04 (0.26)*
Marital status						
Married	20.3 (17.1-23.9)	1.00	1.00	1.00	1.00	*4.26 (0.19)*
Not married	23.4 (21.4-25.6)	1.00	1.26 (0.22)	0.91 (0.19)	1.43 (0.31)	4.11 (0.35)
Education						
Bachelors degree+	12.6 (10.6-15.0)	1.00	1.00	1.00	1.00	*3.82 (0.34)*
Assoc/undergrad diploma	22.5 (17.3-28.6)***	1.00	1.65 (0.46)	2.10 (0.72)*	2.59 (0.83)**	4.69 (0.53)
Trade/tech/apprenticeship/certificate	30.2 (26.5-34.2)***	1.00	2.53 (0.48)***	3.10 (0.76)***	3.75 (0.88)***	4.52 (0.28)
<=6 yrs secondary	35.2 (30.7-40.1)***	1.00	4.20 (0.79)***	2.81 (0.77)***	3.90 (0.99)***	4.03 (0.31)
Non-English speaking background						
No	22.9 (21.0-24.8)	1.00	1.00	1.00	1.00	*4.22 (0.17)*
Yes	18.2 (12.2-26.1)	1.00	0.66 (0.24)	0.69 (0.32)	0.94 (0.36)	4.31 (0.79)
Resident children						
No	21.5 (19.6-23.6)	1.00	1.00	1.00	1.00	*4.19 (0.19)*
Yes (PT or FT)	27.0 (22.9-31.6)*	1.00	1.15 (0.21)	1.67 (0.37)*	1.42 (0.30)	4.33 (0.36)
Employment status						
Employed	23.0 (21.1-25.0)	1.00	1.00	1.00	1.00	*4.16 (0.18)*
Unemployed, looking for work	17.4 (10.2-27.9)	1.00	0.57 (0.27)	1.22 (0.58)	0.54 (0.32)	4.88 (1.03)
Not in labour force	20.8 (15.0-28.0)	1.00	0.59 (0.20)	1.81 (0.55)	0.67 (0.27)	4.78 (0.68)
Government pension/benefit						
No	22.7 (20.9-24.7)	1.00	1.00	1.00	1.00	*4.25 (0.18)*
Yes	21.5 (15.9-28.5)	1.00	0.95 (0.26)	1.09 (0.37)	0.79 (0.28)	3.87 (0.62)
Financial problems						
No	21.5 (19.7-23.5)	1.00	1.00	1.00	1.00	*4.17 (0.19)*
Yes	29.3 (24.4-34.8)**	1.00	1.62 (0.30)***	1.19 (0.32)	1.62 (0.36)*	4.46 (0.39)
Residential tenure						
Owner-buyer	22.9 (20.0-26.1)	1.00	1.00	1.00	1.00	*4.29 (0.29)*
Rental	22.1 (19.5-25.1)	1.00	1.08 (0.78-1.51)	0.96 (0.62-1.47)	0.79 (0.53-1.18)	3.97 (0.27)
Parents/relatives residence	22.5 (19.0-26.7)	1.00	1.07 (0.73-1.58)	0.80 (0.47-1.37)	1.01 (0.64-1.58)	4.44 (0.36)
Other	27.8 (17.7-40.8)	1.00	1.50 (0.68-3.34)	1.61 (0.60-4.30)	0.77 (0.23-2.56)	5.13 (0.93)

†reference categories are indicated with italic font

*p<.05, **p<.01, ***p<.001

Table 4: Multivariate models of the demographic and socioeconomic factors associated with gambling more than monthly and gambling frequency in 24-28y olds (n=2,109).

Characteristic	OR (se) gambling >monthly	Gambling frequency [RRR (se)] across all activities			
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth
Sex					
Men	1.64 (0.18)***	1.00	1.55 (0.23)**	1.73 (0.35)**	1.72 (0.32)**
Women	1.00	1.00	1.00	1.00	1.00
Education					
Bachelors degree+	1.00	1.00	1.00	1.00	1.00
Assoc/undergrad diploma	2.02 (0.39)***	1.00	1.70 (0.48)	2.05 (0.71)*	2.59 (0.84)**
Trade/tech/apprenticeship/certificate	2.98 (0.42)***	1.00	2.59 (0.51)***	2.98 (0.75)***	3.68 (0.89)***
<=5-6 yrs secondary	3.72 (0.56)***	1.00	4.26 (0.84)***	2.70 (0.76)*	3.78 (0.99)***
Resident children					
No	1.00	1.00	1.00	1.00	1.00
Yes	0.95 (0.13)	1.00	0.80 (0.15)	1.22 (0.28)	0.97 (0.21)
Financial problems					
No	1.00	1.00	1.00	1.00	1.00
Yes	1.15 (0.17)	1.00	1.22 (0.23)	0.94 (0.26)	1.23 (0.28)

*p<.05, **p<.01, ***p<.001

The demographic and socioeconomic factors that were significantly associated with gambling more than monthly (sex, education, having a resident child and financial problems) were then entered simultaneously into a logistic regression. The first (shaded) column in Table 4 shows that lower levels of education and being male were independently associated with gambling in this multivariate model.

These same significant demographic and socioeconomic factors were also entered into a multinomial logistic regression. Education and sex remained strongly linked to gambling frequency (Table 4, columns 2 to 5). However, reporting financial problems and having resident children were no longer linked to gambling frequency in the multivariate model. These findings indicate that after taking into account financial problems, having a resident child and sex, lower levels of education were associated with increased odds of gambling across all frequencies, but risk ratios did not increase uniformly across frequency categories.

We did not undertake any multivariate analyses investigating factors associated with days spent gambling amongst gamblers because we had already determined in Table 3 that none of the factors was significant after adjusting for sex.

Gambling participation and frequency across all activities in 44-48y olds

Table 5 shows three sets of analyses investigating demographic and socioeconomic factors associated with gambling, and frequency of gambling in adults aged 44-48y.

The first (shaded) column in Table 5 shows that being male, unmarried, having lower levels of education, financial problems and public rental housing tenure were associated with gambling amongst 44-48y olds. A smaller proportion of participants with resident children were gamblers than those with no resident children.

The centre (unshaded) columns in Table 5 show the results from a multinomial logistic regression investigating the factors associated with gambling frequency categories. All characteristics that were associated with gambling more than monthly were also associated with gambling frequency, and in several instances ratios increased across frequency categories.

The last (shaded) column in Table 5 shows that amongst gamblers, mean gambling days per month were significantly higher for men than women, and higher for those with less than five years education and those with trade qualifications (compared to those with a degree or higher). Gamblers who owned (or were buying) their own home gambled on fewer days per month than those who reported residing in 'other' circumstances (with parents or relatives, in group households or unspecified arrangements). Lastly, male gamblers with resident children spent fewer days gambling per month than male gamblers without resident children. Having resident children was not significantly associated with gambling days per month for women (who as a whole gamble on fewer days per month than men) than men.

The factors that were significantly associated with gambling participation were simultaneously entered into a logistic regression predicting gambling. The first (shaded) column in Table 6 shows that that being male, having never married (as compared to currently married), having lower levels of education, and financial problems were independently associated with increased odds of gambling participation.

The centre four (unshaded) columns shows RRRs after including factors that were significantly associated with gambling one through three, four, or five or more days per month. Being male, and lower levels of education were independently associated with almost all gambling frequencies. Being separated/divorced/widowed was associated with increased odds of

gambling four days per week. Financial problems, and having never married were independently associated with gambling five or more days per week compared to gambling less than monthly.

The last (shaded) column in Table 6 shows the multivariate model investigating mean days gambling per month. Being male, having never married, lower levels of education and residential tenure were independently associated with spending more days gambling per month amongst gamblers. Overall, the results indicate that being male, having never married and lower levels of education were independently associated both with gambling and with gambling more frequently.

Table 5: Demographic and socioeconomic factors associated with gambling more than monthly, gambling frequency and mean days gambling (amongst gamblers) in 44-48y olds (adjusted by sex, n=2,312).

Characteristic	% (95%CI) who gamble > monthly	Gambling frequency [RRR (se)] across all activities				Mean (se) days gambling in gamblers†
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth	
Sex						
Men	38.9 (36.0-41.8)***	1.00	1.36 (0.18)*	1.63 (0.20)***	1.84 (0.28)***	5.05 (0.18)**
Women	28.6 (26.2-31.2)	1.00	1.00	1.00	1.00	*4.22 (0.20)*
Marital status						
Married	31.2 (28.9-33.5)	1.00	1.00	1.00	1.00	*4.54 (0.17)*
Separated/divorced/widowed	38.1 (33.6-42.8)**	1.00	1.11 (0.20)	1.64 (0.25)**	1.29 (0.25)	4.50 (0.30)
Never married	40.3 (34.7-46.3)**	1.00	1.40 (0.28)	1.36 (0.26)	1.83 (0.38)**	5.52 (0.36)*
Education						
Bachelors degree+	22.8 (20.3-25.5)	1.00	1.00	1.00	1.00	*4.06 (0.25)*
Assoc/undergrad diploma	34.3 (28.4-40.7)***	1.00	1.42 (0.33)	1.93 (0.44)**	2.21 (0.61)**	4.11 (0.42)
Trade/tech/apprenticeship/certificate	40.9 (37.1-44.9)***	1.00	1.48 (0.25)*	2.79 (0.45)***	3.40 (0.67)***	4.88 (0.24)*
5-6 yrs secondary	40.5 (34.6-46.7)***	1.00	1.45 (0.34)	3.04 (0.61)***	2.84 (0.74)***	4.92 (0.37)
<5 yrs secondary	53.7 (47.0-60.3)***	1.00	2.51 (0.58)***	4.35 (0.94)***	6.29 (1.57)***	5.69 (0.36)***
Non-English speaking background						
No	34.2 (32.2-36.2)	1.00	1.00	1.00	1.00	*4.74 (0.14)*
Yes	26.9 (21.1-33.6)*	1.00	1.21 (0.27)	0.53 (0.14)*	0.40 (0.15)*	3.82 (0.52)
Resident Children						
No	39.8 (35.9-43.8)	1.00	1.00	1.00	1.00	*M: 5.98 (0.37)**; F 3.98 (0.29)*
Yes	31.4 (29.2-33.6)***	1.00	0.80 (0.12)	0.67 (0.09)**	0.61 (0.10)**	M: 4.63 (0.25); F 4.33 (0.19)
Employment status						
Employed	33.5 (31.5-35.6)	1.00	1.00	1.00	1.00	*4.66 (0.14)*
Unemployed, looking for work	29.4 (17.9-44.3)	1.00	0.76 (0.40)	1.10 (0.47)	0.49 (0.36)	3.63 (1.04)
Not in labour force	34.8 (28.2-42.2)	1.00	0.95 (0.25)	1.04 ((0.24)	1.25 (0.34)	4.78 (0.48)
Government pension/benefit						
No	33.3 (31.3-35.3)	1.00	1.00	1.00	1.00	*4.67 (0.14)*
Yes	39.7 (30.4-49.7)	1.00	1.33 (0.42)	1.46 (0.41)	1.08 (0.41)	4.36 (0.61)
Financial problems						
No	32.4 (30.5-34.4)	1.00	1.00	1.00	1.00	*4.63 (0.14)*
Yes	50.2 (42.0-58.4)***	1.00	1.95 (0.50)**	1.75 (0.43)*	2.87 (0.72)***	5.14 (0.45)
Residential tenure						
Owner-buyer	32.1 (30.0-34.2)	1.00	1.00	1.00	1.00	*4.58 (0.15)*
Private rental	40.3 (33.4-47.5)*	1.00	1.67 (0.37)*	1.09 (0.26)	1.66 (0.41)*	4.94 (0.43)
Public rental	55.3 (44.9-65.3)***	1.00	2.26 (0.72)*	2.92 (0.80)***	2.67 (0.91)**	4.44 (0.54)
Other	46.0 (27.2-66.0)	1.00	0.58 (0.31)	0.67 (0.30)	1.83 (0.67)	7.26 (0.84)**

†reference categories are indicated with italic font; *p<.05, **p<.01, ***p<.001

Table 6: Multivariate models of the demographic and socioeconomic factors associated with gambling more than monthly, gambling frequency and mean days gambling (amongst gamblers) in 44-48y olds (n=2,312).

Characteristic	OR (se) gambling >monthly	Gambling frequency [RRR (se)] across all activities				Mean (se) days Gambling in gamblers†
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth	
Sex						
Men	1.82 (0.17)***	1.00	1.49 (0. 21)**	1.94 (0.25)***	2.16 (0.34)***	5.13 (0.18)**
Women	1.00	1.00	1.00	1.00	1.00	*4.22 (0.20)*
Marital status						
Married	1.00	1.00	1.00	1.00	1.00	*4.54 (0.17)*
Separated/divorced/widowed	1.22 (0.15)	1.00	0.97 (0.19)	1.60 (0.27)**	1.04 (0.23)	4.49 (0.30)
Never married	1.45 (0.24)*	1.00	1.37 (0.33)	1.39 (0.32)	1.69 (0.43)*	5.50 (0.36)*
Education						
Bachelors degree+	1.00	1.00	1.00	1.00	1.00	*4.06 (0.25)*
Assoc/undergrad diploma	1.78 (0.28)***	1.00	1.43 (0.33)	1.95 (0.45)**	2.23 (0.62)**	4.25 (0.41)
Trade/tech/apprenticeship/certificate	2.39 (0.28)***	1.00	1.53 (0.26)*	2.84 (0.47)***	3.43 (0.69)***	4.90 (0.24)*
5-6 yrs secondary	2.32 (0.35)***	1.00	1.46 (0.34)	3.10 (0.63)***	2.82 (0.74)***	4.99 (0.37)*
<5 yrs secondary	3.71 (0.61)***	1.00	2.46 (0.58)***	4.04 (0.91)***	5.90 (1.53)***	5.75 (0.36)***
Non-english speaking background						
No	1.00	1.00	1.00	1.00	1.00	NA
Yes	0.85 (0.15)	1.00	1.36 (0.30)	0.64 (0.18)	0.49 (0.18)	
Resident children						
No	1.00	1.00	1.00	1.00	1.00	NA
Yes	0.81 (0.10)	1.00	0.90 (0.16)	0.75 (0.12)	0.80 (0.16)	
Financial problems						
No	1.00	1.00	1.00	1.00	1.00	NA
Yes	1.53 (0.30)*	1.00	1.58 (0.44)	1.15 (0.32)	2.13 (0.60)**	
Residential tenure						
Owner-buyer	1.00	1.00	1.00	1.00	1.00	*4.58 (0.15)*
Private rental	1.16 (0.20)	1.00	1.48 (0.34)	0.85 (0.21)	1.25 (0.34)	4.90 (0.44)
Public rental	1.46 (0.35)	1.00	1.54 (0.54)	1.58 (0.49)	1.17 (0.0.45)	4.12 (0.56)
Other	0.67 (0.20)	1.00	0.46 (0.25)	0.47 (0.22)	1.22 (0.48)	6.87 (0.85)*

†reference categories are indicated with italic font
*p<.05, **p<.01, ***p<.001

Gambling participation and frequency across all activities in 64-68y olds

Table 7 shows the findings from the three analyses investigating factors associated with gambling participation and frequency in the 64-68y age group. The first (shaded) column shows that being male, lower levels of education, and receiving a government pension or welfare payment as primary source of income were associated with gambling in this age group. Not being in the paid labour force was also associated with gambling, but only in those who were not regular volunteers.

The middle (unshaded) four columns show the characteristics that were associated with specific gambling frequencies when compared to gambling monthly or less. The characteristics that were associated with participation were also associated with increased odds of gambling 1-3 days, 4 day and 5 or more days per month. Furthermore, a greater proportion of this age group had experienced the death of a spouse, and the odds of gambling five or more times per month were significantly higher in this group. Participants residing in rental accommodation were also more likely to report gambling five or more days per month than those who owned (or were buying) their home.

The last (shaded) column in Table 7 shows that amongst gamblers, only sex (being male) and volunteering regularly amongst those not in the paid labour force (compared to having paid employment) were significantly associated with spending more days gambling per month on average.

The first (shaded) column of Table 8 shows that after including all factors associated with gambling participation in a logistic regression, being male, lower level of education and receiving a government pension or benefit were independently associated with increased odds of gambling. The middle (unshaded) columns show that after adjusting for all other significant factors, being male and lower levels of education were independently associated with gambling frequency categories.

Given that sex and not being in the paid labour force were the only factors associated with mean gambling days per month, no further multivariate analyses were conducted, and there is no sixth (shaded) column for this age group in Table 8.

Table 7: Demographic and socioeconomic factors associated with gambling more than monthly, gambling frequency and mean days gambling per month (amongst gamblers) in 64-68y olds (adjusted by sex, n= 2,084).

Characteristic	% (95%CI) who gamble > monthly	Gambling frequency [RRR (se)] across all activities				Mean (se) days gambling in gamblers†
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth	
Sex						
Men	43.7 (40.8-46.6)***	1.00	1.32 (0.18)*	1.42 (0.18)**	3.32 (0.52)***	5.63 (0.20)***
Women	30.6 (27.9-33.5)	1.00	1.00	1.00	1.00	*4.38 (0.25)*
Marital status						
Married	37.0 (34.6-39.4)	1.00	1.00	1.00	1.00	*5.15 (0.18)*
Separated/divorced	35.4 (30.3-41.0)	1.00	0.83 (0.17)	0.98 (0.18)	1.00 (0.21)	5.24 (0.43)
Widowed	40.9 (33.9-48.3)	1.00	1.06 (0.26)	0.92 (0.23)	1.89 (0.48)*	4.93 (0.55)
Never married	29.5 (18.9-42.9)	1.00	0.77 (0.34)	0.46 (0.24)	1.02 (0.46)	4.69 (1.13)
Education						
Bachelors degree+	21.9 (19.0-25.1)	1.00	1.00	1.00	1.00	*4.70 (0.34)*
Assoc/undergrad diploma	32.7 (26.8-39.3)**	1.00	1.90 (0.47)*	1.27 (0.34)	2.33 (0.61)**	5.36 (0.53)
Trade/tech/apprenticeship/certificate	41.5 (37.6-45.6)***	1.00	2.56 (0.47)***	2.25 (0.40)***	2.88 (0.56)***	5.14 (0.28)
5-6 yrs secondary	44.4 (37.4-51.7)***	1.00	2.90 (0.73)***	2.68 (0.65)***	2.98 (0.80)***	4.72 (0.49)
<5 yrs secondary	55.0 (50.1-59.9)***	1.00	4.01 (0.82)***	4.39 (0.83)***	4.68 (1.01)***	5.56 (0.31)
Non-english speaking background						
No	36.5 (34.4-38.7)	1.00	1.00	1.00	1.00	*5.10 (0.17)*
Yes	39.4 (33.5-45.7)	1.00	1.31 (0.26)	1.05 (0.21)	1.04 (0.23)	5.34 (0.45)
Resident children						
No	36.8 (34.6-39.0)	1.00	1.00	1.00	1.00	*5.08 (0.17)*
Yes	37.6 (32.3-43.2)	1.00	0.90 (0.18)	0.99 (0.18)	1.24 (0.23)	5.42 (0.41)
Employment status						
Employed	32.5 (28.7-36.6)	1.00	1.00	1.00	1.00	*4.61 (0.33)*
NLF, regular volunteer	34.2 (30.6-37.9)	1.00	0.96 (0.18)	1.00 (0.18)	1.34 (0.27)	5.60 (0.30)*
NLF, not a regular volunteer	42.0 (38.8-45.3)***	1.00	1.48 (0.26)*	1.31 (0.21)	1.82 (0.33)**	5.08 (0.23)
Government pension/benefit						
No	33.7 (31.4-36.1)	1.00	1.00	1.00	1.00	*4.99 (0.19)*
Yes	46.4 (42.2-50.6)***	1.00	1.64 (0.24)**	1.65 (0.23)***	1.85 (0.34)***	5.43 (0.28)
Financial problems						
No	37.0 (34.9-39.1)	1.00	1.00	1.00	1.00	*5.10 (0.16)*
Yes	38.8 (25.7-53.7)	1.00	0.92 (0.45)	0.99 (0.45)	1.43 (0.66)	6.37 (1.10)
Residential tenure						
Owner-buyer	36.1 (34.0-38.3)	1.00	1.00	1.00	1.00	*5.08 (0.17)*
Public or private rental	45.9 (37.6-54.4)	1.00	1.46 (0.38)	1.15 (0.31)	2.04 (0.51)**	5.73 (0.57)
Other	40.4 (28.3-53.9)	1.00	1.14 (0.62)	1.28 (0.49)	1.16 (0.53)	5.23 (0.97)

†reference categories are indicated with italic font; *p<.05, **p<.01, ***p<.001

Table 8: Multivariate models of the demographic and socioeconomic factors associated with gambling more than monthly and gambling frequency in 64-68y olds (n=2,084).

Characteristic	OR (se) gambling >monthly	Gambling frequency [RRR (se)] across all activities			
		<monthly	1-3 days p/mth	4 days p/mth	5+ days p/mth
Sex					
Male	2.36 (0.24)***	1.00	1.70 (0.26)***	1.86 (0.27)***	5.01 (0.89)***
Female	1.00	1.00	1.00	1.00	1.00
Marital status					
Married	1.00	1.00	1.00	1.00	1.00
Separated/divorced	0.92 (0.13)	1.00	0.84 (0.18)	0.95 (0.19)	0.98 (0.22)
Widowed	1.06 (0.18)	1.00	0.96 (0.25)	0.85 (0.22)	1.63 (0.44)
Never married	0.76 (0.25)	1.00	0.93 (0.43)	0.53 (0.29)	0.88 (0.45)
Education					
Bachelors degree+	1.00	1.00	1.00	1.00	1.00
Assoc/undergrad diploma	1.71 (0.30)**	1.00	1.85 (0.49)*	1.24 (0.34)	2.24 (0.60)**
Trade/tech/apprenticeship/certificate	2.37 (0.30)***	1.00	2.45 (0.48)***	2.12 (0.39)***	2.62 (0.53)***
5-6 yrs secondary	2.78 (0.50)***	1.00	2.84 (0.75)***	2.69 (0.67)***	2.81 (0.77)***
<5 yrs secondary	3.87 (0.57)***	1.00	3.58 (0.78)***	4.07 (0.81)***	3.93 (0.91)***
Employment status					
Employed	1.00	1.00	1.00	1.00	1.00
NLF, regular volunteer	1.00 (0.13)	1.00	0.87 (0.17)	0.93 (0.17)	1.27 (0.26)
NLF, not a regular volunteer	1.12 (0.14)	1.00	1.11 (0.20)	0.97 (0.17)	1.39 (0.27)
Government pension/benefit					
No	1.00	1.00	1.00	1.00	1.00
Yes	1.32 (0.15)*	1.00	1.33 (0.22)	1.34 (0.21)	1.30 (0.23)
Residential tenure					
Owner-buyer	1.00	1.00	1.00	1.00	1.00
Public or private rental	1.06 (0.21)	1.00	1.08 (0.30)	0.81 (0.24)	1.41 (0.39)
Other	0.94 (0.29)	1.00	0.71 (0.35)	1.16 (0.46)	0.94 (0.44)

*p<.05, **p<.01, ***p<.001

Hours spent gambling per month on main activity

Analysis of variance was used to investigate the demographic and socioeconomic factors associated with hours gambling per month (on main activity) amongst gamblers, excluding participants who mainly gambled on scratch tickets/lottery (for obvious reasons). This reduced the sample size substantially (n=741 gamblers) and consequently the analysis needed to be undertaken combining all age groups. Dummy variables were included in the analysis in order to adjust for all age and sex differences.

The first column in Table 9 shows the mean hours gamblers spent gambling on their main activity across a range of demographic and socioeconomic factors. Amongst gamblers, being an older male, not owning (or buying) your home, being unmarried, having completed less than five years secondary school, not having paid work and relying on a government pension/benefit were all associated with spending more hours gambling. The multivariate model (column 2) simultaneously includes all significant factors in the analysis. Only education, residential tenure, and age and sex differences remained associated with hours gambling on main activity.

Table 9: Hours spent gambling per month on main activity amongst gamblers (adjusted for age and sex unless otherwise specified), n=741.

	Hours gambling (per month)	**Hours gambling (per month) Multivariate model††**
Characteristic (n) †	**Mean (95% CI)**	**Mean (95% CI)**
Age and sex group (unadjusted)		
Men *24-28 (187)*	7.21 (5.72-8.70)	7.21 (4.82-8.06)
44-48 (128)	11.76 (8.96-14.56)**	13.75 (11.22-16.27)***
64-68 (147)	12.53 (9.28-15.78)***	14.04 (11.42-16.67)**
Women24-28 (86)	7.39 (4.88-9.90)	7.56 (4.43-10.70)
44-48 (92)	9.29 (7.27-11.31)	9.62 (6.71-12.52)
64-68 (101)	9.20 (6.87-11.53)	9.44 (6.14-12.75)
Residential tenure		
Owner buyer (462)	7.53 (6.18-8.88)	7.53 (6.11-8.96)
Other (279)	13.03 (11.23-14.83)***	11.02 (9.06-12.98)*
Currently married		
Yes (361)	8.24 (6.70-9.79)	8.24 (6.65-9.83)
No (379)	11.05 (9.45-12.64)*	9.21 (7.57-10.86)
Education		
Bachelors degree+ (137)	7.67 (5.28-10.06)	7.67 (5.30-10.05)
Assoc/undergrad diploma (79)	8.37 (5.26-11.48)	8.13 (5.07-11.20)
Trade/apprenticeship/certificate (252)	9.29 (7.54-11.03)	9.17 (7.44-10.90)
5-6 yrs secondary (135)	9.21 (6.79-11.63)	8.97 (6.58-11.36)
<5 yrs secondary (138)	13.19 (10.75-15.63)**	12.64 (10.21-15.08)*
Non-english speaking background		
No (685)	9.39 (8.33-10.46)	-
Yes (53)	12.48 (8.60-16.37)	
Employment status		
Employed (495)	8.52 (7.12-9.91)	8.52 (7.10-9.94)
Not in paid workforce/unemployed (245)	11.67 (9.48-13.86)*	9.93 (7.66-12.20)
Volunteer (60 only)		
Employed (58)	6.85 (2.21-11.49)	-
NLF, regular volunteer (70)	13.65 (9.56-17.75)*	
NLF, not a regular volunteer (115)	11.02 (1.61-14.19)	
Government pension/benefit		
No (613)	8.81 (7.68-9.94)	8.81 (7.68-9.95)
Yes (127)	13.20 (10.59-15.80**	10.49 (7.69-13.30)
Financial problems		
No (643)	8.90 (7.80-10.00	8.90 (7.81-9.99)
Yes (98)	14.24 (11.38-17.10)**	12.18 (9.16-15.21)

†Italics denote the reference group

†† all significant characteristics (from column one) were included in the multivariate model

*p<.05, **p<.01, ***p<.001

The association between having resident children and hours spent gambling was found to differ by age and sex (3-way interaction p=.038). There was also a significant two-way interaction between sex and having resident children on hours spent gambling (p=.016) amongst 44-48y olds. Figure 2 shows that having resident children was associated with spending *fewer* hours gambling amongst 44-48y old men, but not 44-48y old women. The number of participants with resident children in other age groups was small. The association linking having resident children with hours gambling was not significant in 24-28y and 64-68y olds (adjusting for sex).

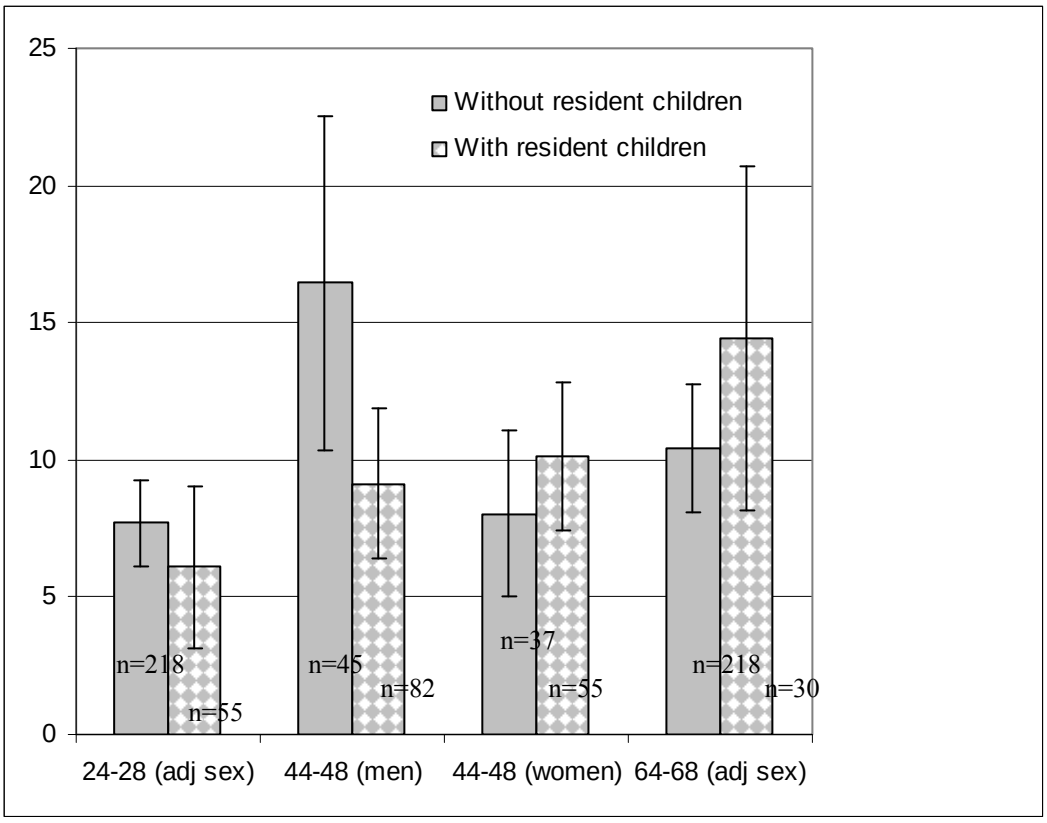


Figure 2: Mean (95% CIs) hours gambling per month on main activity amongst gamblers for participants with and without resident children.

Main gambling activity

Table 10 shows main gambling activity as a percentage of the total sample and as a percentage of all gamblers. The most frequently endorsed gambling activity was 'lottery games'. Nearly 18% of the sample and more than half all gamblers reported lottery games as their main gambling activity. The next most common main activity was poker/gaming machines, reported by almost 8% of the sample and almost a quarter of the gamblers.

Amongst those that gambled more than monthly, mean gambling days per month did not vary substantially across main activity. Across all main activities, mean gambling days per month was 5.1 (Table 10). The only group reporting less than four days per month were those who identified buying scratch tickets as their main activity (3.3 days per month). Groups reporting more than six days per month were those who identified their main activity as betting on horse or greyhound races (6.6), bingo (6.3), and Keno (7.9). Only one participant reported internet casino games as their main activity and they gambled on 12 days per month.

Participants who reported lottery or scratch tickets as their main activity were not asked about the length of gambling sessions. Excluding these participants, the mean length of gambling sessions across all gambling types was 1.7 hours. Betting on sports events involved shorter sessions on average (0.7 hours), while casino table games (3.1 hours) and playing cards or mahjong for money (3.3 hours) involved longer sessions. On average, across all types of gambling, gamblers reported undertaking their main activity for nearly 10 hours per month. Across gambling type, the greatest time per month involved cards or mahjong (25.3 hours), horse or greyhound races (15.8 hours), bingo (14.2 hours), and casino table games (12.1 hours). Betting on other sports events, playing Keno and playing poker/gaming machines involved fewer hours per month.

Table 10: Number, proportion and time spent playing main gambling activity.

Type of gambling	N	% of sample	% of gamblers	Days per mth	Mean (SD) hours per session*	Mean (SD) hours per mth*
Lottery games	1171	17.8	56.7	4.5 (1.1)	n.a.	n.a.
Poker/gaming machines	506	7.7	24.5	4.6 (3.8)	1.6 (1.2)	7.7 (8.8)
Scratch tickets	133	2.0	6.4	3.5 (3.2)	n.a.	n.a.
Horse or greyhound races (excluding sweeps)	130	2.0	6.3	6.6 (6.0)	2.0 (1.7)	15.8 (24.9)
Bingo at a hall or club	46	0.7	2.2	6.3 (4.6)	2.2 (0.8)	14.2 (13.4)
Sporting events i.e. football, cricket	38	0.6	1.8	4.1 (3.2)	0.7 (1.2)	6.1 (16.7)
Keno	20	0.3	1.0	7.9 (9.0)	1.2 (1.3)	6.5 (10.0)
Table games i.e. blackjack, roulette	14	0.2	0.7	4.2 (3.5)	3.1 (1.9)	12.1 (15.2)
Cards or mahjong for money	7	0.1	0.3	6.0 (6.4)	3.3 (1.7)	25.3 (24.6)
Internet casino games	1	0.0	0.0	12.0 (n.a.)	1.5 (n.a.)	18.0 (n.a.)
All main activities	2066	31.3	-	5.1 (4.6)	1.7 (1.4)	9.6 (14.3)

*hours spent on main gambling activity

In order to investigate factors associated with main gambling activity, several gambling types needed to be combined. This was primarily due to the low frequency of several activities.

Categories investigated were: (1) sports betting and races; (2) scratch tickets and lottery games; (3) poker/gaming machines; (4) bingo; and (5) other activities (encompassing Keno, table games, cards or mahjong and internet casino games). Figure 3 shows a breakdown of these activities by age and sex, amongst gamblers. Amongst 24-28y old male gamblers, the most popular form of gambling was poker machines (45%), followed by scratch tickets/lottery (32%) and races/sports events (17%). Chi-square statistics and adjusted residuals were used to test whether age and sex were associated with different types of gambling (see Appendix 2). Scratch tickets/lottery games were less popular in the youngest age group and more popular in men in the middle and older age groups. Poker machines were the most popular in youngest age group, particularly young men. Betting on races/sports events was more common in men than in women.

It should be remembered that this is based only on reports of individuals' main type of gambling, so it does not reflect other forms of gambling in people who engage in more than one activity.

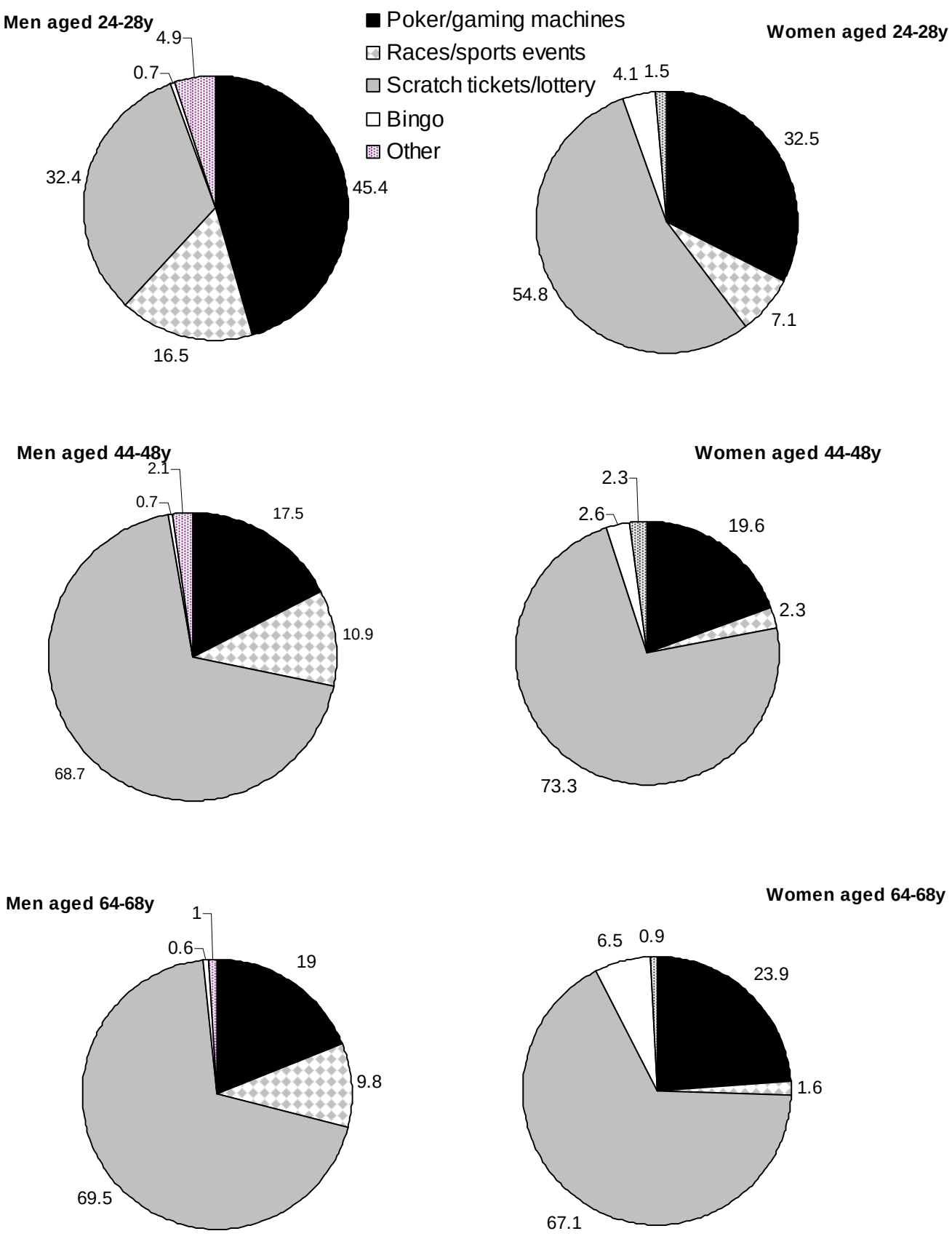


Figure 3: Main gambling activity (%), by age group and sex.

A series of logistic regression analyses investigated whether demographic and socioeconomic factors were associated with specific types of gambling amongst gamblers. The factors associated with mainly gambling on: (1) poker machines; (2) races/sports betting; and (3) bingo were identified. Scratch tickets/lottery were defined as the reference group for all analyses. Dichotomous demographic and socioeconomic measures were used in this analysis because contrasting different types of gambling activities introduced power limitations. The findings are presented separately for men and women when significant interactions were found, otherwise all analyses were adjusted for sex.

Table 11 shows that amongst 24-28y gamblers, those with financial problems, who were unmarried and did not have a degree were more likely to report that playing poker/gaming machines was their main gambling activity (compared to lottery/scratch tickets).

Amongst 44-48y gamblers, participants who did not own and were not buying their home, who were not in the labour force and who did not have a degree were more likely to report that playing poker/gaming machines was their main activity compared to scratch tickets/lottery.

Lastly, amongst the 64-68y gamblers, financial problems were associated with mainly gambling on poker/gaming machines over scratch tickets/lottery. Significant interactions linked residential tenure and sex (p=.012) as well as marital status and sex (p=.008) with reporting poker/gaming machines as a main activity. Women who did not own their home, and who were unmarried were *less* likely to say that playing poker/gaming machines was their main gambling activity. In contrast, for men residential tenure and marital status were not significantly associated with main gambling activity.

Table 11: Demographic and socioeconomic factors [OR, (95% CI)] associated with main gambling activity relative to scratch tickets/lottery by age group (adjusted by sex).

Age group	**Poker/gaming machines**	**Scratch tickets/lottery**	**Races/sports**	**Bingo**
24-28y				
Male (unadjusted)	2.37 (1.57-3.56)***	1.00	1.67 (0.85-3.25)	
Resident child	0.72 (0.43-1.19)	1.00	1.38 (0.69-2.77)	-
Financial problems	2.09 (1.22-3.56)**	1.00	0.71 (0.36-1.37)	-
Government pension/benefit	1.36 (0.61-3.04)	1.00	1.46 (0.37-5.79)	-
Other vs owner buyer	1.39 (0.90-2.15)	1.00	0.53 (0.29-0.98)*	
Unmarried vs married	2.05 (1.24-3.40)**	1.00	0.71 (0.36-1.37)	-
No paid employment	0.74 (0.36-1.51)	1.00	n/a	-
No graduate qualifications	2.25 (1.36-3.71)**	1.00	1.05 (0.55-2.01)	-
44-48y				
Male (unadjusted)	0.95 (0.66-1.38)	1.00	5.36 (2.36-12.16)***	
Resident child	0.68 (0.46-1.01)	1.00	0.87 (0.47-1.61)	-
Financial problems	1.58 (0.87-2.86)	1.00	1.58 (0.58-4.32)	-
Government pension/benefit	1.69 (0.76-3.80)	1.00	na	-
Other vs owner buyer	3.00 (1.95-4.59)***	1.00	1.56 (0.76-3.20)	
Unmarried	1.20 (0.82-1.76)	1.00	0.91 (0.49-1.69)	-
No paid employment	1.98 (1.12-3.51)*	1.00	1.54 (0.56-4.20)	-
No graduate qualifications	2.62 (1.63-4.20)**	1.00	1.73 (0.86-3.49)	-
64-68y			*Men only*	*Women only*
Male (unadjusted)	0.77 (0.54-1.09)	1.00	na	
Resident child	0.73 (0.43-1.23)	1.00	1.33 (0.63-2.83)	1.34 (0.38-4.73)
Financial problems	3.01 (1.07-8.46)*	1.00	na	na
Government pension/benefit	1.08 (0.74-1.57)	1.00	1.40 (0.74-2.68)	1.56 (0.74-3.31)
Other vs owner buyer	M: 1.55 (0.74-3.26)	1.00	1.65 (0.64-4.23)	1.64 (0.51-5.23)
	F: 0.28 (0.08-0.96)*	1.00		
Unmarried	M: 1.17 (0.65-2.10)	1.00	0.97 (0.43-2.19)	1.24 (0.58-2.63)
	F: 0.36 (0.19-0.69)**	1.00		
No paid employment	1.04 (0.69-1.56)	1.00	0.82 (0.43-1.56)	na
No graduate qualifications	1.10 (0.72-1.69)	1.00	1.34 (0.67-2.68)	na

*p<.05, **p<.01, ***p<.001

Table 12: Multivariate models investigating socioeconomic and demographic factors associated with main activity (poker/gaming machines vs scratch tickets/lottery) for 24-28y and 44-48y olds.

Age group and characteristic	OR (95% CI)
24-28y	
Male	2.14 (1.403.27)***
Financial problems	1.59 (0.91-2.77)
Unmarried	2.00 (1.19-3.37)**
No graduate qualifications	2.17 (1.29-3.64)**
44-48y	
Male	1.04 (0.71-1.53)
Other vs owner-buyer	2.62 (1.68-4.11)***
No paid employment	1.37 (0.74-2.53)
No graduate qualifications	2.54 (1.56-4.14)***

*p<.05, **p<.01, ***p<.001

We then investigated whether the significant characteristics in Table 11 were independently associated with gamblers reporting that poker/gaming machines were their main activity (compared to scratch tickets/lottery). Table 12 shows that amongst 24-28y olds, being male, unmarried and having no graduate qualifications were independently associated with mainly gambling on poker/gaming machines (compared to scratch tickets/lottery). In the 44-48y age group, not owning (or buying) your home, and having no graduate qualifications was associated with participants reporting that poker/gaming machines was their main gambling activity. Multivariate analyses were not conducted on the 64-68y age group, because having financial problems was the only factor associated with main gambling activity for both male and female gamblers.

The role of gambling activity in gambling frequency and hours spent gambling

We investigated whether main gambling activity was influencing, or indeed responsible for the associations linking socioeconomic characteristics with gambling days per month across all activities (the last columns in Tables 3-8). A variable identified participants who mainly gambled on: (1) scratch tickets/lottery; (2) poker/gaming machines; (3) races/sporting events; and (4) other activities. Analysis of variance indicated that these gambling activities were not associated with frequency of gambling amongst 24-28y gamblers (adjusting for sex , p=.090). Amongst 64-68y old gamblers, volunteering was the only factor (other than sex) that was associated with mean gambling days per month amongst gamblers (see Table 7). Gambling frequency remained significantly higher in weekly volunteers who were not in the paid work force (mean 5.63, se 0.29) compared to those in the paid work force (mean 4.61, se 0.32) after

adjusting for main gambling activity and sex (p=.020). For 44-48y olds, the main gambling activity measure was added to the multivariate analysis of variance investigating the socioeconomic characteristics associated with gambling days per month amongst gamblers (the last column in Table 6). Adjusting for main gambling activity did not substantially change the findings.

We also examined whether type of main gambling activity could have influenced or accounted for associations linking demographic and socioeconomic characteristics with hours spent gambling on main activity. We added the main gambling activity variable to the multivariate analysis of variance model presented in Table 9. Table 13 shows that age, sex, residential tenure and education were associated with hours spent gambling after adjusting for main gambling activity. Indeed, adjusting for main gambling activity *strengthened* some of the findings, rather than serving as an explanation for them.

Table 13: Multivariate models investigating hours gambling per month on main activity amongst gamblers, n=741.

	Multivariate model††	Further adjusting for main gambling activity
Characteristic (n)†	**Mean (95% CI)**	**Mean (95% CI)**
Age and sex group		
Men *24-28 (187)*	7.21 (4.82-8.06)	7.21 (4.87-9.56)
44-48 (128)	13.75 (11.22-16.27)***	13.15 (10.66-15.64**
64-68 (147)	14.04 (11.42-16.67)**	13.79 (11.15-16.38)**
Women24-28 (86)	7.56 (4.43-10.70)	7.97 (4.88-11.05)
44-48 (92)	9.62 (6.71-12.52)	10.17 (7.29-13.05)
64-68 (101)	9.44 (6.14-12.75)	10.31 (7.03-13.59)
Main gambling activity		
Poker machines (497)	N/A	7.79 (6.58-8.99)
Races/sports events (158)		14.30 (12.08-16.53)***
Other (86)		12.01 (9.03-15.00)*
Residential tenure		
Owner buyer (462)	7.53 (6.11-8.96)	7.53 (6.13-8.93)
Other (279)	11.02 (9.06-12.98)*	11.27 (9.34-13.19)**
Currently married		
Yes (361)	8.24 (6.65-9.83)	8.24 (6.67-9.81)
No (379)	9.21 (7.57-10.86)	9.27 (7.65-10.89)
Education		
Bachelors degree+ (137)	7.67 (5.30-10.05)	7.67 (5.33-10.00)
Assoc/undergrad diploma (79)	8.13 (5.07-11.20)	8.94 (5.92-11.95)
Trade/apprenticeship/certificate (252)	9.17 (7.44-10.90)	9.45 (7.76-11.14)
5-6 yrs secondary (135)	8.97 (6.58-11.36)	8.83 (6.47-11.18)
<5 yrs secondary (138)	12.64 (10.21-15.08)*	12.93 (10.53-15.33)**
Employment status		
Employed (495)	8.52 (7.10-9.94)	8.52 (7.12-9.93)
Not in paid workforce/unemployed (245)	9.93 (7.66-12.20)	10.18 (7.94-12.42)
Government pension/benefit		
No (613)	8.81 (7.68-9.95)	8.81 (7.69-9.93)
Yes (127)	10.49 (7.69-13.30)	9.61 (6.84-12.38)
Financial problems		
No (643)	8.90 (7.81-9.99)	8.90 (7.83-9.97)
Yes (98)	12.18 (9.16-15.21)	12.66 (9.68-15.64)*

†Italics denote the reference group

†† all significant factors from Table 9 were included in the multivariate model

*p<.05, **p<.01, ***p<.001

Similarities and differences across age groups and sex

Table 14 gives a summary of the demographic and socioeconomic factors associated with each of the gambling variables, to enable comparison across age groups and sex and between gambling measures. Significant interactions indicated that some factors associated with gambling participation differed across age groups and by sex. For instance, being unmarried and residing in rental accommodation was associated with gambling participation in the 44-48y but not the 24-28y age group. Financial problems were only associated with gambling participation in the younger age groups. Receiving a government pension was only associated with gambling participation in 64-68y olds. Having a resident child was not associated with gambling participation in the oldest age group, but was associated with *increased* odds of gambling in 24-28y olds and *decreased* odds of gambling in 44-48y olds. The most consistent factors across age groups were sex and education.

Significant age and sex differences were also evident in factors associated with days and hours spent gambling, and with main gambling activity. For instance, male gamblers in the 44-48y age group also spent fewer days and hours gambling on their main activity if they had a resident child compared to male gamblers with no resident children. For 64-68y old female gamblers, being unmarried and not owning or buying their home was associated with gambling mainly on scratch tickets/lottery over poker/gaming machines. These factors were not associated with main gambling activity in male gamblers of the same age.

While we found that many demographic and socioeconomic factors were associated with gambling participation after adjusting for sex, there were few factors that were associated with mean days gambling across all activities amongst 24-28y and 64-68y gamblers. Indeed, there were none in the youngest age group and in 64-68y old gamblers, being male was the only factor associated with gambling more days per month. In contrast, for 44-48y old gamblers, being male, having fewer than five years secondary school, having never married, not owning or buying a home, and not having a resident child were all associated with spending more days gambling. Furthermore, the first three of these were shown to be independently associated with mean days gambling in a multivariate model.

Factors that were associated with main gambling activity were frequently different from those associated with participation. In 24-28y olds, marital status was not associated with participation

or days spent gambling but gamblers who were unmarried were more likely to report that poker machines, rather than scratch tickets/lottery, were their main gambling activity. In 44-48y olds, being male, financial problems and being unmarried were independently associated with gambling participation, however these factors were not associated with main gambling activity amongst gamblers. In 64-68y olds, lower education, being male and receiving a government pension or benefit were independently associated with gambling participation, but none of these factors was associated with main gambling activity.

Table 14 also shows similarities across socioeconomic, demographic and gambling measures. For instance, almost all demographic and socioeconomic measures were linked with hours spent gambling on main activity amongst gamblers, although having a lower education, being male and not owning or buying a home were the only factors found to have an *independent effect* in multivariate analyses.

This table indicates that sex and education were the factors most consistently associated with gambling measures. Being male and lower levels of education were associated with gambling participation in all age groups. These factors were also linked to gamblers spending more days gambling in 44-48y olds, mainly gambling on poker machines (in both 24-28y and 44-48y age groups) and spending more hours gambling (across all age groups, adjusted for age). These associations were significant in multivariate models indicating that education and sex were independently associated with participation, days gambling, main type of activity and hours gambling per month.

Table 14: Summary of the demographic and socioeconomic factors associated with (a) gambling participation, (b) days gambling per month, (c) main type of gambling activity, and (d) hours gambling per month.

	Participation (> monthly) across all activities			**Days gambling per month (amongst gamblers) across all activities**			**Main type of activity (amongst gamblers): Poker machines vs scratch tickets/lottery**			**Hours gambling per month (amongst gamblers) on main activity †**
	24-28y	**44-48y**	**64-68y**	**24-28y**	**44-48y**	**64-68y**	**24-28y**	**44-48y**	**64-68y**	**All ages**
Lower education	+*	+*	+*		+*		+*	+*		+*
Male	+*	+*	+*		+*	+	+*			+*
Financial problems	+	+*					+		+	+
Unmarried		+*			+*		+*		- Women only	+
Non owner/buyer		+			+			+*	- Women only	+*
Resident child	+	-			- Men 44-48y only					- Men 44-48y only
Government pension/benefit			+*							+
No paid employment								+		+
Non-english speaking background		-								

†excluding participants whose main activity was lottery or scratch tickets
+increased odds or mean score; - decreased odds or mean score
*significant in multivariate models

4. Social, psychological and health outcomes

Dose-response relationships with gambling frequency and hours spent gambling

The associations linking gambling frequency (across all activities) and hours spent gambling (on main activity) with each of the continuous social, psychological and health outcomes were explored using (1) regression modelling to test for significant linear and non-linear components and (2) lowess plots to depict relationships graphically. The results from the regression models (Table 15) should be read in conjunction with the corresponding curves shown in Figures 4 through 29.

Regression models were run with each of the social, psychological and health measures as dependent variables. Gambling frequency across all activities and hours spent gambling per month on main gambling activity (excluding scratch tickets/lottery) were used as independent variables in separate analyses along with the following covariates: the categorical education variable, a dummy variable representing all six age and sex groups, and interaction terms involving education and age/sex categories. Initially, a quadratic term for the appropriate gambling measure (either frequency or hours spent) was also included in the regression models. Non-linearity was assessed by testing whether removing the quadratic variable from the regression analysis significantly changed the fit of the model. If the quadratic variable was not significant, it was omitted from the final model. Regression coefficients (unstandardised and standardised) from the final models are shown in Table 15, including the quadratic terms where significant.

Table 15: Linear and quadratic regression models linking gambling with social, psychological and health outcomes (adjusted for age, sex & education).

Measure	Bx (se)	βx	p-value Bx	χ^2 change†	Bx^2 (se)	βx^2	p-value Bx^2
DAYS GAMBLING PER MONTH ACROSS ALL ACTIVITIES							
Negative interactions with friends	0.01 (0.01)	0.02	*	1.56			
Positive support from friends	-0.02 (0.01)	-0.04	**	0.16			
Negative interactions with family	0.02 (0.01)	0.03	*	1.60			
Positive support from family	0.002 (0.005)	0.01		0.03			
Negative interactions with partner	0.04 (0.02)	0.04	*	0.09			
Positive support from partner	-0.01 (0.01)	-0.01		0.77			
Childhood adversity	0.001 (0.01)	0.002		0.05			
Stressful life events	0.03 (0.01)	0.06	***	1.45			
Depressive symptoms	0.05 (0.01)	0.06	***	1.76			
Anxiety symptoms	0.05 (0.01)	0.06	***	1.78			
Cigarettes per day	0.33 (0.05)	0.16	***	10.91**	-0.01 (0.004)	-0.08	**
Drinks per week	0.44 (0.04)	0.14	***	1.89			
Physical health	-0.34 (0.09)	-0.10	***	5.49*	0.02 (0.01)	0.06	*
HOURS GAMBLING PER MONTH ON MAIN ACTIVITY							
Negative interactions with friends	0.01 (0.01)	0.03	*	0.82			
Positive support from friends	-0.02 (0.004)	-0.05	***	0.03			
Negative interactions with family	0.01 (0.01)	0.01		0.03			
Positive support from family	0.003 (0.004)	0.01		2.62			
Negative interactions with partner	0.03 (0.01)	0.04	*	0.23			
Positive support from partner	-0.01 (0.01)	-0.01		0.33			
Childhood adversity	0.01 (0.01)	-0.02		2.69			
Stressful life events	0.02 (0.005)	0.05	***	1.48			
Depressive symptoms	0.03 (0.01)	0.06	***	1.47			
Anxiety symptoms	0.04 (0.01)	0.06	***	3.71			
Cigarettes per day	0.55 (0.05)	0.37	***	50.81***	-0.01 (0.002)	-0.23	***
Drinks per week	0.55 (0.07)	0.25	***	11.83***	-0.01 (0.003)	-0.11	**
Physical health	-0.15 (0.03)	-0.07	***	1.40			

†significance of change in model fit from removing quadratic term
B=unstandardised regression coefficient; β=standardised regression coefficient
*p<.05, **p<.01, ***p<.001

Table 15 shows that neither gambling measure was significantly associated with positive support from family or partner or with childhood adversity. Hours spent gambling was also not associated with negative interactions with family. Significant associations were seen for all other measures. In four instances the relationships with level of gambling departed significantly from linearity. Significant quadratic terms were seen for cigarettes consumed per day and physical health with frequency of gambling across all activities. Cigarettes smoked per day also departed from linearity with hours gambling per month, and drinks consumed per week similarly showed a significant quadratic term with hours gambling.

Lowess curves depicted the shape of associations between gambling measures and each of the continuous social, psychological and health outcomes. These used regression residuals to adjust the outcome measures for age, sex and education. Separate lines were plotted for all gambling activity (gambling frequency only), for participants whose main activity was poker/gaming machines (both gambling measures), for participants whose main activity was scratch tickets/lottery games (gambling frequency only) and for all activities excluding scratch tickets/lottery games (gambling hours only). Percentiles (amongst gamblers) are marked along the top x-axis of each graph as a guide to the dispersion of gamblers across the gambling measures. For every graph, the y-axis represents about one standard deviation on the dependent variable, providing an approximation to effect sizes. Broadly speaking, this enables comparison across the various social, psychological and health outcomes in terms of the slopes and shapes of the different plots. If a more accurate estimate of effect sizes is needed, the standard deviations of all outcome measures and other descriptive information are presented in Appendix 3.

Two examples help to explain the information presented in Table 15 and the lowess figures; one example of a linear relationship and one which departs significantly from linearity. (1) The regression analysis showed a significant linear relationship of depressive symptoms with gambling days per month across all activities ($p<.001$) with no significant quadratic term. Figure 20 shows the equivalent curve for all activities; depression score increases by about half a point (equivalent to a quarter of a standard deviation) across the full range of gambling frequency. (2) For cigarettes consumed per day, regression analysis showed a significant quadratic term with hours gambling per month for all activities excluding scratch tickets/lottery games ($p<.001$). Figure 25 shows the corresponding lowess curve, where cigarette consumption increases by about 4 cigarettes per day (equivalent to two-thirds of a standard deviation) over the range from 0 to 20 hours gambling per month and then levels off for more hours spent. This

figure also illustrates how the curve is steeper for those who identified playing poker/gaming machines as their main activity and is less steep for other activities.

A summary of the results from Table 15 and Figures 4 to 29 is provided in Chapter 5.

Figure 4: Negative interactions with friends and days gambling per month on all activities by main activity (adjusted for age, sex and education)

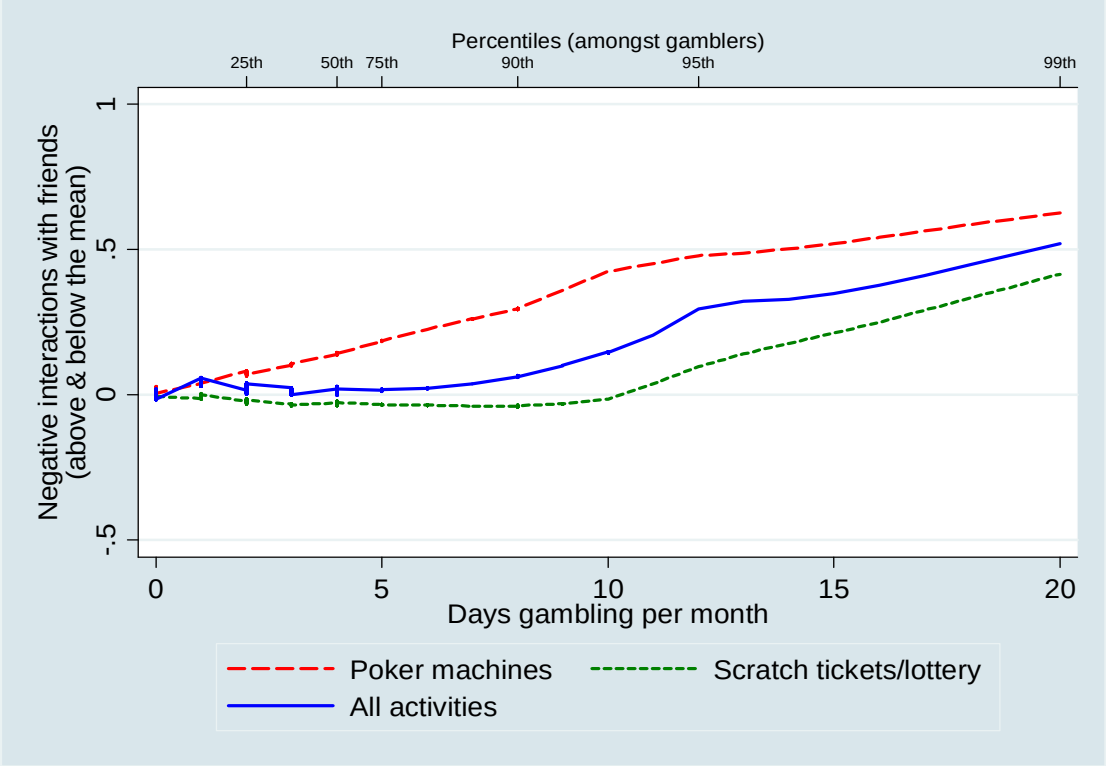
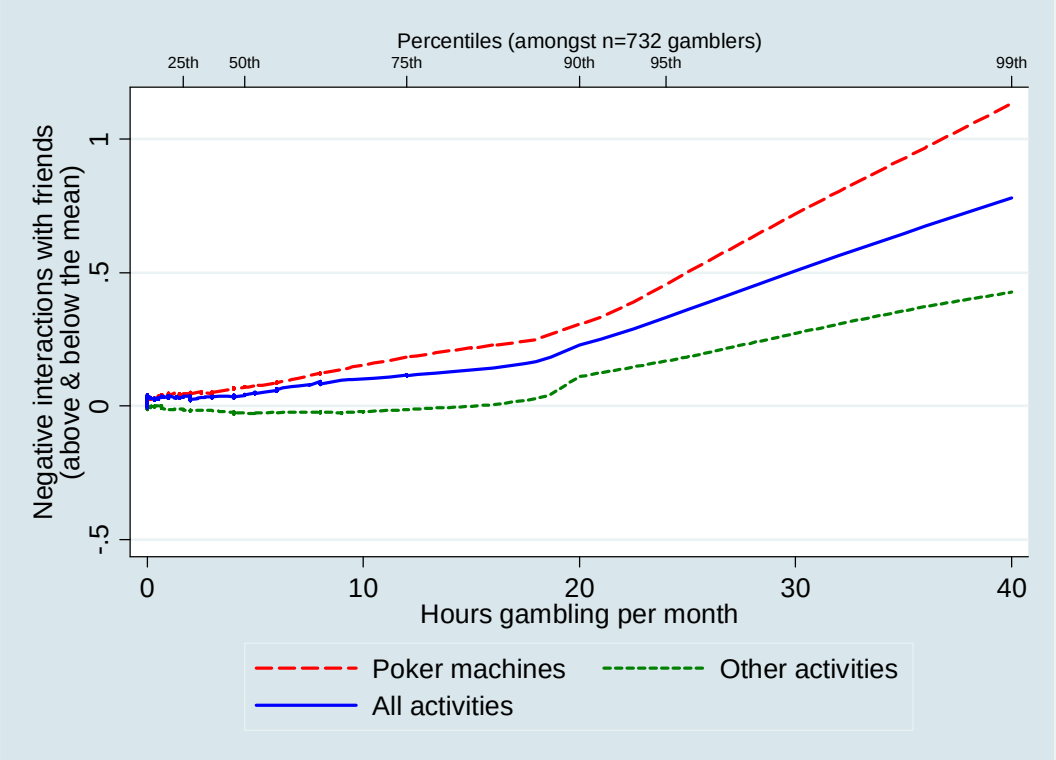


Figure 5: Negative interactions with friends and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 6: Positive support from friends and days gambling per month on all activities by main activity (adjusted for age, sex and education)

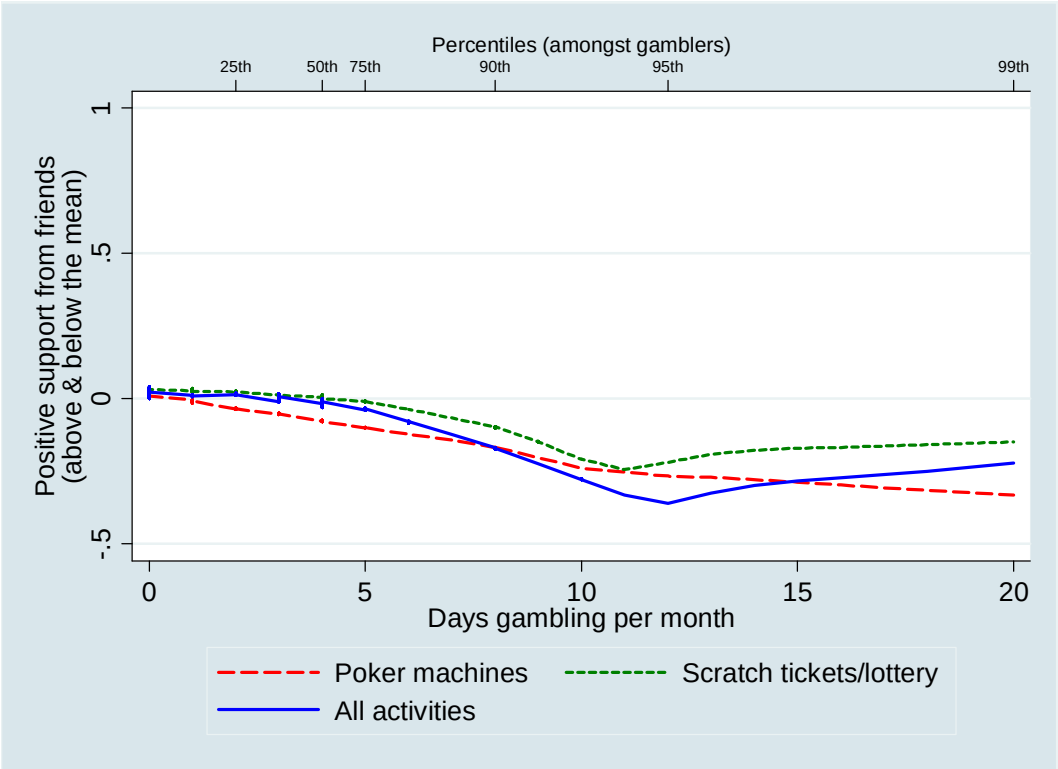
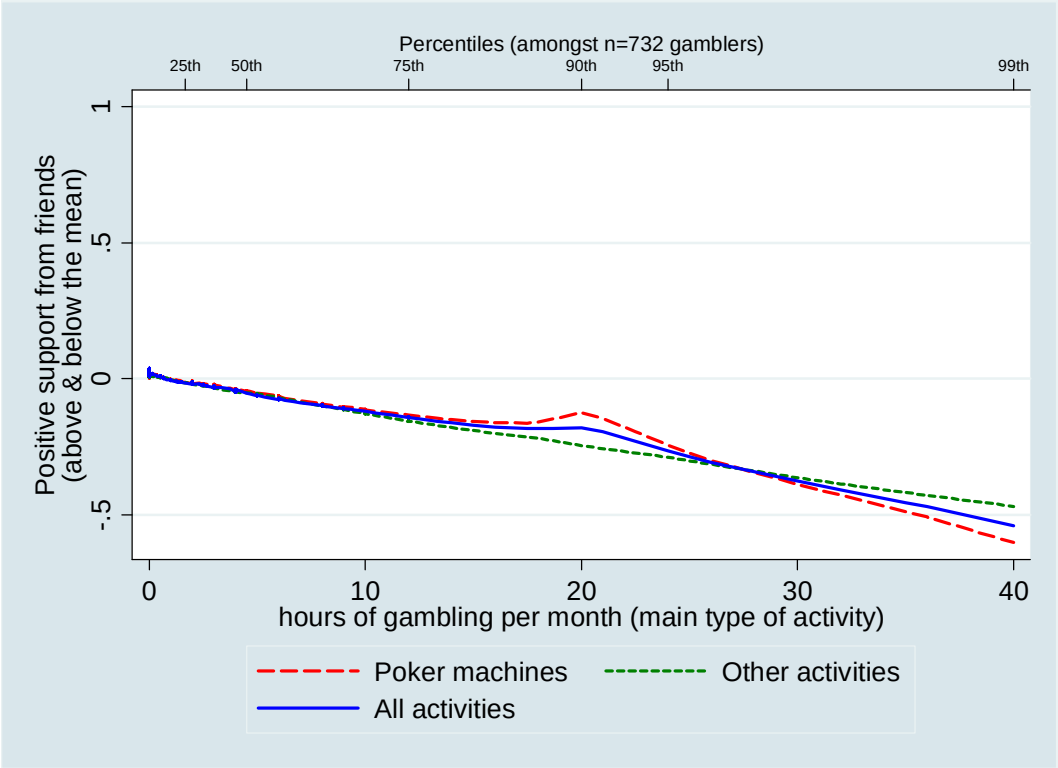


Figure 7: Positive support from friends and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 8: Negative interactions with family and days gambling per month on all activities by main activity (adjusted for age, sex and education)

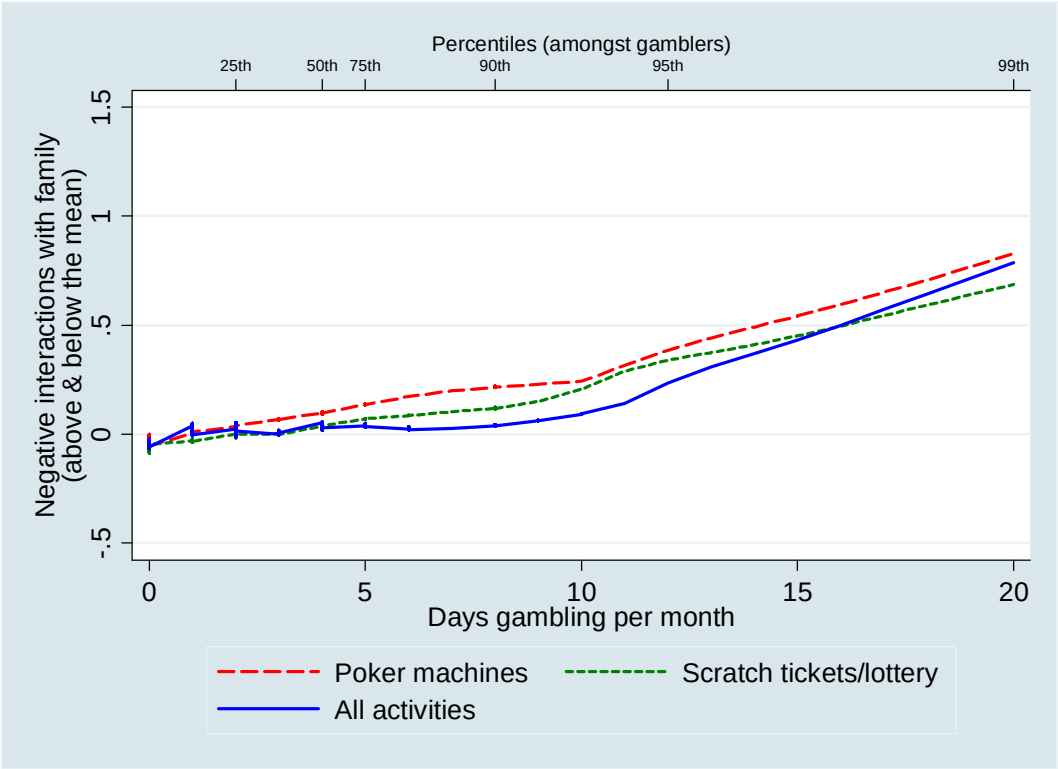
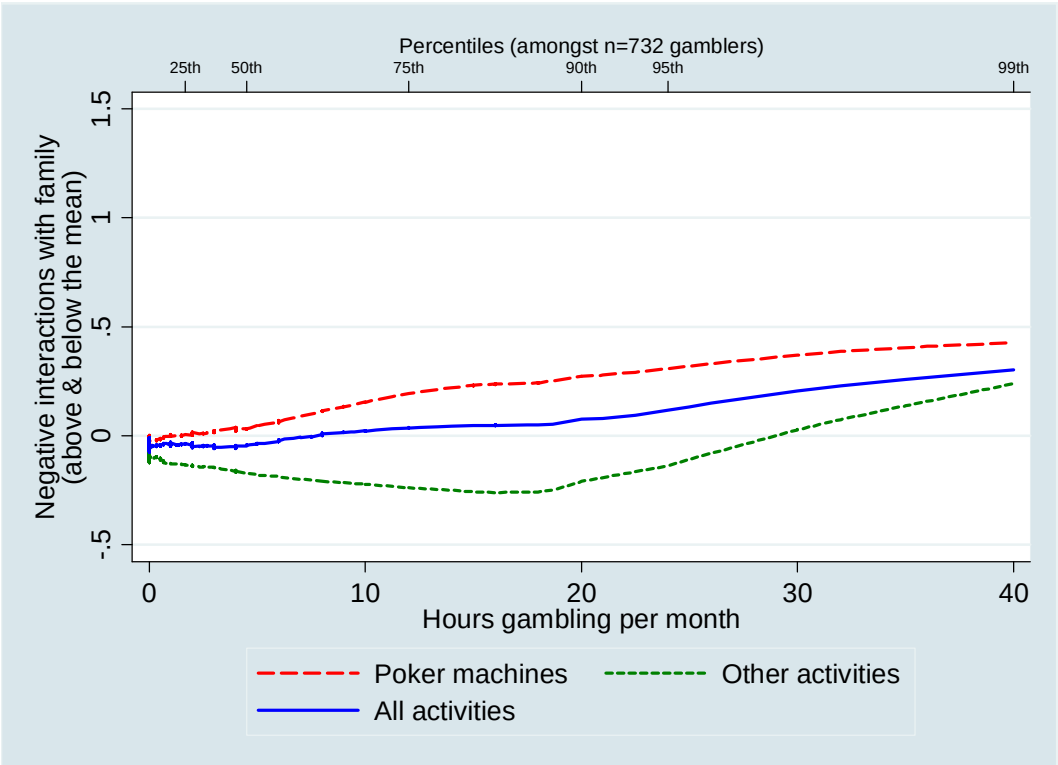


Figure 9: Negative interactions with family and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 10: Positive support from family and days gambling per month on all activities by main activity (adjusted for age, sex and education)

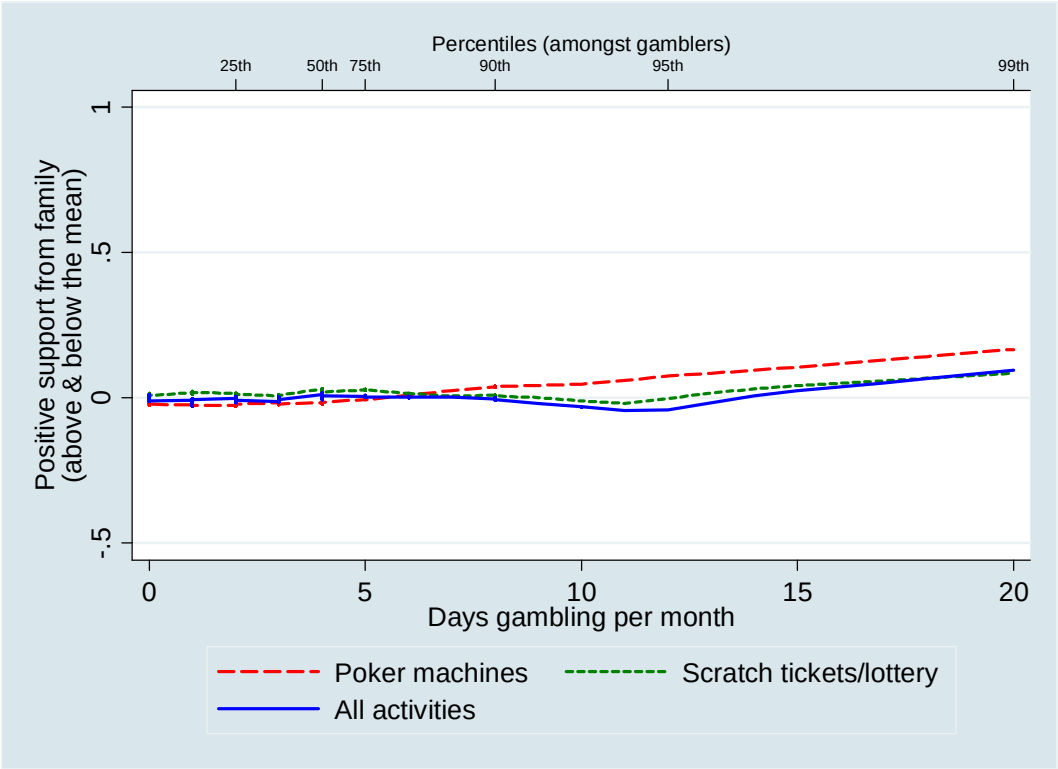
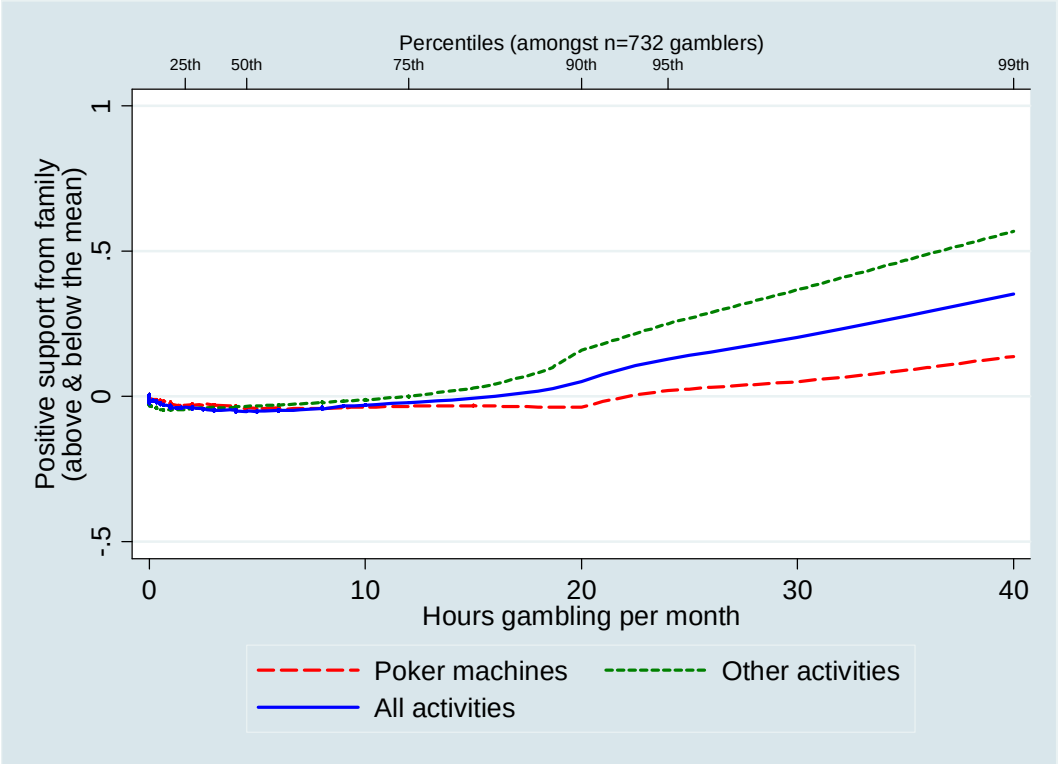


Figure 11: Positive support from family and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 12: Negative interactions with a partner and days gambling per month on all activities by main activity (adjusted for age, sex and education)

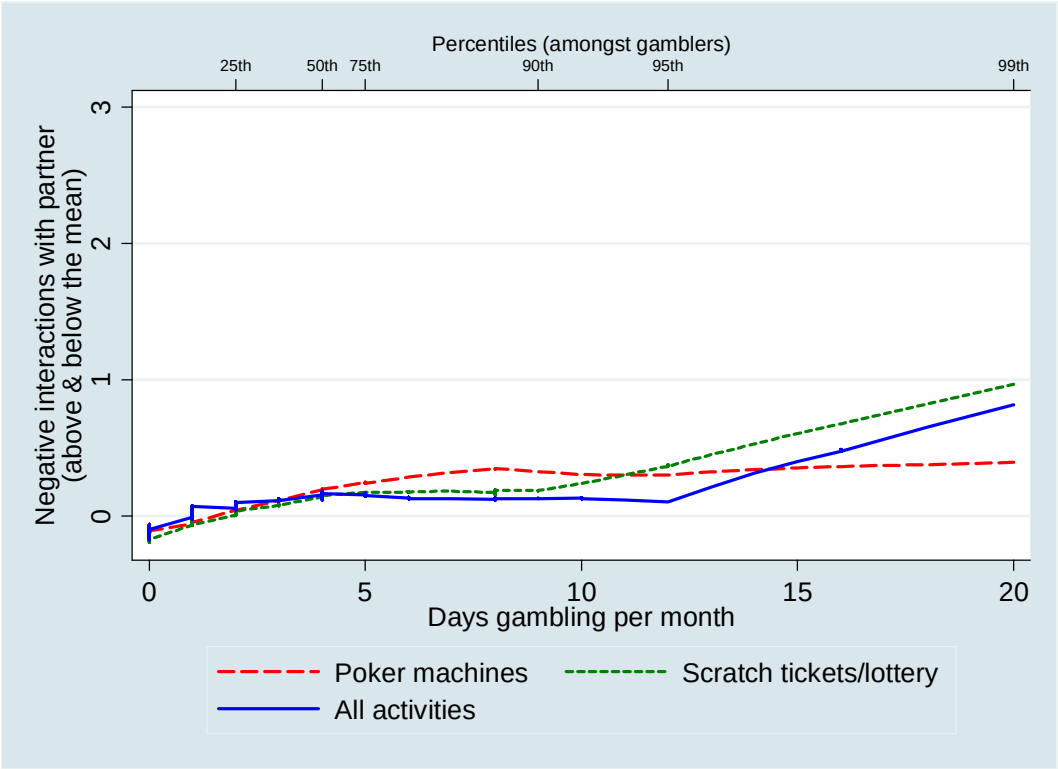
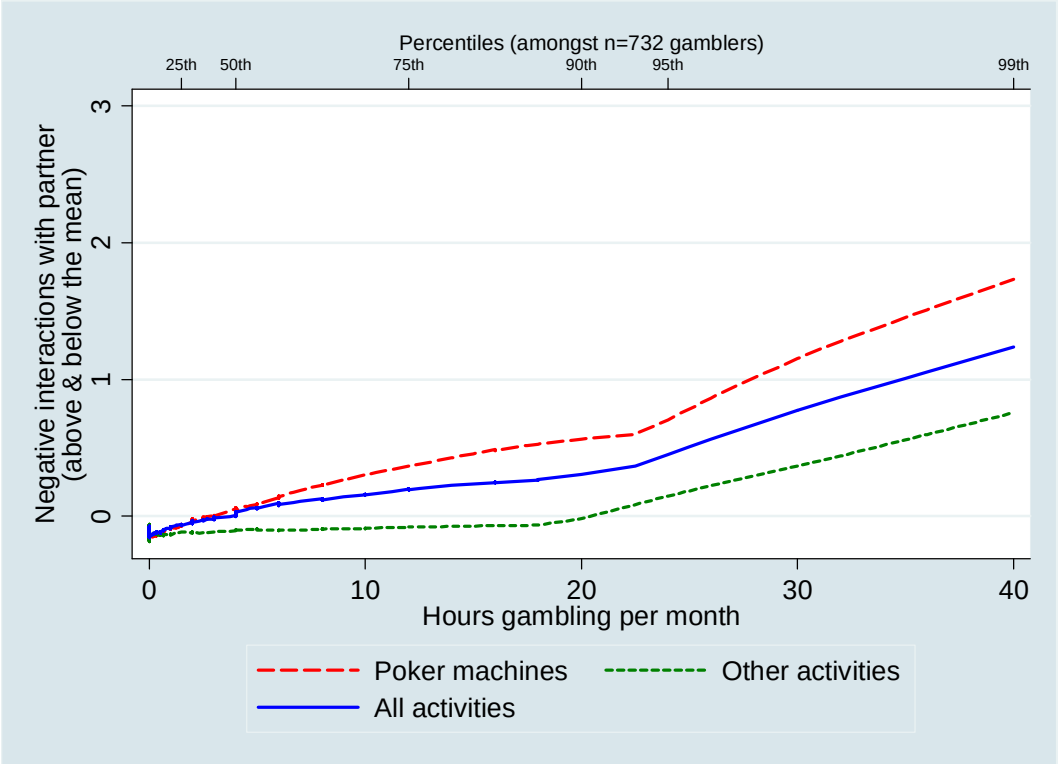


Figure 13: Negative interactions with a partner and hours gambling per month on main activity (adjusted for age, sex and education)*



***excludes the following activities [scratch tickets/lottery] & participants with no partner**

Figure 14: Positive support from a partner and days gambling per month on all activities by main activity (adjusted for age, sex and education)

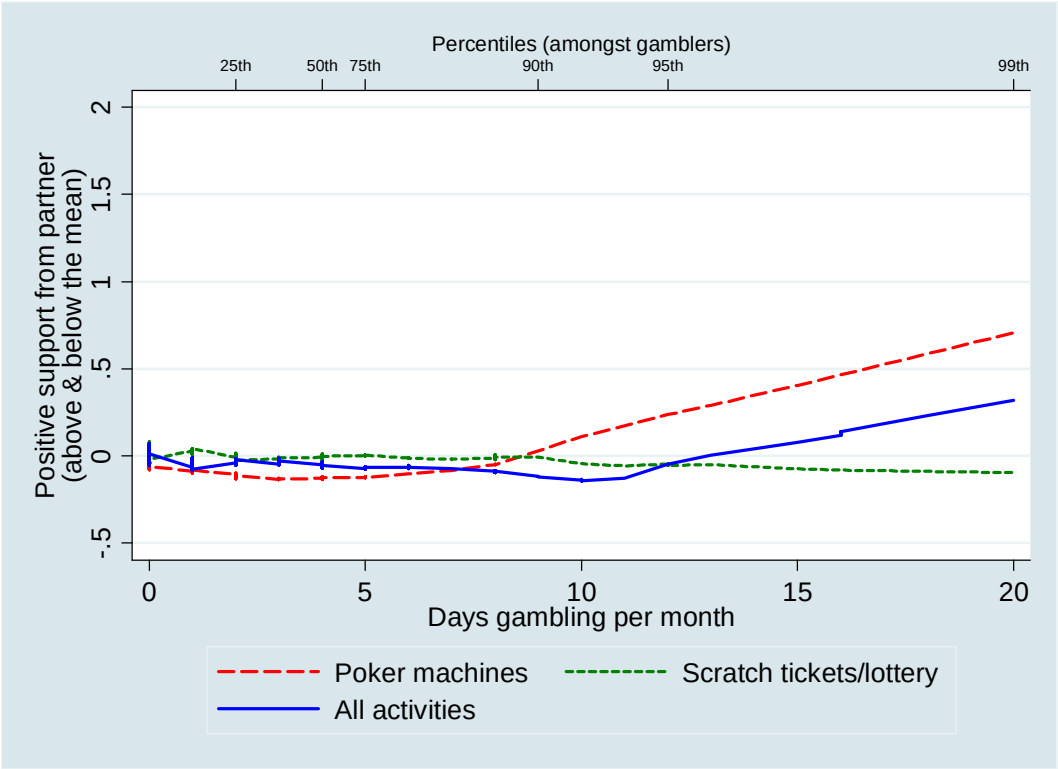
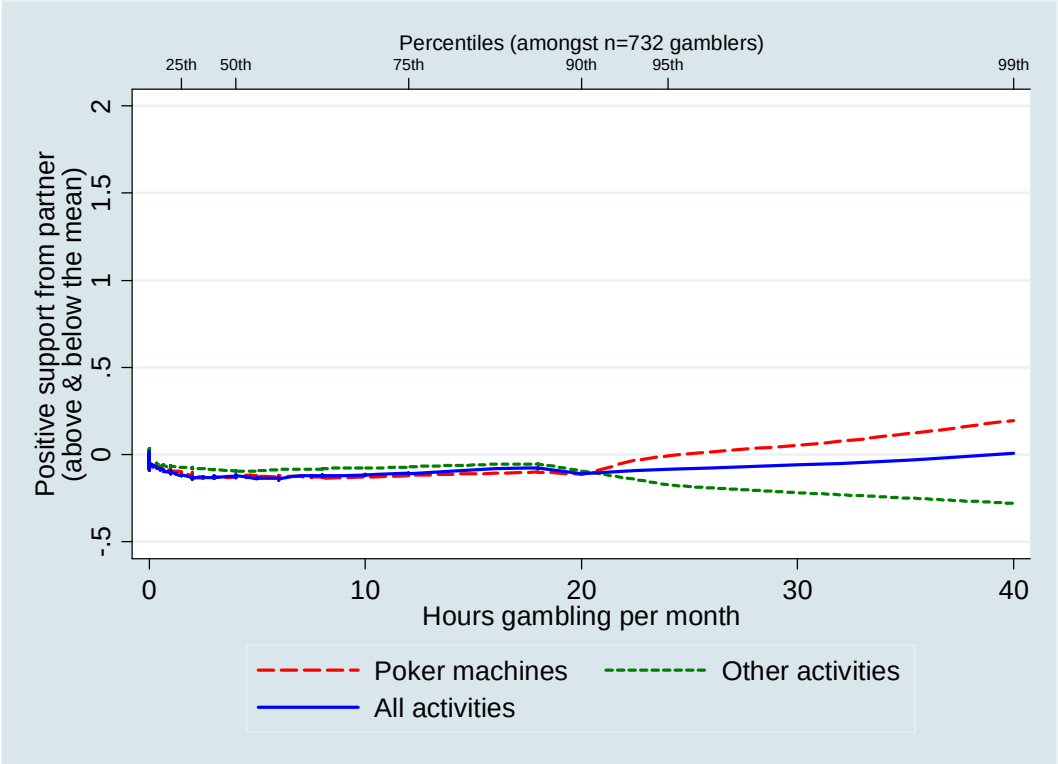


Figure 15: Positive support from a partner and hours gambling per month on main activity (adjusted for age, sex and education)*



***excludes the following activities [scratch tickets/lottery] & participants with no partner**

Figure 16: Childhood adversity and days gambling per month on all activities by main activity (adjusted for age, sex and education)

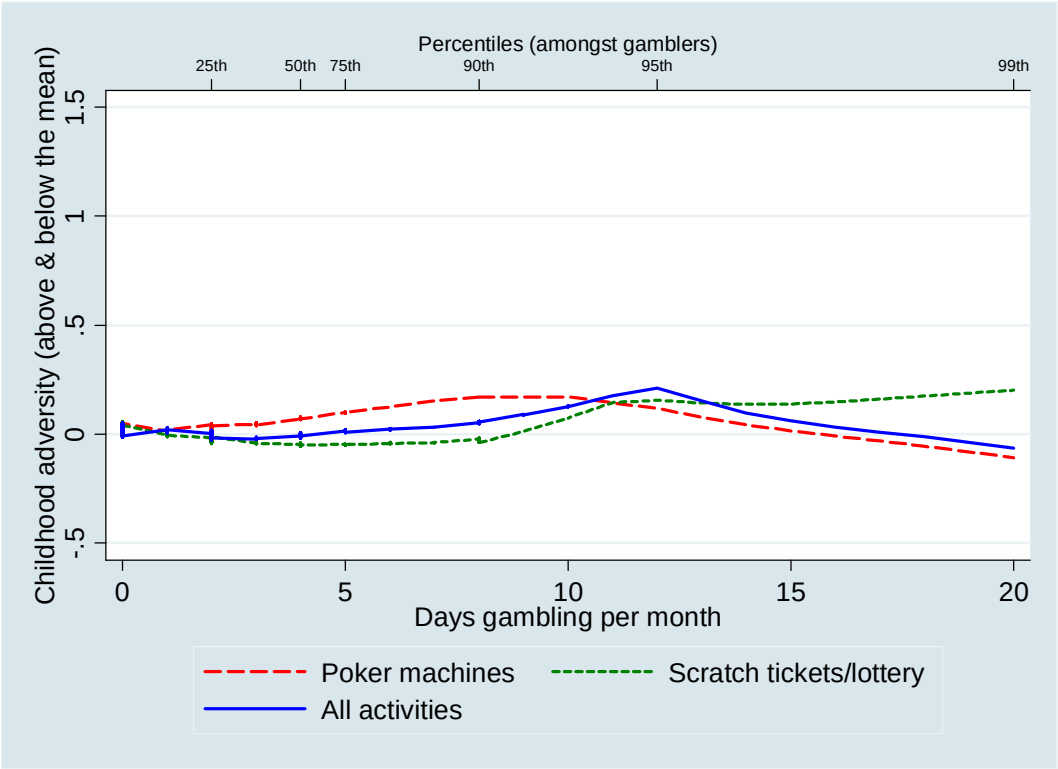
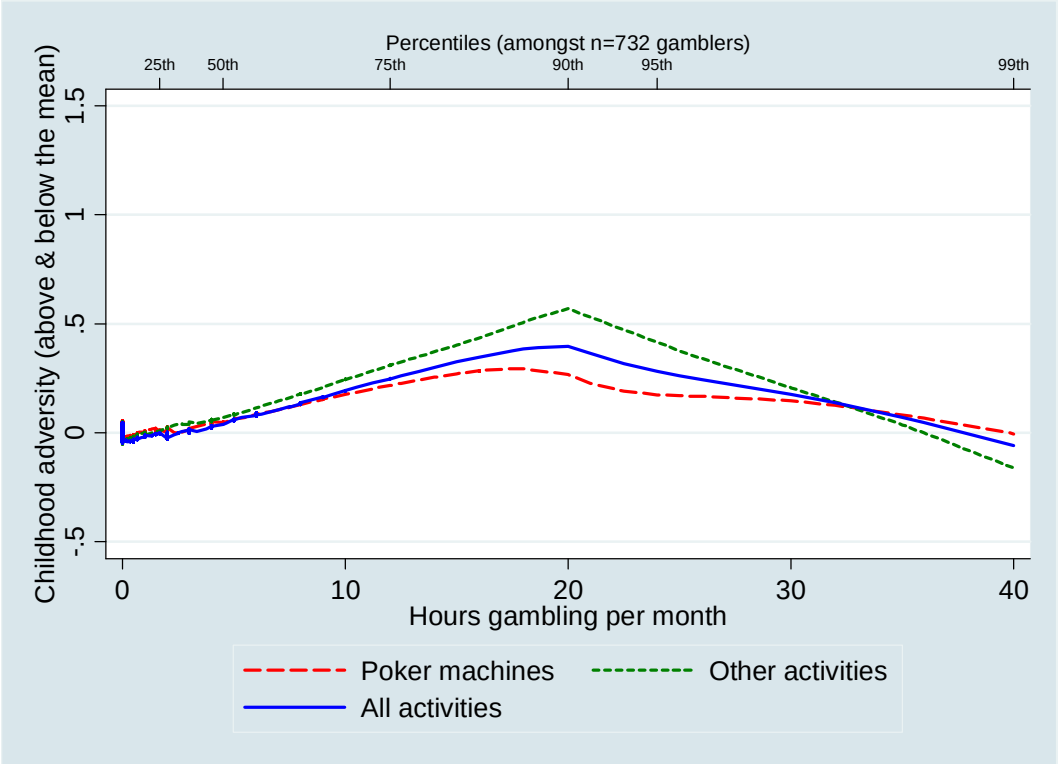


Figure 17: Childhood adversity and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 18: Number of stressful life events and days gambling per month on all activities by main activity (adjusted for age, sex and education)

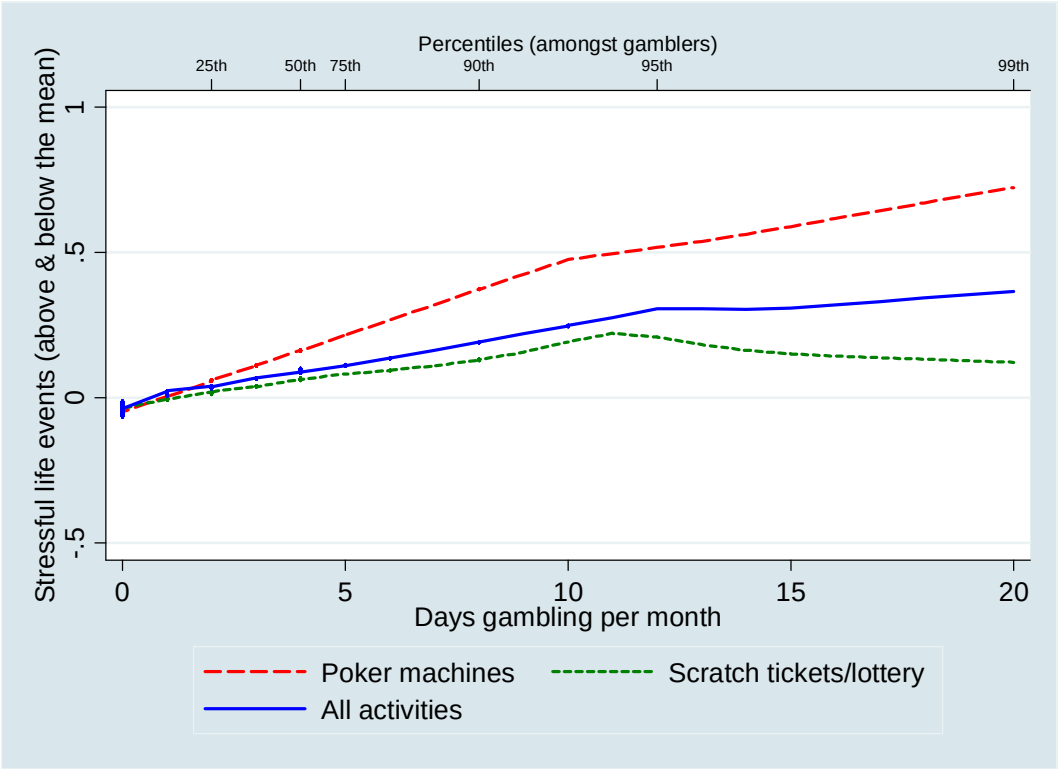
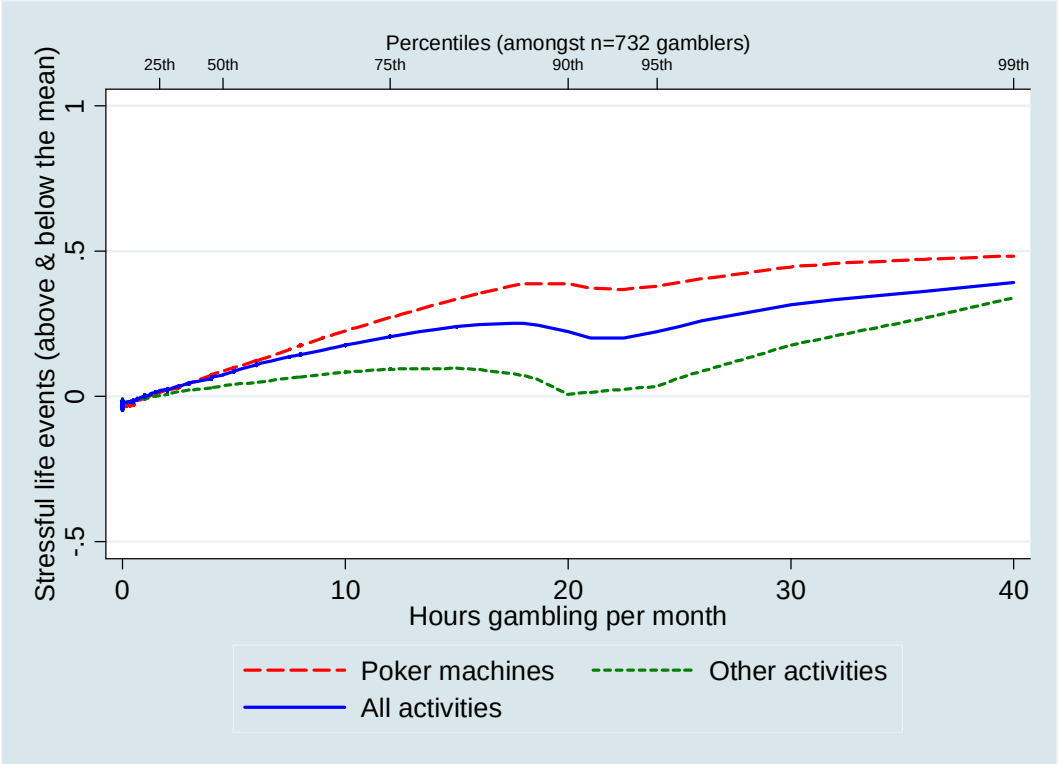


Figure 19: Stressful life events and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 20: Symptoms of depression and days gambling per month on all activities by main gambling activity (adjusted for age, sex and education)

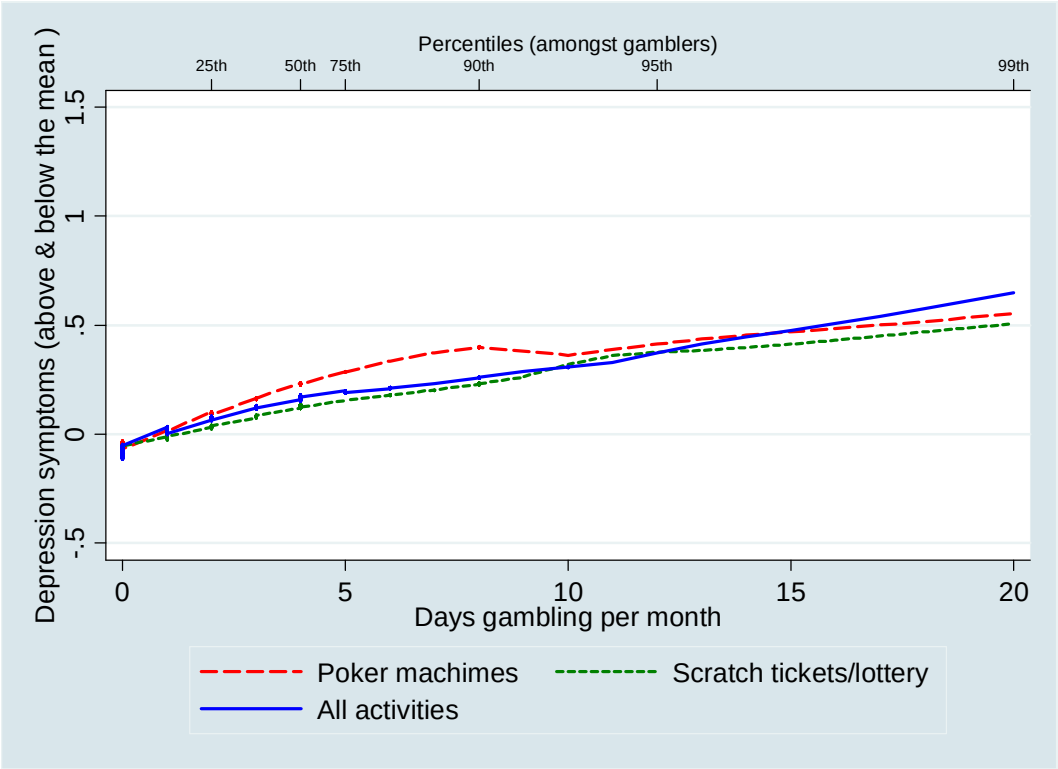
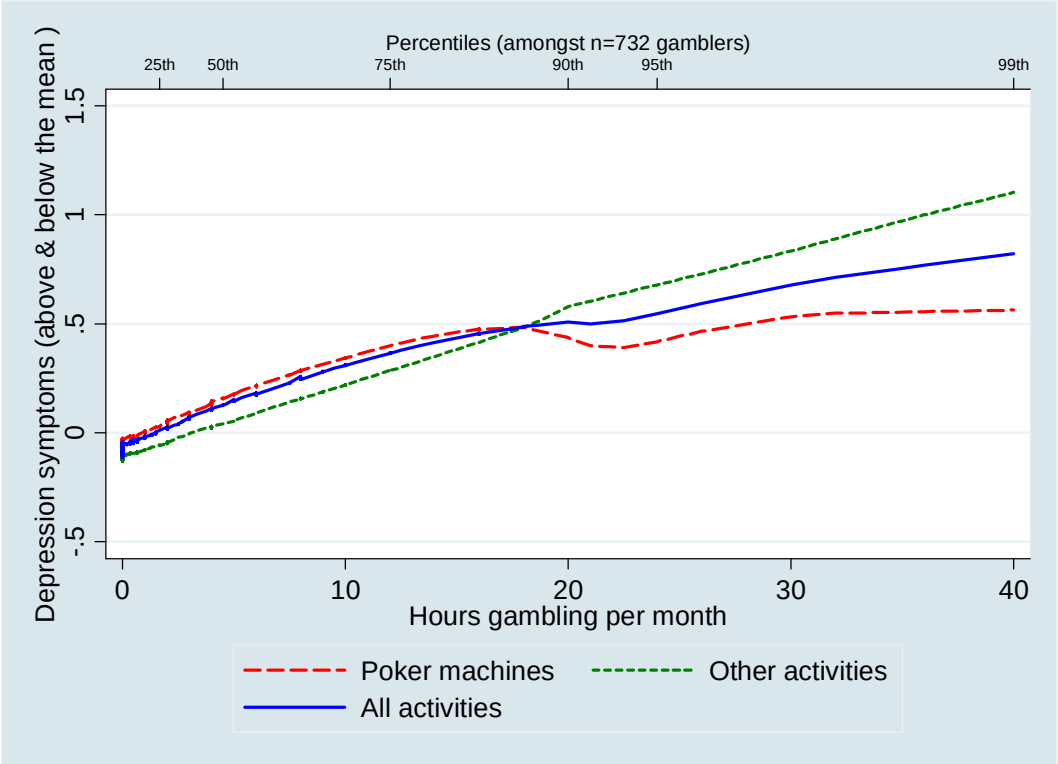


Figure 21: Symptoms of depression and hours gambling per month on main gambling activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 22: Symptoms of anxiety and days gambling per month on all activities by main gambling activity (adjusted for age, sex and education)

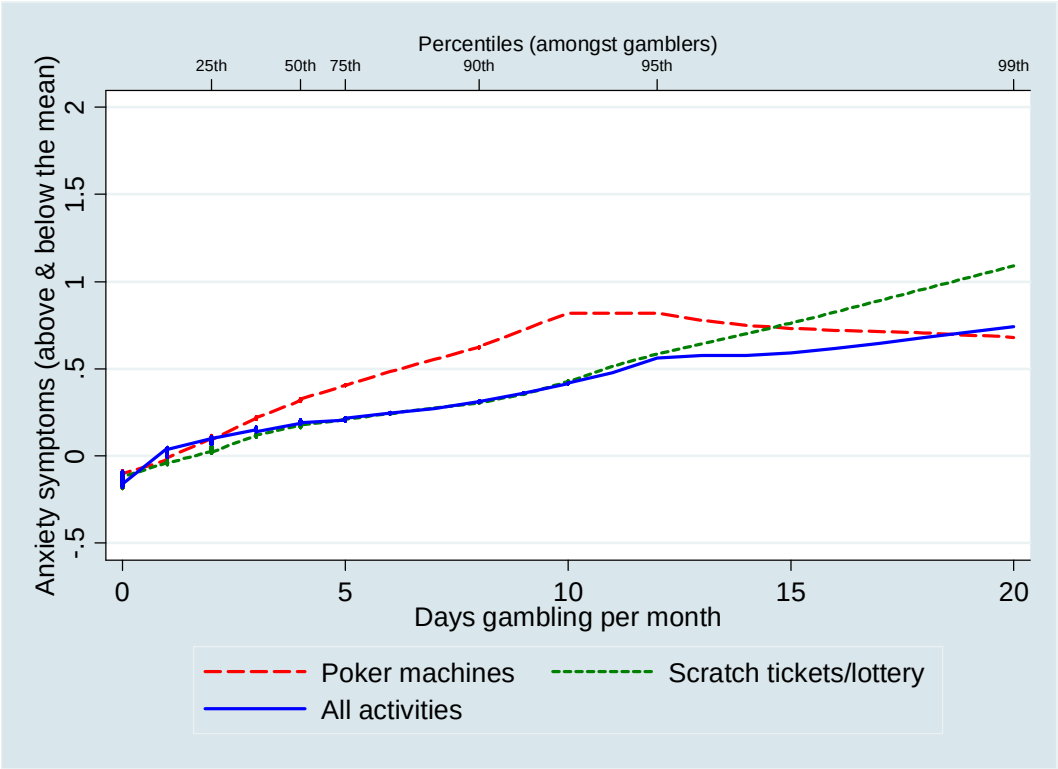
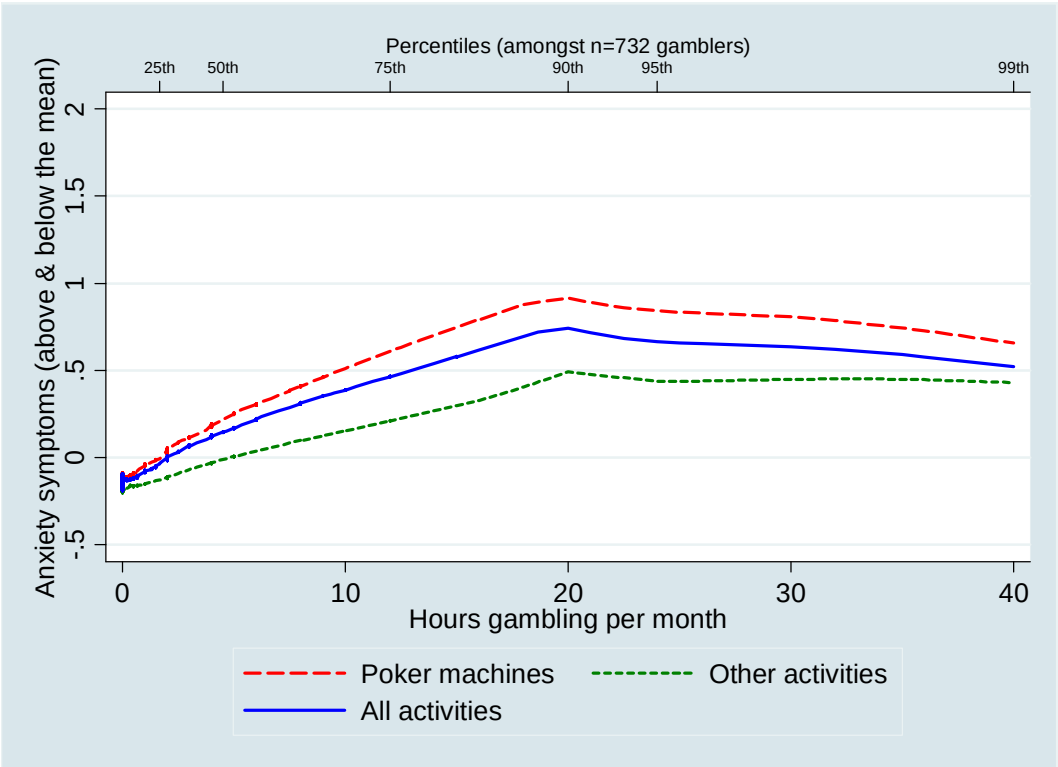


Figure 23: Symptoms of anxiety and hours gambling per month on main activity (adjusted for age, sex and education)*



*** excludes the following activities [scratch tickets/lottery]**

Figure 24: Number of cigarettes smoked per day and days gambling per month on all activities by main activity (adjusted for age, sex and education)

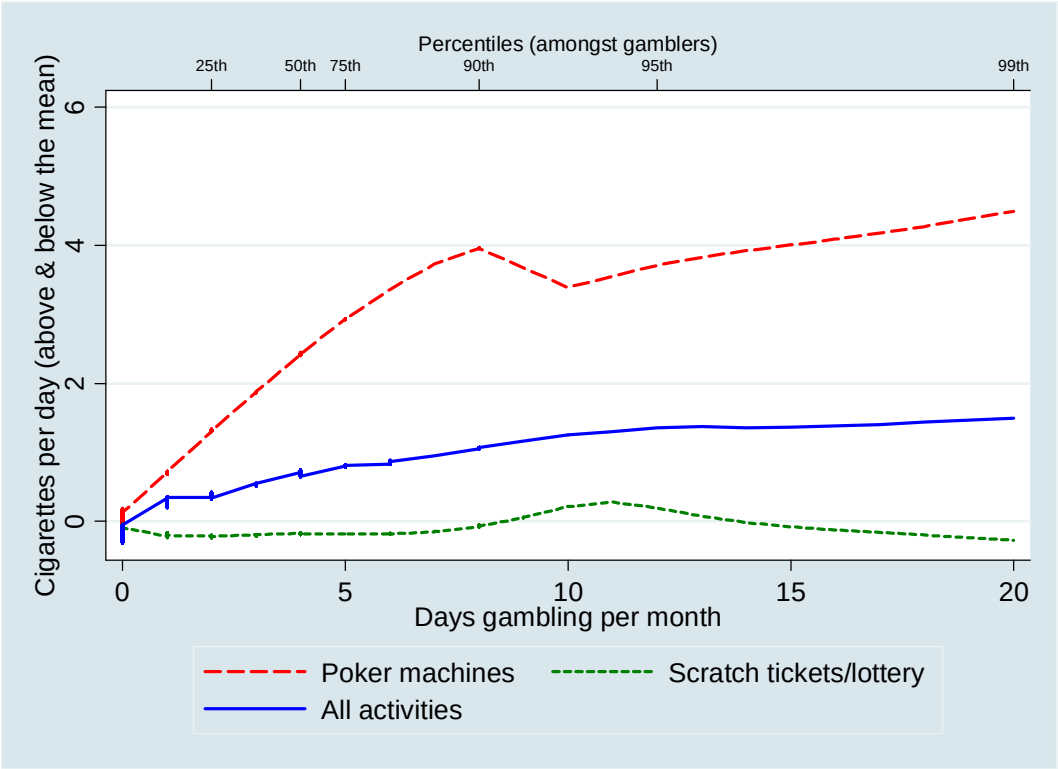
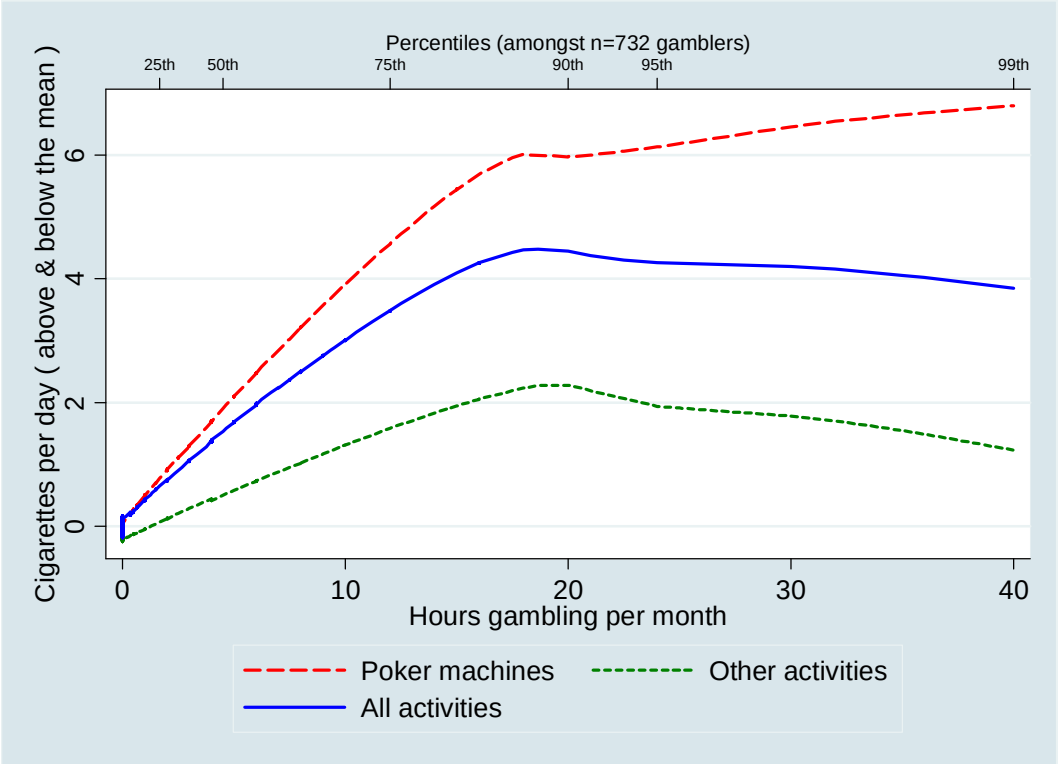


Figure 25: Number of cigarettes smoked per day and hours gambling per month on main activity (adjusted for age, sex and education)*



***excludes the following activities [scratch tickets/lottery]**

Figure 26: Number of drinks consumed per week and days gambling per month on all activities by main activity (adjusted for age, sex and education)

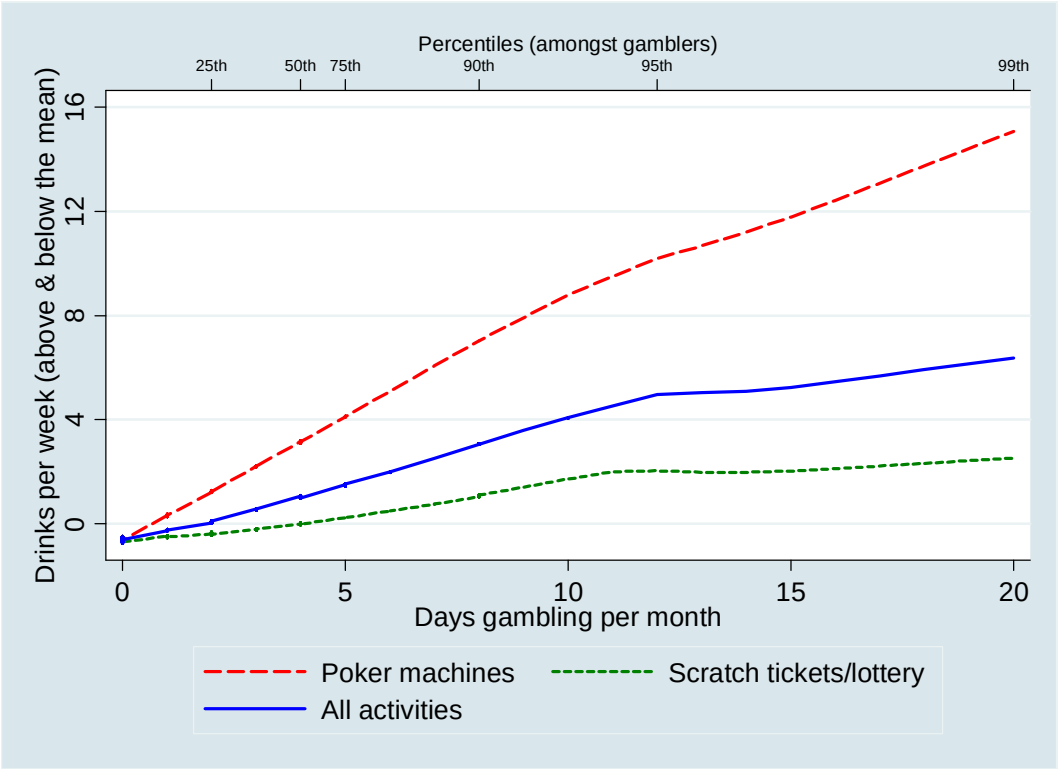
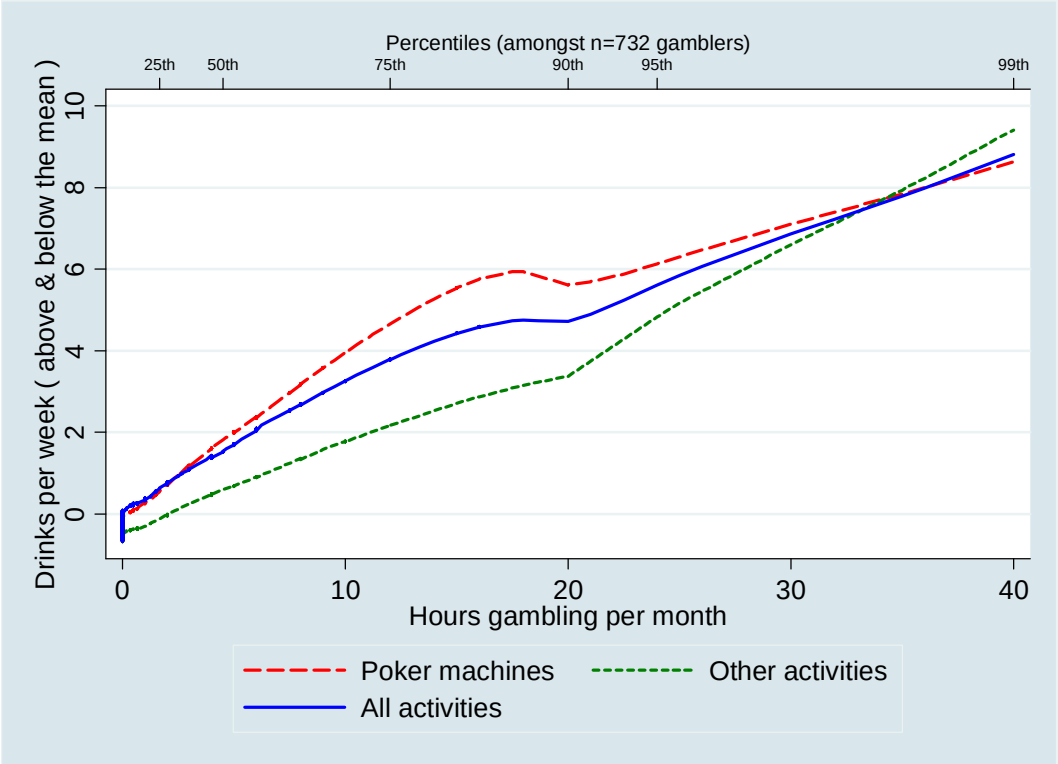


Figure 27: Number of drinks consumed per week and hours gambling per month on main activity (adjusted for age, sex and education)*



***excludes the following activities [scratch tickets/lottery]**

Table 28: Physical health and days gambling per month on all activities by main activity (adjusted for age, sex and education)

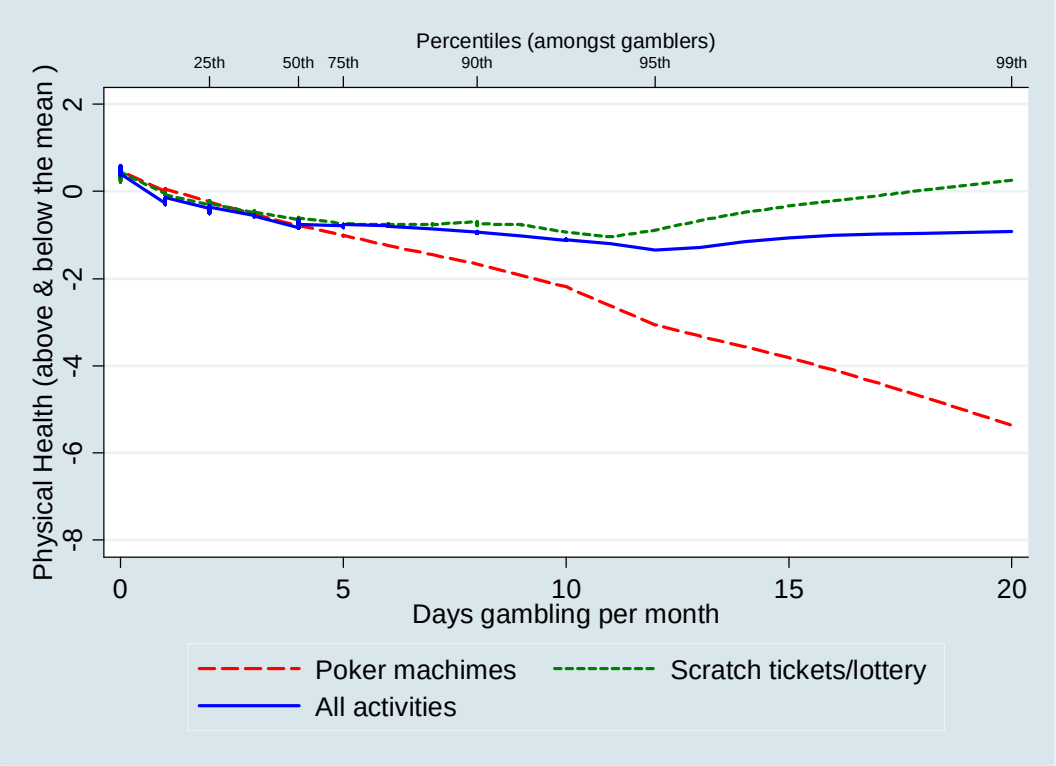
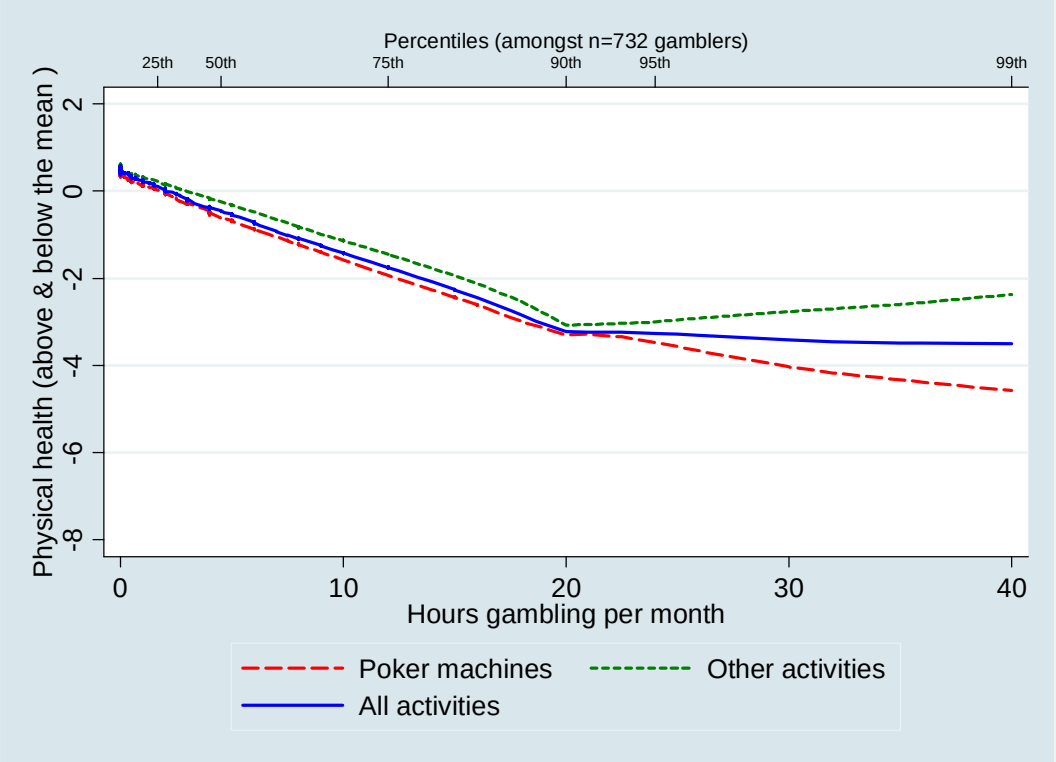


Table 29: Physical health and hours gambling per month on main activity (adjusted for age, sex and education)*



***excludes the following activities [scratch tickets/lottery]**

Past year illicit drug use and gambling in 24-28y olds

This section explores the association between past year illicit drug use and gambling in 24-28y olds. The analysis was restricted to the youngest age group because past year illicit drug use (particularly ecstasy and amphetamines) amongst 44-48y olds was relatively infrequent and could not be explored in relation to gambling. The questionnaire for 64-68y olds did not include questions on cannabis, amphetamine and ecstasy use. Logistic regression was used to explore the association between illicit drug use (cannabis, amphetamine and ecstasy) and gambling participation amongst 24-28y olds, adjusting for sex. Table 16 shows that cannabis use was associated with increased odds of gambling before and after adjusting for education.

Table 16: Illicit drug use and the odds of gambling more than once a month in 24-28y olds.

Illicit substance use measures (n)	**%**	**OR (95% CI) Adjusted for sex**	**OR (95% CI) Adjusted for sex & education**
Cannabis use			
Never/not in past year (1545)	19.7	1.00	1.00
Past year use (557)	30.2	1.76 (1.41-2.20)***	1.65 (1.31-2.07)***
Past year amphetamine & ecstasy use			
Neither drug (1688)	20.5	1.00	1.00
Amphetamine only (50)	41.5	2.75 (1.54-4.91)**	2.12 (1.18-3.83)*
Ecstasy only (153)	23.0	1.16 (0.78-1.72)	1.30 (0.87-1.95)
Both drugs (213)	32.4	1.86 (1.37-2.54)***	1.76 (1.28-2.42)**

*p<.05, **p<.01, ***p<.001

Past year amphetamine and ecstasy use were also associated with gambling. Table 16 shows that only ecstasy users who also used amphetamine were more likely to gamble. Participants who had used amphetamines but not ecstasy in the past year were also more likely to gamble. The odds ratios were only minimally reduced after adjusting for education. The findings on ecstasy and amphetamine use support other analyses indicating that ecstasy users who use amphetamines are different from those who use ecstasy alone (George, 2008).

Analysis of variance was then used to determine whether gamblers who had used cannabis in the past year gambled more frequently (across all activities) than gamblers who had not used cannabis (Table 17). Amongst gamblers, the association between past year cannabis use and gambling days per month approached statistical significance (p=.053). Table 17 also shows that gamblers who had used both ecstasy and amphetamines during the past year reported gambling more frequently than

those who had used neither drug. These findings were unchanged after adjusting for education (results not shown).

Table 17: The association between illicit drug use and frequency of gambling on all activities in 24-28y old gamblers (adjusted by sex).

Illicit drug use measure (n)	**Mean gambling days per month (95% CI)**
Past year cannabis use	
Never, not in past year (303)	3.97 (5.55-4.39)
Past year use (178)	4.66 (4.11-5.21)
Past year ecstasy & amphetamine use	
Neither (348)	4.06 (3.67-4.45)
Amphetamine only (21)	4.44 (2.86-6.02)
Ecstasy only (37)	4.04 (2.85-5.24)
Both (74)	5.07 (4.22-5.92)*

*p<.05, **p<.01, ***p<.001

Table 18: The association between illicit drug use and hours gambling per month on main activity amongst 24-28y old gamblers (adjusted for sex).

Illicit drug use measure (n)	**Mean (95% CI)**
Past year cannabis use	
Never, not in past year (150)	5.95 (4.20-7.70)
Past year use (123)	8.87 (6.93-10.80)*
Past year cannabis use in those with ≤6 years secondary school	
Never, not in past year (50)	6.07 (2.14-10.01)
Past year use (40)	13.95 (9.54-18.35)*
Past year cannabis use in those with > secondary education	
Never, not in past year (100)	5.87 (4.19-7.55)
Past year use (83)	6.44 (4.59-8.29)
Past year ecstasy & amphetamine use	
Neither (176)	6.09 (4.48-7.70)
Amphetamine only (16)	7.90 (2.58-13.22)
Ecstasy only (26)	7.83 (3.66-12.01)
Both (54)	10.69 (7.78-13.61)**

*p<.05, **p<.01, ***p<.001

Analysis of variance was also used to investigate whether illicit drug use was associated with hours gambling on main activity amongst gamblers. Table 18 shows that past year cannabis use was associated with spending more hours gambling per month. Further investigation revealed a stronger association between cannabis use and hours gambling amongst gamblers with 6 or less years secondary school than those with higher levels of education (interaction p=.035). Gamblers who

had left school prior to Year 10 (n=18) were excluded from analysis to determine whether this finding was evident in those who had completed 5-6 years of high school (n=72). In gamblers with 5-6 years secondary school, cannabis use was associated with spending significantly more hours gambling (*past year use*: mean 10.93, se 1.86; *no use*: mean 5.63, se 1.57; p=.034). In contrast, cannabis use was not associated with hours gambling amongst gamblers with higher levels of education in the 24-28y olds.

Lastly, gamblers who reported using both ecstasy and amphetamines during the past year gambled an extra 4.6 hours per month on average than those who had not used either of these drugs. Adjusting for education did not significantly alter these findings (results not shown).

5. Discussion

Strengths and limitations

Before moving to a discussion of the main findings, their implications and our conclusions, it is important to acknowledge the limitations of this study and to recognise its strengths. The limitations of the study include the nature of the target population, the cross-sectional study design, the sample size, and the constraints of available measures of gambling behaviour.

The target population for the present study was limited to Australian citizens and therefore excludes non-citizens with permanent and temporary visitor status. Some ethnic minorities and people of non-English speaking background are therefore more likely to be excluded from the sample frame than longer established (predominantly European) ethnic groups. The sample was also limited to three age bands, excluding adolescents and young adults (under age 24) as well as older adults (above age 68). Further, residents of the Canberra region are more highly educated and are socioeconomically advantaged relative to the Australian population as a whole. Traditionally, the ACT has higher per capita expenditure on gambling than the national average but this represents a lower proportion of household disposable income (Productivity Commission, 1999 Figure 3.1). It has the highest density of poker machines of any Australian State and Territory (Delfabbro and LeCouteur, 2003), and poker machine profits represent a correspondingly high proportion of all gambling expenditure (net losses), estimated at 75% for 2003-2004 compared with around 60% for Australia as a whole (for poker machines outside of casinos). As a consequence, findings reported here may not generalise to other regions or to the excluded population groups.

The limitations of the survey design present difficulties in terms of establishing possible causal connections. Longitudinal follow up may help extend the results in this report and give firmer ground for making causal inferences, but the present findings represent cross-sectional associations and should be acknowledged as such. The sample size of the present study was far from small (over 6,500 individuals) but it still set limits on statistical power for certain types of analyses. This is particularly the case when sub-groups are of particular interest. For example, investigation of type of gambling activity was limited to certain common forms of gambling and the aggregation of less common activities into an 'other' grouping. The most evident constraint of the present study was the limited data collected on gambling behaviour. This stems from the inevitable trade-off between breadth of information and detail in general purpose studies. Ideally, the study would have liked to include an assessment of problem gambling in addition to measures of frequency and hours spent, but this was not feasible within the limited questionnaire space. Similarly, some

additional information on the number of gambling activities engaged in by participants would have provided a valuable supplementation to the data on main activity.

On the positive side, this sample was representative of the population from which it was drawn and the attrition rate between Wave 1 and Wave 2 of the study was small. Although the region is advantaged in socioeconomic terms, participation across the full range of gambling activities is typical of Australia as a whole (Productivity Commission, 1999 Table B.1) and it is similarly close to the national average in respect of mental health and substance use (Australian Bureau of Statistics, 1999). The method of data collection, using notebook computers, is expected to be a more valid means of gathering sensitive information than alternative approaches (such as face-to-face interview) and was particularly suited to the questions on gambling behaviour, substance use and other sensitive topics (Gavin et al., 1992). A particular strength of the present study was the collection of a broad range of information spanning the major areas of social, psychological and physical wellbeing, which could be related to the measures of gambling behaviour.

Summary of main findings

Analyses of characteristics of people who gamble produced findings consistent with the existing literature, bearing in mind that the present study focussed on people who gambled monthly or more often. Importantly, the present study investigated demographic and socioeconomic characteristics in combination in order to identify the independent influences of individual factors. It also reported findings separately for the three age groups, as significant interaction terms involving age group had been identified in preliminary analyses. In these ways, the results gave a better indication of the relative importance of predictors than can be obtained from simple bivariate analyses (e.g. the results from the Australian NGS 1999). Men were more likely to gamble than women across the three age groups (Table 2), and the younger age group (24-28y) was less likely to gamble on a monthly basis than the two older age groups. The size of these differences is greater than those typically reported in studies where participation is defined as any gambling activity in the past year (Productivity Commission, 1999). In our multivariate analyses, level of education was the most striking factor associated with prevalence of gambling; the odds of gambling increasing to almost four times higher for those of the lowest educational level compared with those with degree level qualifications. This was so for all three age groups even though the absolute qualification levels had improved substantially, as expected, from the oldest to the youngest cohort (Tables 4, 6 & 8). After adjusting for sex, age and educational level, the only other factors significantly linked to participation were financial hardship and never being married in the 44-48y group (Table 6), and

being on a government pension in the 64-68y group (Table 8), although odds ratios in all these instances were modest (between 1.3 and 1.5).

Contrasting findings on gambling participation with gambling frequency (days per month), there were few differences in significant factors for the 24-28y group, with sex and education showing similar relationships across gambling frequency (multinomial models in Table 4). In those aged 44-48y, the sex difference widened showing that men, relatively, were more likely to be frequent gamblers than women (Table 6). A similar pattern was evident for education; the lower the education level, the greater the likelihood of frequent gambling. The tendency for men to be more frequent gamblers was also found in the 64-68y group but there was no differential relationship between educational level and frequency of gambling in the oldest cohort (Table 8). This pattern of findings was confirmed by analysis of variance of gambling days per month among gamblers. No variables were significant for 24-28y olds, being male and having lower education were significantly linked to higher mean days gambling per month in the 44-48y olds, and being male was associated with more days gambling per month in 64-68y olds.

Analyses of mean hours spent gambling per month necessarily excluded those whose main activity was playing lottery games or buying scratch tickets and age groups were combined to retain statistical power. Male gamblers in the two older cohorts spent significantly and substantially more hours gambling than either younger men who gambled or female gamblers (Table 9). Education did not show the steady gradation with gambling hours as had been found for gambling frequency, with only the lowest education group reporting significantly greater hours spent gambling per month. The only other factor showing a significant independent relationship with hours gambling per month was residential tenure; those who were not buying and did not already own their home spent more time on their main gambling activity than others.

Descriptive analyses of type of main gambling activity showed large differences between groups (Figure 3). In the two older cohorts, lotteries and scratch tickets were the predominant main activity and playing poker machines accounted for most of the remainder. For younger women, lotteries and scratch tickets were still the most frequently reported main activity (55% of all gamblers) but playing poker machines was also popular (33% of gamblers). In young men, playing poker machines was the most commonly reported main gambling activity (45%), with lotteries and scratch tickets in second place (32%) and betting on races or other sporting events coming third (17%). Of course, it is not possible to anticipate whether the younger cohort will maintain its gambling preferences as it grows older or whether it will become more like the older cohorts with time. Multivariate analyses investigated which demographic and socioeconomic factors were the

most important features of players of different gambling activities, using lottery and scratch ticket players as the reference group for comparison. In the youngest cohort, playing poker machines was independently associated with being male, not having graduate qualifications and being unmarried (Table 12). In the 44-48y group, playing poker machines was most strongly related to not owning or buying a home and not having graduate qualifications. Financial hardship was related to playing poker machines in the 64-68y olds.

In view of the demographic and socioeconomic differences found between people reporting different types of main gambling activity and also the variation in frequency and duration of sessions across gambling activities (Table 10), additional analyses were conducted to assess the extent to which type of activity played a role in the earlier findings related to frequency of gambling and hours spent gambling per month. These analyses showed that the inclusion of a variable representing main type of activity did not change reported associations for demographic and socioeconomic factors with either gambling days per month or hours per month. In other words, the different levels of gambling participation across different groups within the population are observed regardless of type of main activity.

Results on dose-response relationships for social, psychological and health outcomes by total gambling days per month and by hours per month spent on main gambling activity were presented as lowess curves. Again, it is stressed that the cause-effect relationship is unknown for these relationships. Essentially, they provide descriptions of differences across a range of attributes for different levels of gambling participation, something that has been notably lacking in previous research. Such differences were reported for several measures of social interaction, adverse events and circumstances in childhood and recent adulthood, mental health, substance use, and self-reported physical health. In all these analyses, adjustment was made for sex, age and education (i.e. the demographic factors previously identified as being independently associated with participation and level of gambling).

For social interactions, patterns were stronger and more consistent for negative interactions than for positive support. For the latter, support from friends was the only variable significantly related to overall participation (Table 15) showing a decrease with increasing participation (Figures 6 & 7). Negative social interactions showed clearer increases with frequency of gambling and gambling hours per month. There was some indication of a less steep gradient at lower levels of participation and a steeper gradient at higher levels in the lowess curves (Figures 4, 5, 8, 12 & 13) but quadratic terms were not significant for any of the equivalent regression models (Table 15). The study did not have the statistical power to assess quadratic terms for sub-groups of gamblers identified by

their main activity. It is possible, therefore, that the monotonic relationships for negative social interactions seen in all gamblers combined are derived predominantly from the patterns of results for poker machine players, but a larger sample would be required to confirm any non-linear relationships in those whose main activity was lotteries, scratch tickets or the 'other activities' (i.e. betting on races and other sports events, keno, table games, card games and bingo). For those whose main activity was playing poker machines, the monotonic increases in negative interactions with friends and with partner were more strongly linked with hours spent gambling than with gambling days per month (Figures 4, 5, 12 & 13).

There were no clear-cut patterns linking childhood adversity with level of gambling (Figures 16 & 17) but reports of recent stressful life events increased with both gambling days per month and with hours per month for the main gambling activity (Table 15 and Figures 18 & 19). Although dose-response relationships were seen across types of main gambling activity, the gradient appeared steeper for those identifying poker machines as their main type of activity.

Both depression and anxiety showed increases with level of gambling (Table 15 and Figures 20-23) with a clear monotonic relationship for depression. Anxiety appeared to level off at higher gambling frequencies and hours spent (Figures 22 & 23) but quadratic terms were non-significant in the equivalent regression models (Table 15). There was very little variation in curves for depression and anxiety across groups identified by main gambling activity and it is worth noting that depression and anxiety were significantly elevated for frequent gamblers who identified their main activity as playing lotteries or buying scratch tickets.

The clearest and strongest dose-response relationships across measures were found for substance use. Gradients for cigarette smoking were pronounced other than for those who identified playing lotteries or buying scratch tickets as their main activity, and were especially strong for those whose main activity was playing poker machines (Figures 24 & 25). Quadratic terms in the regression models were highly significant (Table 15), reflecting the plateaux in curves at around 8-10 total gambling days per month and 18 hours per month for main activity. Strong gradients were also seen for number of alcoholic drinks consumed per week (Figures 26 & 27) and, again, this was less apparent for those who identified lotteries or scratch tickets as their main activity. The curve for drinks consumed by days gambling per month was monotonic and the quadratic term in regression analysis was non-significant. A significant quadratic term was found for number of drinks by hours gambling per month (Table 15) but this seemed to arise from unexplained inflections in the curves rather than from any plateau or threshold effect (Figure 27). The curves for gambling hours

per month on main activity were little different comparing those who mainly played poker machines and those who identified other main activities.

Strong dose-response relationships were also found for self-reported physical health, indicating that those with higher levels of gambling had poorer health (Table 15 & Figures 28 & 29). Again, however, this overall pattern did not apply for those reporting lottery games and scratch tickets as their main activity. The quadratic term in regression analysis was significant for days gambling per month (Table 15), corresponding to the plateau for 'all activities' in Figure 28. However, the curve for those whose main activity was playing poker machines continued on a downward trend for more frequent levels of gambling. The curves for gambling hours per month were similar for those whose main activity was playing poker machines and for those who indicated other main activities (Figure 29).

It was not possible to utilise lowess curves to investigate dose-response relationships with less prevalent forms of substance use, but it was possible to examine whether gambling participation (i.e. more than monthly) was related to use of cannabis, ecstasy and amphetamines in the youngest age group and to see whether mean gambling days per month and hours per month amongst gamblers were related to substance use. In the 24-28y group, gambling was more common in cannabis users, and gamblers that used cannabis reported higher gambling hours for their main activity than non-cannabis users. The latter finding was especially striking for cannabis users who had not completed high school and was not seen in those with higher educational levels. Gambling was also more common in amphetamine users in the youngest cohort. It was unrelated to ecstasy use other than for those who used amphetamines in addition to ecstasy. Gamblers who used both amphetamines and ecstasy reported spending more days/hours on their main activity than non-users.

Setting findings in the context of existing research

This project is significant in both its methodological and substantive implications and the methodological aspects will be discussed first. One strength of the present investigation is that demographic and socioeconomic characteristics related to gambling participation were investigated through multivariate analyses. This may seem rudimentary but most published studies rely on two-way tables only to describe relationships with gambling prevalence and level of gambling. Consequently, it has been difficult to determine whether some associations with demographic and social factors may be spurious. For example, low participation rates for the widowed may simply

reflect the older age of widows and widowers relative to the population average and the marked sex ratio in this group, i.e. many more women than men. In the present study, very few factors were related to participation or level of gambling after adjustment for sex, age and education. These findings require replication using other samples, but they suggest that the epidemiology of participation and frequent gambling may be simpler than previously indicated by bivariate tabulations, as foreshadowed by Delfabbro and LeCouteur (2003).

The main methodological contribution of this study is its demonstration of the utility of continuous measures of gambling frequency and hours gambling per month in the investigation of social, psychological and health outcomes. Across all the findings on dose-response relationships there was no instance of a threshold effect; the only non-monotonic relationships arising from plateaux effects. Further, the ubiquitous monotonic associations showed increases in several outcomes over very low levels of gambling participation. In all such instances, the pattern indicated by lowess curves is well established in the range corresponding to the 75th percentile of gambling frequency or gambling hours per month, well short of the point at which poor outcomes for pathological or problem gamblers would influence the shape of the curves. (Indeed, a number of the most active gamblers were excluded from the figures shown in the report.) The findings themselves attest to the construct validity of the two dimensions of gambling behaviour available in the PATH study. Some of the more detailed multivariate analyses add further weight to their validity. When main type of gambling was included in analyses of level of participation, it had little impact on the predictive models. This provides some empirical support that measures such as gambling frequency and gambling hours per month are not distorted as a result of type of preferred activity; rather, the demographic links with gambling behaviours seem consistent across type of activity. To stretch the analogy with measures of alcohol consumption, it would be problematic if an index of drinks consumed per week was systematically distorted by individual preferences for spirits, wine or beer. Our findings do not imply that universal metrics akin to standard drinks have been or can be identified for gambling behaviours, but they suggest that one possible source of distortion is not problematic in the particular context of the present study (i.e. the gambling services available to and preferred by this sample).

Moving to the substantive contribution of the study, this flows predominantly from the reporting of dose-response relationships. We reiterate that these do not imply causal relationships between gambling behaviour and such outcomes as depression, anxiety and substance use. However, these analyses are a first step in an empirical approach to evaluating the possible benefits and costs of gambling participation as distinct from problem gambling. The most important point is that any attempt at evaluating benefits and costs must consider gambling behaviour as a continuum or a set

of continua. If analyses are restricted to a small proportion of gamblers, they miss the larger part of the picture. The second and related point is that it is no longer tenable to presume that quantifying the costs and benefits of gambling is a process of determining the balance between adverse consequences for problem gambling and the implicit benefits for non-problematic or recreational gambling. Research and policy development should be open to the possibility that recreational gambling may not be beneficial or may even cause harm.

For all the major findings in this report on social, psychological and health outcomes are cross-sectional associations, it can be useful to consider what lies behind these relationships. Putting together the early analyses on demographic and socioeconomic characteristics of gamblers with the absence of dose-response relationships linking childhood adversity with gambling frequency or gambling hours per month provides some clues about factors that influence gambling participation and more frequent gambling. The many non-significant findings are as helpful as the significant results, in that they indicate that gambling (and even frequent gambling) is not concentrated in what would be considered vulnerable or disadvantaged groups and individuals. We know from earlier research using the present sample that the childhood adversity measure is strongly related to a wide range of adult social and psychological outcomes (Rodgers et al., 2006) but it was not found here to be associated with gambling participation or level (Table 15). However, education was one of the strongest predictors of gambling participation and was notably linked to more frequent gambling in the 44-48y cohort (Table 6). Taken together, this indicates strong cultural rather than socioeconomic influences on gambling behaviour. As noted in the introduction of this report, surveys in other countries suggest that poor financial circumstances often characterise *non-gamblers*. However, participation in these studies is typically defined as any past year gambling activity whereas the present study focussed on those who gambled monthly or more often. At this level of participation, education is a strong predictor. It should be kept in mind that the sample in our study is more highly educated than Australians as a whole, and it was impossible to consider very low education in the youngest cohort. Nevertheless, educational level across the full range was related to gambling participation in the middle and oldest cohort. Reported gradients were striking for all three age groups and consistently showed that gambling was more common in those with lower education.

Turning to measures of social interaction (positive support and negative interactions), these were not strongly related to level of gambling and it was mostly the measures of negative interaction that showed significant associations. The measure of stressful life events showed a similar relationship to negative interactions and this could well reflect the fact that many reported events are of an interpersonal nature. It was beyond the scope of the present analyses to examine individual events

but this may be a useful area of future enquiry to provide insight into possible links with social behaviour and measures of mental health. The findings for negative interactions with partners, family and friends are contrary to commonly expressed notions of recreational gambling as a social and socialising activity. It is possible that people with less satisfactory social relationships are more likely to turn to gambling as a form of recreation, or that gambling actually interferes with personal relationships, or that some common factor (e.g. an impulsive personality) predisposes individuals to both gambling and poorer relationships. Longitudinal studies would help to unravel the causal connections behind these unexpected findings.

In the domain of mental health, the associations of anxiety and depression with level of gambling are similarly of uncertain origin. One important pathway to consider is what would be termed 'self-medication' in the substance use literature when addressing possible causes of comorbidity. Some support for this idea can be found in information reported from the Australian Productivity Commission (1999) Survey of Clients of Counselling Agencies on the positives of gambling for problem gamblers. Three of the four most endorsed items in this survey were 'Took mind off worries', 'Made feel less lonely' and 'Relaxation' (the other being 'Pleasure and fun'). However, it is unwise to assume that such self-reported 'benefits' equate to efficacy when considering self-help strategies for dealing with psychological distress. The literature in this area indicates that the most common self-help strategies used by people who feel anxious or depressed are not supported by scientific evidence of efficacy, and that some strategies may exacerbate rather than relieve distress (Jorm et al., 2002, Jorm et al., 2004). This is particularly so for substance use, including tobacco and alcohol (other than in moderate amounts). Given the lack of an evidence base to support gambling behaviour as an anxiolytic, it could be dangerous to suggest that gambling can help to relieve anxiety. The evidence from the present study indicates that light to moderate gambling is associated with elevated levels of depression and anxiety. This may reflect the way in which people turn to gambling when they are more distressed or it could indicate that these people have failed to identify a more effective means of dealing with their personal difficulties. As mentioned previously, gambling and mental health problems may have common contributory factors and longitudinal investigation could help untangle these possible causal pathways.

The same applies to findings on substance use. The striking dose-response relationships with level of gambling provide no indication that gambling presents either an alternative form of recreation or an alternative means of self-medication. A likely contributor to these findings, especially those for alcohol use, is that gambling and alcohol consumption are often collocated and that some participants in this study engaged concurrently in gambling activities and drinking. (Data on venues or other contexts of gambling activities were not available in the present study.) For

playing EGMs in particular, a part of the association with alcohol use could be due to alcohol reducing self-control, so that people who had intended not to play end up doing so after they have had a couple of drinks (Baron and Dickerson, 1999). For other gambling activities, drinking may extend periods of gambling through 'chasing behaviour' (Dickerson and Baron, 2000). Possible causal pathways are less obvious for cigarette smoking because many smokers smoke on a daily basis whereas the vast majority of gamblers (over 95%) do not gamble as often as every other day. It is likely, therefore, that most cigarettes are consumed outside of gambling sessions. There is a further difference in that some gambling venues have smoking restrictions, although the data for the present study were collected before the enactment of the prohibition of smoking in enclosed public places, effective from the 1 December 2006 in the ACT and the 2 July 2007 in New South Wales. This brought blanket bans on smoking in pubs, clubs and other public indoor areas. A new study in the same region may find a change in the reported relationship between gambling level and cigarette smoking. Although, many gambling venues have introduced smoking areas (e.g. heated 'outdoor' zones) following the new legislation, these necessitate people halting their gambling activity while they smoke. In addition to the likelihood of concurrent substance use and gambling behaviour, a further reason for their association is that they have common underlying influences, including personality factors. Some of this common influence could arise from genetic predisposition, but studies have indicated that the common genetic vulnerability to alcohol dependence and pathological gambling is only of the order of 20% (Slutske et al., 2000, Petry, 2007).

The findings on physical health in the present study are of interest because there has been very little research on this topic. Even the relationship between pathological gambling and physical health has not attracted much attention. The evidence from studies of older adults indicates that recreational gamblers are healthier than non-gamblers (Levens et al., 2005, Vander Bilt et al., 2004) but the PATH data show clear relationships linking poorer health to increased frequency of gambling and to hours per month spent on gambling. These associations were most evident in gamblers whose main activity was playing poker machines, but a similar pattern was found for the 'other' activity group (betting on races and other sports events, keno, table games, card games and bingo). It is possible that links between gambling and poorer physical health are accounted for by health behaviours, including substance use, and further analyses would be needed to examine this in more detail.

Stepping back from the complex processes that may explain or contribute to observed relationships between gambling participation and the range of individual social, psychological and health outcomes measured in this study, the predominant finding is the seeming absence of benefits for

recreational gamblers. Across a wide range of measures of social and personal wellbeing, our results failed to identify a single instance where people who gambled at low or moderate levels were better off than those who did not gamble at all. This pattern is very unlike research findings for alcohol consumption where abstainers have been found to have poorer social, psychological and physical health status than light and moderate drinkers (Power et al., 1998, Caldwell et al., 2002, Rodgers et al., 2005, Rodgers et al., 2000b, Rodgers et al., 2000a). Of course, economic benefits and costs of gambling activities must also be considered, but the crucial point remains that social and psychological consequences of recreational gambling must be open to empirical investigation and cannot be assumed to be positive. The U.S. National Gambling Impact Study Commission (1999) began its 1999 report with the sentence, 'Today the vast majority of Americans either gamble recreationally and experience no measurable side effects related to their gambling, or they choose not to gamble at all.' It is difficult to identify the empirical justification for the first part of this sentence, given the paucity of evidence relating measures of wellbeing to gambling at recreational levels.

Implications for future research and policy

Moving forward to considerations of future research and policy development, our findings suggest that measures of gambling participation can be used profitably to complement the existing emphasis on measures of problem gambling, rather in the way that measures of alcohol consumption are utilised in epidemiology and health promotion. The measures collected in the present study, gambling frequency and gambling hours per month, are not the only measures that could be of value. Other possibilities include the number of reported gambling activities, which is strongly related to number of pathological gambling symptoms in Canadian and U.S. general population studies (Cox et al., 2000, Welte et al., 2004). The Welte et al (2004) study went further in showing that number of gambling activities was independently predictive of pathological symptoms after adjustment for both frequency of gambling and size of bets. Another possible measure is amount of money spent on gambling, either in absolute terms or as a proportion of disposable income (e.g. Currie et al., 2006), or as estimated by algorithms for gambling volume (Welte et al., 2004). One disadvantage of using expenditure on gambling as a measure of participation level is the degree of underreporting, estimated at up to 50% (Worthington et al., 2007), and it is difficult to determine the extent of bias that this may introduce when comparing across individuals or between population sub-groups. Further research is needed on interrelationships between the various possible measures of gambling participation, and on their associations with problem gambling. This would not only be valuable in studying the development

of gambling-related problems but could also inform understanding of risky and responsible behaviour in those who have received treatment for problem gambling (Weinstock et al., 2007). Measures of participation may be similarly useful in gaining a better understanding of the developmental processes involved in the aetiology of pathological gambling. For example, the lack of association between measures of gambling participation and childhood adversity in the present study is a sharp contrast to links between pathological gambling and childhood traumatic events (Scherrer et al., 2007). It may be that such experiences do not predispose towards uptake of gambling but that they convert participation into problematic behaviours.

In regard to bridging the research-policy nexus, considerable progress has already been made through adopting a population health approach to gambling and problem gambling (Messerlian et al., 2005, Korn et al., 2003, Shaffer and Korn, 2002, Bondolfi and Ladouceur, 2001). Developments have included efforts to (1) assess the prevalence of gambling problems in the general population, (2) identify risk factors for problem gambling, (3) quantify the degree of comorbidity between problem gambling and psychological and physical morbidity, and (4) quantify the population burden of problem gambling. However, these advances do not cover the full range of areas in which a population health approach might be expected to bear fruit. One omission is a consideration of the 'iceberg' principle of health problems whereby more serious health conditions have more impact on individual sufferers and their families but account for less of the burden on the population as a whole than less serious conditions (Rose, 1993). This arises because the latter are of far greater prevalence in the general population than the former. The failure to consider this phenomenon in the gambling field arises from the previously discussed presumption that gambling behaviour which falls short of problem gambling is necessarily benign. Whilst this presumption is often implicit, it is overt in the population health framework developed specifically for gambling by Korn et al. (2003), where 'healthy gambling' occupies the space between 'unhealthy gambling' requiring treatment and 'no gambling'. There is a clear carry over of such thinking into economic cost-benefit analysis, but the assumption is no longer explicit. To give one example of many, a paper by Walker (2003) on methodological issues in cost of gambling studies begins by discussing costs and benefits of gambling in a general way but then settles quickly on a specific aim of analysing the 'costs and effects of *pathological* [our emphasis] gambling.' This unacknowledged conceptual leap lies behind the failure to exploit the iceberg principle in gambling studies even when a population health approaches is being encouraged.

A second omission in the gambling field is that frameworks for prevention and early intervention are poorly developed. The emphasis historically has been on possible interventions for people who have an existing and identifiable gambling problem. The current National Framework on Problem

Gambling 2004-2008 for Australia includes, as one of its four key focus areas, a concern with gambling environments in an effort 'to minimise the likelihood of recreational gamblers developing problem gambling behaviours'. The evidence base in this area is weak and it is not self-evident why progression from recreational to problem gambling falls exclusively within the province of concern with gambling environments rather than, say, public awareness and education. Preventive strategies in relation to gambling differ from the approach adopted for alcohol consumption where guidelines have been developed for defining risky alcohol consumption, with 'risk' conceptualised in terms of possible future problems, including physical morbidity. A failure to make this type of distinction in the gambling field is illustrated in the Productivity Commission (1999) report which includes a table (Table 6.21) on 'The prevalence and incidence of public health concerns'. The 0.9% of severe gambling problems and 1.2% of moderate gambling problems estimated for the Australian population is contrasted with the 7.1% of people who drank above the limits identified as hazardous or harmful (four drinks per day for men and two per day for women). However, this is an inappropriate comparison because gambling problems are, by definition, pathological outcomes whereas alcohol consumption is a risk factor for possible future pathology.

If a population health approach is to be applied to gambling, then strategies for prevention and early intervention need to delineate levels of gambling behaviour and other possible risk indicators that help identify individuals and groups who have an increased likelihood of encountering problems in the future. Possible future problems include problem gambling, as defined by diagnostic criteria or screening assessments, and other social, psychological and health consequences that may or may not occur in conjunction with problem gambling. Extending this approach to health promotion strategies, there is minimal evidence to date that might help to determine guidelines for responsible gambling in the same sense as has been applied to alcohol consumption. Recent work by Currie et al. (2006) is a first step in this direction, albeit using concurrent (i.e. cross-sectional) measures. Their risk curve analyses of data from the Canadian CHS 2002 indicated that the likelihood of experiencing gambling-related harm increased steadily with frequency of gambling and with money spent on gambling (gamblers whose only activity was weekly lotteries were excluded from these analyses). On the assumption of applying equal weighting to sensitivity and specificity in the prediction of harm, optimal cut-points were identified for defining low-risk gambling limits. These thresholds were found to be (1) gambling more than 2-3 times per month, (2) spending more than $1000CAN per year on gambling, or (3) spending more than 1% of gross income on gambling. These thresholds identified up to 30% of those who had gambled in the past year. When risky gambling behaviours are identified in this way, their prevalence is far in excess of figures for existing problem gambling.

The type of analysis used by Currie et al. (2006) needs to be extended to cover a range of possible adverse outcomes and to incorporate future rather than contemporary outcomes. Although little is known about the natural history of gambling behaviour and problem gambling, one longitudinal study of adolescents provides some interesting and unexpected evidence (Vitaro et al., 2001). This study reported on continuities in gambling frequency and gambling problems over a 12-month interval in over 700 adolescent boys in Canada. The correlation between gambling frequency at Time 1 (age 16) and that at Time 2 (age 17) was .57 compared with just .20 for gambling problems measured at the two ages. More importantly, gambling problems at Time 2 were predicted more strongly by Time 1 gambling *frequency* (.36) than by Time 1 problems (.20). It would be inappropriate to extrapolate from this one finding on adolescents to the development of gambling problems in adult populations but this result does point to the importance of investigating risk factors for the onset of gambling problems and the role of frequency and intensity of gambling in the development of later problems. This study illustrates the possible danger of assuming that secondary prevention and early intervention should be oriented towards people with existing problems.

Conclusions

In regard to the characteristics of people who gamble, this study has shown that:

- Sex, age and education are predictors of gambling participation.
- In middle-age, education is strongly related to frequency of participation amongst gamblers.
- Once sex, age and education are taken into account, few other demographic or socioeconomic factors are related to participation.
- Playing poker machines as a main gambling activity (relative to lottery games and scratch tickets) is more common in those with lower education. In young people, it is also linked to being male and to not being married. In middle-aged people, it is linked to not owning or buying a home.
- Gambling days and gambling hours per month are related to sex, age and education irrespective of main type of activity.

In regard to social, psychological and health outcomes, most outcomes are significantly related to level of gambling activity, although measures of positive social support and childhood adversity are typically not. Significant relationships with days and hours per month gambling are predominantly of a monotonic nature – poorer outcomes are seen with increasing levels of participation. The only non-monotonic relationships (found for smoking and physical health) showed steeper gradients

across lower levels of participation with a plateau at higher levels. In no instance, across many analyses, were recreational gamblers found to be better off than non-gamblers in respect of social, psychological or health measures.

Comparing across outcome measures, the strongest relationships with level of gambling activity were seen for smoking and alcohol consumption. Other highly significant and meaningful associations were found for recent stressful life events, depression, anxiety, and self-reported physical health. Relationships were less strong for the group who identified lottery games or scratch tickets as their main activity, but were still seen to some degree for depression, anxiety and alcohol consumption. The only other substantial difference across main type of activity was a much stronger association of cigarette smoking with gambling hours per month in poker machine players compared with the 'other activities' group.

This study indicates the value of measuring level of gambling participation on continuous dimensions. The results represent a useful first step in utilising such measures to help identify levels of responsible gambling; distinguishing risky levels that may lead to future problems. Such an approach is complementary to the recent focus on defining and measuring problem gambling. It would add to opportunities for developing secondary prevention and health promotion strategies, with the goal of reducing the incidence of personal and social problems arising from gambling behaviour.

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Figure 1 (A depiction of the methods underlying localised linear regression: Altman, 1992) is reprinted with permission from the *American Statistician.* Copyright 1992 by the American Statistical Association. All rights reserved.

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8. Appendices

Appendix 1: Gambling questions from the PATH Through Life Project

Q71. We would now like to ask you about your gambling activities. These include:

1. Playing poker machines/gaming machines
2. Betting on horse or greyhound races (excluding sweeps)
3. Bought instant scratch tickets
4. Playing lotto or any other lottery games such as Tattslotto, Powerball, the pools, 2 million jackpot lottery, Tatts 2, Tatts Keno
5. Playing keno at a club, hotel, casino or other place
6 .Playing table games such as blackjack or roulette at a casino
7. Playing bingo at a club or hall
8. Betting on a sporting event like football, cricket or tennis
9. Playing casino games on the internet
10. Playing games like cards or mahjong for money

Would you play any of these, alone or in combination, more than once a month?

❍Yes ❍No ❍*Refused/Don't know*

JUMP 71A TO Q72 IF Q71 NOT YES

Q71A. Over the last year, thinking about any of the sorts of gambling listed, on approximately how many days *each month* would you gamble? *(To see the list of gambling activities ask interviewer for Showcard B. (Enter 88 if you don't know, 99 if you don't wish to answer).*

☐☐ *days per month*

Q71B. Of the following gambling activities, which one have you *played the most* in the last 12 months?

❍Poker machines/gaming machines
❍Horse or greyhound races (excluding sweeps)
❍Instant scratch tickets
❍Lotto or other lottery games
❍Keno at a club, hotel, casino or other place
❍Tables games e,g. blackjack/roulette at a casino
❍Bingo at a club or hall
❍A sporting event such as football, cricket or tennis
❍Casino games on the internet
❍Cards or mahjong for money
❍*Refused/Don't know*

JUMP TO Q72 IF Q71B = REFUSED

Q71C. Thinking specifically about the form of gambling that you did *most*, in the last 12 months, on approximately how many days each month would you gamble?

☐☐ *days per month*

JUMP TO Q72 IF Q71B=3 OR 4

Q71D At each gambling session, for how long do you usually play? *(Enter 99 to refuse or don't know).*

☐☐ hours ☐☐ minutes

Q71C. Thinking specifically about the form of gambling that you did *most*, in the last 12 months, on approximately how many days each month would you gamble?

☐☐ *days per month*

JUMP TO Q72 IF Q71B=3 OR 4

Q71D At each gambling session, for how long do you usually play? *(Enter 99 to refuse or don't know).*

☐☐ hours ☐☐ minutes

Appendix 2: Main gambling activities by age and sex [n (%) Adjusted residuals]

Age and sex	Poker machines	Races/sporting events	Scratch tickets/lottery	Bingo	Other activities
24-28 Men	129 (45.5) 8.8	47 (16.5) 5.6	92 (32.4) -11.6	2 (0.7) -1.9	14 (4.9) 3.7
24-28 Women	64 (32.5) 2.7	14 (7.1) -0.6	108 (54.8) -2.5)	8 (4.1) 1.8	3 (1.5) -0.5
44-48 Men	74 (17.5) -3.7	46 (10.9)2.3)	290 (68.7) 2.7	3 (0.7) -2.4	9 (2.1) 0.2
44-48 Women	69 (19.6) -2.3	8 (2.3) -4.4	258 (73.3) 4.3	9 (2.6) 0.5	8 (2.3) 0.4
64-68 Men	93 (19.0) -3.2	48 (9.8) 1.6	340 (69.5) 3.4	3 (0.6) -2.8	5 (1.0) -1.8
64-68 Women	77 (23.9) -0.3	5 (1.6) -4.7	216 (67.1) 1.6	21 (6.5) 5.7	3 (0.9) -1.5

Note Adjusted residuals >1.96 or <1.96 cells indicate cells with frequencies greater or less than would be expected if the association between age/sex and gambling preference were not significant.

Chi-square=252.23(df=20), p<.001

Appendix 3: Means and standard deviations for social, psychological and health measures

Scale	Mean (sd)	Observed range	Scale range
Goldberg's depression	2.23 (2.28)	0-9	0-9
Goldberg's anxiety	3.02 (2.64)	0-9	0-9
Physical health (SF-12)	50.73 (9.69)	17-99	0-100
Stressful life events	1.11 (1.45)	0-13	0-17
Childhood adversity	1.68 (2.23)	0-14	0-16
Cigarettes per day*	2.10 (6.05)	0-70	n/a
Drinks per week**	7.09 (9.14)	0-65.5	0-65.5
-ve support friends	2.62 (1.66)	0-9	0-9
+ve support friends	5.07 (1.20)	0-6	0-6
-ve support family	3.68 (2.11)	0-9	0-9
+ve support family	5.37 (1.09)	0-6	0-6
-ve support partner	5.15 (3.13)	0-15	0-15
+ve support partner	13.26 (2.59)	0-15	0-15

*Smokers directly reported how many cigarettes they smoked per day.

** Forced choice quantity and frequency questions were used to estimate drinks consumed per week. The highest possible combination yielded an estimate of 65.5 drinks per week.