

*Report on The National Longitudinal Study
of Gambling Behaviour (NLSGB) in South Africa*



NATIONAL
**Responsible
Gambling**
PROGRAMME



Andre Hofmeyr, Andrew Dellis, Harold Kincaid, Don Ross
University of Cape Town

On behalf of the South African Responsible Gambling Foundation

i. Introduction

This report discusses some preliminary findings from the National Longitudinal Study of Gambling Behaviour (NLSGB) in South Africa. The NLSGB is a 15-month panel¹ study of gamblers residing in the four major metropolitan areas of South Africa: Johannesburg, Pretoria / Tshwane, Durban and Cape Town. It was conducted under the auspices of the South African Responsible Gambling Foundation (SARGF) and with generous funding from the National Responsible Gambling Programme (NRGP). The study is currently in its sixth and final wave² of data collection so this report discusses the first five waves of data that were collected.

We stress that this report is preliminary, in that it reports on only a few leading relationships in the data that we have so far explored. We collected information on a very wide range of variables. In later analyses, we will hone in on many of these for specific investigation. In addition, we can explore the extent, which we have not yet done, to which different variables *interact* with one another. We can also use the data to ask questions about specific sub-samples of the study participants. Thus the NLSGB is expected to yield several papers over the coming two years or so. It would, however, be premature to begin all of this labour while the final wave is still being conducted. In this preliminary report, we concentrate on analyses based on aggregating all of our observations to date, as these are most likely to yield conclusions that will not be significantly modified in light of the data to come. As questions and analyses get more fine-grained, it becomes more important to be patient and wait for all results.

The NLSGB was an ambitious study which tracked a set of 300 gamblers over a 15-month period. A comprehensive survey instrument was compiled by the research team to analyse the factors which affect and contribute to gambling problems over time. The study was conducted in the four major metropolitan areas of the country and despite very selective recruitment procedures, the people who took part in the study are representative of individuals residing in these areas.

In wave 1 of the study, 96 people in the sample were classified as at No Risk for developing gambling problems according to the Problem Gambling Severity Index (PGSI). A further 36 were classified as Low Risk whereas 73 and 93 people fell into the Moderate Risk and Problem Gambler categories, respectively, on the PGSI. Given the range of gambling problem diagnoses in the sample it is possible to explore the extent to which certain factors affect gambling severity³ over time.

One of the first findings in the report is that gambling participation – measured as the proportion of individuals in the sample engaging in various gambling activities – declined over the course of the study. However, the average amount of time that people gambled and the

average amount of money spent on gambling was relatively stable over the time period under study.

One of the most interesting results in this report is the relatively low persistence or stability of gambling severity classification across waves of the study. For example, we find that for those individuals who were ever classified in the No Risk gambling severity category, only approximately 56% of their observations lay within that category over the course of the research project. In other words, people tended to shift out of the No Risk category at a relatively high rate. Similarly for those individuals who were ever classified as problem gamblers, only 43% of their observations fell within this category of gambling severity over time. Thus, there was a large amount of flux in the classification of individuals as problem gamblers.

In the final two sections of the report we focus on the link between a set of mental disorders and gambling behaviour. We find that anxiety, depression, impulsivity and alcohol use are positively related to gambling severity but smoking status is not. These results are particularly relevant to treatment because they suggest that it is essential for clinicians to screen for other co-occurring disorders when assessing the extent of a person's gambling problems so that treatment approaches can be tailored to the issues that the person faces.

The report is structured as follows. First, we discuss the rationale for and design of the study. Second, we present summary statistics for our sample, focussing on the characteristics of the research subjects, the distribution of gambling severity and the level of gambling involvement across waves of the study. Third, we look at the persistence of gambling severity in our sample over time. Fourth, we focus on the link between a set of mental disorders and gambling behaviour. Fifth, we analyse the factors that contribute to gambling severity over time. Finally, we set these preliminary results in the context of background information about South African gamblers that we have obtained from other studies and analyses we have done, and we offer some reflections based on general findings in the science of gambling behaviour.

¹ The term “panel study” is more common in the economics literature than in other disciplines where the terms “longitudinal study” and “prospective study” are often used. Note that the terms all refer to a study where information is collected on a sample of individuals at multiple points in time.

² Note that the terms ‘wave’ and ‘visit’ will be used interchangeably in the text to refer to one time period during which data were collected.

³ The term ‘gambling severity’ is used to refer to the extent to which an individual suffers from gambling problems. This does not presuppose that most or even many people have gambling problems but rather that gambling problems lie on a continuum. On the one end, people take part in gambling recreationally with little or no associated problems. On the other, people gamble pathologically which severely disrupts their personal, vocational and family lives.

ii. *The Design and Implementation of the NLSGB*

Background

Researchers at the University of Cape Town (UCT) were awarded a tender in 2008 by the South African Responsible Gambling Foundation (SARGF) to conduct the National Urban Prevalence Study of Gambling Behaviour (NUPSGB) in South Africa. The researchers' mandate was to establish baseline prevalence rates for gambling and problem gambling in the country and to analyse risk factors for pathological gambling (PG). To this end, a sample of 3000 individuals was drawn from the four major metropolitan areas of South Africa: Johannesburg, Pretoria/Tshwane, Durban and Cape Town. To ensure adequate coverage of the metropolitan areas, probability proportional to size (PPS) cluster sampling was employed. Ipsos Markinor, a research firm with extensive experience in conducting household surveys in South Africa, was appointed to administer the questionnaires in each metropolitan area.

Although crucial for establishing baseline prevalence rates of gambling and problem gambling in the country, the NUPSGB was a relatively blunt instrument for analysing the factors that may affect or contribute to gambling severity. This is true of any cross-sectional study because one only observes a snapshot of the sample of interest at one point in time. If, on the other hand, one follows a set of gamblers over time, it is possible to isolate the factors that affect their gambling behaviour. The SARGF therefore commissioned a panel study of gambling behaviour in South Africa to complement the aforementioned prevalence study. The research team who were responsible for the NUPSGB were awarded the tender for this project and upon completion of the prevalence study on 10 November 2008, they set to work designing an instrument that could be used in a 15-month panel study of gambling behaviour.

Unlike other panel studies that typically have long gaps between waves of data collection - the norm being one year - the research team decided to focus on the short-run determinants of gambling behaviour by visiting a sample of 300 gamblers every three months. With 6 visits in total over a period of 15 months, the team could collect a wealth of data on each individual while minimising sample attrition. To our knowledge, no study has made this number of repeat visits to a sample of gamblers.

Questionnaire Design

The survey instrument for the study was compiled to elicit information on subjects' gambling behaviour and to measure factors that have been associated with this behaviour in other studies. To this end, an extensive literature review was conducted to determine which questions and screens warranted inclusion in the survey instrument. This process culminated in the development of a questionnaire that

included 26 questions on personal and household demographics and 29 questions on gambling participation, expenditure and attitudes. We also included 12 questions focussing on subjects' expectations of the future (e.g. "Looking ahead, do you expect any major change in your family situation that will lead to higher or lower earnings during the next 3 months?"). In addition, a number of validated psychological screens were included to assess gambling behaviour and other factors. These included: the Problem Gambling Severity Index (PGSI), the scored module of the Canadian Problem Gambling Index (CPGI, (Ferris and Wynne, 2001)); the Beck Depression Inventory-II (BDI-II, (Beck et al., 1996)); the Beck Anxiety Inventory (BAI, (Beck et al., 1988)); the Barratt Impulsiveness Scale-11 (BIS-11, (Patton et al., 1995)); the Kessler Psychological Distress Scale (K10, (Kessler et al., 2002)); the List of Threatening Experiences Questionnaire (LTE-Q, (Brugha et al., 1985, Brugha and Cragg, 1990)); the Perceived Stress Scale (PSS, (Cohen et al., 1983)); the General Self-Efficacy Scale (GSE, (Schwarzer and Jerusalem, 1995)); the Perceived Social Support – Friend Scale (PSS-Fr, (Procidano and Heller, 1983)); the Perceived Social Support – Family Scale (PSS-Fa, (Procidano and Heller, 1983)); a multiple response version of the Diagnostic and Statistical Manual of Mental Disorders IV pathological gambling screen (DSM-IV-MR, (Fisher, 2000)); and the World Health Organisation's (WHO) Alcohol, Smoking and Substance Involvement Screening Test (ASSIST, (WHO ASSIST Working Group, 2002)).

By collecting this information on the subjects in our sample on each wave of the study, we can focus on the potential causes of changes in gambling severity over time. For example, suppose that a gambler moves from a moderate risk classification on one visit to a problem gambler classification on the next. Suppose further that there has been no change in any of the measures above other than a marked increase in the person's alcohol use. This finding would be suggestive of a relationship between alcohol use and gambling severity⁴.

Given the relatively short time period between waves of the study, it was necessary to adjust some of the screens in the survey instrument. For example, the PGSI is framed with reference to the past 12 months. It would not make sense on, say, the third wave of the study to ask a subject about their gambling behaviour in the last year because this would overlap with measurements taken on the two preceding waves. Fortunately there is a precedent for such a change. Wulfert et al. (2005) examined the psychometric properties of two screens for gambling problems - the South Oaks Gambling Screen (SOGS) and the NORC DSM-IV Screen for Gambling Problems (NODS) – when the time frame of the screens was shortened from one year to three months. They found that the 3-month versions had good internal consistency, convergent validity and discriminant validity and concluded that "... shortening the time frame to 3 months does not seem to have adverse consequences on the psychometric properties

⁴ This example was only used for illustrative purposes. Clearly such a finding would need to be interrogated and validated by a statistical analysis involving the full sample of gamblers where the marginal effect of an increase in alcohol use on gambling severity is obtained while holding the other variables in the model constant.

of SOGS and NODS” (Wulfert et al., 2005). The only screens that needed to be adapted in this way were the PGSI and the DSM-IV-MR because every other screen either refers to no time frame (e.g. the BIS-11, GSE, PSS-Fr and PSS-Fa), a 3-month time frame (e.g. the WHO ASSIST) or a very short time frame (e.g. two weeks for the BDI-II and one week for the BAI). Note that we also framed any time-varying socio-demographic information, like income and employment, and information on gambling behaviour, like participation and expenditure, with reference to the past 3 months. Furthermore, the questions focussing on subjects’ expectations of the future covered the three months between one visit and the next.

Diary Intervention

In addition to the questionnaire the research team designed a simple randomised control trial (RCT) that would take place between the final two waves of the study. This so-called diary intervention randomly allocated research subjects in each category of gambling severity, based on their scores on the PGSI, to a treatment and control group. The group that was selected for treatment received a weekly telephone call that gathered information on their gambling behaviour during the past week. People in the control group, by contrast, were not contacted.

The rationale for this intervention was to test whether people who had to discuss their gambling behaviour on a weekly basis, and thereby reflect on it, would be significantly different on measures of gambling behaviour and severity at follow-up to those who were not contacted. While we could have asked people in the treatment group to keep a diary detailing their gambling behaviour each week it would be very difficult to monitor and ensure compliance. We opted for a weekly phone call so that subjects in the treatment group had to think about and report their behaviour.

To make the comparison between our two groups meaningful we had to ensure that those who were selected for treatment were not significantly different according to socio-demographics and gambling behaviour to those who were not. Otherwise any differences at follow-up could be attributed to differences between the groups at baseline rather than to the effect of the intervention. Thus, we took random draws from each category of gambling severity - no and low risk, moderate risk and problem gambler – and tested for differences in language, age, gender, race, metropolitan area, education, employment, income, money spent on gambling in the last month and PGSI score between our treatment and control groups; no differences were found.

The script that was used during each telephone call included four questions about work, relationships with family and friends, alcohol consumption and the subject’s mood over the past week and five questions about gambling behaviour. If a person did not

gamble during the past week then the other questions on gambling behaviour were not applicable. To prevent subjects from strategically reporting no gambling to limit the length of the call, we included three filler questions on food consumption and expenditure over the past week. This would reduce the strategic incentive to underreport gambling behaviour because the call’s length would be practically identical irrespective of whether they gambled or not.

Those subjects who were selected into the treatment group received an additional R150 for their participation during the final wave of the study. The weekly phone calls were made by fieldworkers at Ipsos Markinor and lasted 2 – 3 minutes on average.

The diary intervention data have only just been gathered and there has not yet been time to clean and model them. More importantly, the diary intervention will only furnish interesting information in light of comparison between observations taken in the waves before it was administered and observations taken in the currently ongoing sixth wave. Therefore, the diary intervention will not be further discussed in this preliminary report.

Translation, Piloting, Fieldworker Training and Selection

Upon completion of the design stage of the research project, the survey instrument and diary intervention script were sent in for translation. The study was conducted in the four major metropolises of South Africa: Johannesburg, Pretoria/Tshwane, Durban and Cape Town. South Africa has 11 official languages but the research instruments were only translated into the five languages with high prevalence rates in the survey areas: Afrikaans, IsiZulu, IsiXhosa, Sesotho and Setswana. The translation department at Ipsos Markinor completed this task.

With a full set of translated instruments in hand, the research team began the pilot phase of the study. A member of the research team was sent to the branch offices of Ipsos Markinor in Johannesburg⁵, Durban and Cape Town to train the fieldworkers on questionnaire administration.

Sampling

The final stage of the study prior to fieldwork was the recruitment of the sample. As discussed previously, the study was designed to follow a set of 300 gamblers over a period of 15 months. During this time frame there would be 6 visits to each subject spaced 3 months apart. Given our interest in exploring the factors that lead to changes in gambling behaviour over time, we wanted to recruit a sample that consisted of gamblers with differing levels of severity. The data from the NUPSGB were an invaluable resource because we already had a large pool of gamblers from which to draw. Using the PGSI classification of gambling severity, we hoped to recruit 100 people

⁵ Pretoria/Tshwane is only a 45-minute drive from Johannesburg so the fieldworkers in Pretoria came through to Johannesburg for the training.

in the no and low risk categories, 100 people in the moderate risk category and 100 people in the problem gambler category.

The no and low risk categories of the PGSI span scores of 0 – 2 on this instrument. We therefore aimed to recruit 33 people with scores of 0, 33 people with scores of 1 and 34 people with scores of 2 so that there was a good representation of each score in our panel sample.

With 1384 no and low risk gamblers in the NUPSGB we felt it would not be difficult to recruit 100 people who fell into these gambling categories. However, to ensure that the gamblers who were selected to take part in the panel study were not significantly different from those who were not selected, we took a random draw of 240 people (80 with scores of 0, 80 with scores of 1 and 80 with scores of 2) from this subsample. We then tested whether there were any significant differences between those who were selected and those who were not according to metropolitan area, language, gender, age, race, education, employment, income and amount spent on gambling in the last month. We found no significant differences between these groups.

The moderate risk category of the PGSI spans scores of 3 – 7 on this instrument. Our goal was to recruit 20 individuals with each score in this range. In the NUPSGB, there were 92 people with scores of 3, 48 with scores of 4, 48 with scores of 5, 29 with scores of 6 and only 11 with scores of 7, for a total 228 people in the moderate risk category. Clearly it would not be possible to recruit 20 people with scores of 7 on the PGSI from the NUPSGB. This fact coupled with the next, required an additional recruitment source.

Of the 3000 people interviewed in the NUPSGB only 97 fell into the problem gambler category of the PGSI. To reach our target of 100 problem gamblers, it was imperative therefore that we use alternative recruitment mechanisms, particularly because with a 14-month lag between the prevalence and panel studies we knew we would be unable to contact or recruit everyone in the NUPSGB (i.e. people would have relocated or changed their phone numbers during that time and some would refuse to participate).

In December 2009 we placed advertisements in three local newspapers in the Cape Town area to recruit additional subjects; the advertisement appears below. It was designed to attract moderate risk and problem gamblers by including three questions from the PGSI that are typically endorsed by gamblers of this level of severity. A research assistant's phone number was listed on the advertisement and he read through a recruitment script during each telephone call. The script informed potential subjects that they may be contacted in January 2010 by other researchers to discuss the study in more detail. It also assured subjects that their responses to any questions would be kept strictly confidential. After subjects gave their oral consent to be asked some questions, the research assistant administered the PGSI and then took down their contact details. The research assistant

The poster is titled "University Gambling Research Seeks Individuals Who Gamble" in bold blue text on a yellow background. Below the title is the "NATIONAL Responsible Gambling PROGRAMME" logo, which includes a blue square with a white 'R' and the text "NATIONAL Responsible Gambling PROGRAMME". A yellow banner below the logo reads "EARN MONEY FOR PARTICIPATION IN OUR RESEARCH!". The main text asks, "During the past 3 months have you... bet more than you could really afford to lose? needed to gamble with larger amounts of money to get the same feeling of excitement? gone back on another day to try to win back the money you lost?". It then states, "Then you could be a prospective subject for a scientific study being conducted by researchers at the University of Cape Town. The study involves no hardship other than an hour or two of your time answering some questions. All data about you collected by the researchers will be kept strictly confidential. The purpose of this study is to learn more about gambling behaviour." Eligibility criteria are listed: "All respondents should reside within Johannesburg, Pretoria, Durban or Cape Town and must be 18 years or older. Prospective subjects should contact: By phone (between 09h00 and 20h00 daily): Alexander Schurr 071 076 3791". At the bottom, there are logos for the "University of Cape Town" and "SARGT SOUTH AFRICAN RESPONSIBLE GAMBLING TRUST", along with a small red logo for "SOUTH AFRICAN NATIONAL LOTTERY".

scored the PGSI and entered the subjects' details into a spreadsheet. This recruitment drive yielded 41 people in the problem gambler category, 4 in the moderate risk category and 2 in the no and low risk categories.

Recruitment for the panel study started on 25 January 2010. People were recruited by the Computer Assisted Telephonic Interview (CATI) department of Ipsos Markinor in Johannesburg. Callers in the CATI department worked off recruitment scripts that were specific to the recruitment source: NUPSGB or newspaper advertisement. Potential subjects were briefed on the nature of the study and the number of visits that would occur over the 15-month period. Subjects were assured that any information that they provided would be kept strictly confidential. Finally, people were only recruited if they committed to taking part in the entire 15-month study. This would be impossible to enforce in practice but we wanted an assurance that they had taken into account the nature and length of the study before accepting our invitation to participate.

The CATI department provided the research team with daily updates on the recruitment process. To build trust, bolster the credibility of the research project and to prevent attrition between recruitment and the commencement of the study, people who agreed to participate

were paid R14.50 two days after the recruitment call. This money was delivered to their houses by drivers of Ipsos Markinor at a time that was convenient for the recruits.

From the initial list of 240 people in the no and low risk categories from the NUPSGB we only managed to recruit 26 with scores of 0, 22 with scores of 1 and 16 with scores of 2. The two main reasons for the shortfall in recruitment were that some people's telephone numbers had changed and others refused to participate. Fortunately we managed to recruit the 1 subject with a score of 0 and the 1 subject with a score of 2 who responded to the newspaper advertisement. It was necessary therefore to take a second random draw from the prevalence study so that our recruitment targets could be reached. Similar checks for significant differences between those who were selected and those who were not were conducted and no differences were found.

With regards to the moderate risk category, we managed to recruit 20 people with a score of 3, 13 with a score of 4, 19 with a score of 5, 8 with a score of 6 and 3 with a score of 7 from both the NUPSGB and the newspaper advertisement, yielding a total of 63 moderate risk gamblers. As with the shortfall in the no and low risk categories, a number of people's telephone numbers had changed and some refused to participate.

Finally, with regards to the problem gambler category, we only managed to recruit 60 people in total from both the NUPSGB and the newspaper advertisement. It became clear therefore that we would need another recruitment drive to reach our sample targets. Consequently, the research team placed an advertisement in five local newspapers in the greater Johannesburg area in the middle of February 2010 – the advertisement appears below. Unlike the previous advert which specifically targeted moderate risk and problem gamblers we decided to make this advertisement more general because the previous one failed to attract significant numbers of moderate risk gamblers. The advertisement was also placed on notice boards in community centres in the four metropolises where the study would take place and the advertisement was handed out to people outside gambling venues.

Another research assistant's number was placed on the advertisement and she fielded telephone calls from potential recruits. She followed the same script that was used in the previous recruitment drive and received 115 calls in total: 109 from responses to the newspaper advertisement, 3 in response to notice board advertisements and 3 in response to advertisements distributed outside gambling venues. Of the 115 people who called, 21 fell into the low risk category, 29 into the moderate risk category and 65 into the problem gambler category.

With only an additional 29 moderate risk gamblers we realised it would be impossible to recruit 20 people for every score in the moderate risk category range. Thus, we aimed to recruit 100 moderate risk gamblers in total regardless of their specific score on



The advertisement is a vertical poster with a blue border. At the top, a yellow banner contains the text "University Gambling Research Seeks Individuals Who Gamble" in blue. Below this is the logo for the "NATIONAL Responsible Gambling PROGRAMME", which includes a stylized blue and yellow 'N' and the text "NATIONAL Responsible Gambling PROGRAMME". A yellow banner below the logo reads "EARN MONEY FOR PARTICIPATION IN OUR RESEARCH!". The main body of the poster is white with blue text. It asks "During the past 3 months have you..." followed by a list of gambling activities: "gambled?", "played slots?", "played poker on the internet?", "gone to a casino?", "played the lottery or scratch cards?", "bet on sports?", and "bet on cards or dice?". Below this, it states: "Then you could be a participant in a scientific study being conducted by researchers at the University of Cape Town. The study involves no hardship except the use of some of your time to answer questions. All information about you collected by the researchers will be kept strictly confidential. The purpose of this study is to learn more about gambling behaviour." Further down, it specifies: "All respondents should reside within Johannesburg, Pretoria, Durban or Cape Town and must be 18 years or older." It then provides contact information: "Prospective subjects should contact: By phone (between 09h00 and 20h00 daily): Sarah Wilkinson 082 305 4966". At the bottom, a yellow banner reads "SOUTH AFRICAN RESPONSIBLE GAMBLING FOUNDATION".

the PGSI. This meant that we could contact people with scores of 3 who had been excluded from the earlier recruitment process once the cap of 20 people with this score was reached.

The new list of names and contact details were sent to the CATI department of Ipsos Markinor for what we hoped would be the final stage of recruitment. On 4 March 2010 we finally reached our targets of 100 no and low risk gamblers, 100 moderate risk gamblers and 100 problem gamblers. Note that the gambling classification of individuals in the sample was based on data from the NUPSGB and the PGSI screen that was administered to people who responded to our advertisements. Given the 14-month lag between the NUPSGB and the start of the panel study we expected some people's gambling severity to have changed over that time. It would only be possible to assess this during the first wave of fieldwork but at least we had achieved our targets with the information that was available to us at the time.

Fieldwork

After a final set of training sessions in each branch of Ipsos Markinor, the NLSGB started on 6 March 2010. Field managers at Ipsos Markinor

drew up schedules which matched interviewers to research subjects. This was done according to the language of the interviewer and the subject. Prior to each interview, fieldworkers contacted their subjects to set up a date and time that would be convenient for them. On the day of an interview, fieldworkers went to the branch offices of Ipsos Markinor to collect their fieldwork packs. These packs included: an English questionnaire; a vernacular questionnaire specific to the subject's home language; and showcards for particular questions on the questionnaire.

Fieldworkers either used their own transport to get to the subjects' houses or they were taken there by a driver. In the latter case, a team of interviewers were transported to a particular area and dropped off and collected by the driver. At the end of the interview, the completed questionnaires were then taken back to the branch offices for capturing.

The fieldwork took place over a period of 4 weeks under close supervision of the research team and field supervisors at Ipsos

Markinor. Unfortunately two people dropped out of the study before we could interview them. Feedback from the research subjects was very positive; they found the questionnaire interesting and were happy to be interviewed. Fieldworkers reported that the interview process ran smoothly and that they did not encounter any problems. The mean interview length was 126.13 minutes with a standard deviation of 30.51 minutes. 44 percent of questionnaires were back-checked, either personally (2.8%) or telephonically (41.2%), to ensure the accuracy and reliability of the information that was obtained.

The same fieldwork process was followed in every wave of the study, with the only difference being that fieldworkers were allocated to different subjects on each visit. As with any longitudinal study there was sample attrition over time. The original sample of 298 people in the first wave dropped to 291 in the second, 281 in the third, 270 in the fourth, 258 in the fifth and the sixth and final wave is currently ongoing.



iii. Summary Statistics

This section will present summary statistics of the data from the NLSGB to give the reader a feel for the data. Please note that all of the analyses have been conducted using data from the first 5 waves of the study because the final wave of data collection is still taking place.

The following table presents summary statistics from wave 1 of the study. The individuals in the sample are predominantly African with 12 years of education, in their late 30s, employed and living in Johannesburg with approximately 3 – 4 dependants. Note that there is a very even gender split in the sample; 48% of subjects are female. The sample's average score on the Living Standards Measure (LSM) implies that the average household monthly income is approximately R6500 but note the large standard deviation around this mean. 86% of the sample gambled in the month prior to wave 1 and the average amount spent on gambling is approximately R1000; this high figure is driven by the problem gamblers in the sample who spend a large amount of money on gambling each month, hence the large standard deviation around this mean. Approximately 53% of the sample drank alcohol in the month prior to data collection and 36% of the sample smoked cigarettes. Mean scores on the Beck Depression Inventory-II (BDI-II) and the Beck Anxiety Inventory (BAI) imply that most individuals suffer from minimal depression and mild anxiety, respectively. Finally, the mean score on the Barratt Impulsiveness Scale-11 (BIS) of 61.96 is uninformative in isolation because the screen does not provide cut-offs for levels of impulsivity. This variable will be useful later though when we explore the link between impulsivity and gambling severity.

The figure below shows the distribution of gambling severity categories, based on subjects' PGSI scores, on wave 1 of the study. As is evident, 32% of the sample (96 people) fell into the No Risk category on the PGSI. A further 12% (36 people) fell into the Low Risk category while 24% (73 people) and 31% (93 people) fell into the Moderate Risk and Problem Gambler categories, respectively. As discussed in the previous section, we were hoping to recruit 100 individuals each in the No/Low Risk, Moderate Risk and Problem Gambler categories for the study. Given the lag between the NUPSGB

and the NLSGB we knew that it would be impossible to achieve this target precisely but as the figure shows there is a good representation of gamblers from all of the severity categories of the PGSI.

TABLE I

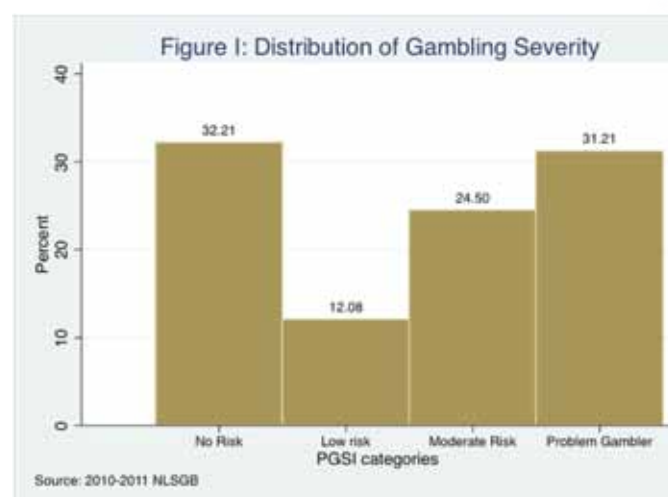
SUMMARY STATISTICS OF NLSGB DATA - WAVE 1		
Variable	Mean	Std Deviation
Female	0.479	0.500
African	0.674	0.469
White	0.144	0.352
Coloured	0.107	0.310
Asian/Indian	0.074	0.262
Education	12.316	2.371
Cape Town	0.186	0.389
Durban	0.162	0.369
Johannesburg ¹	0.588	0.493
Pretoria/Tshwane	0.065	0.247
Employed ²	0.601	0.491
Age	38.188	12.201
Number of dependents	3.507	2.422
LSM score ³	6.842	1.693
Gamble (last month)	0.862	0.345
Amount spent gambling (last month)	999.166	3064.523
Drink alcohol	0.534	0.499
Smoke tobacco	0.366	0.482
Depression score	11.507	11.056
Anxiety score	9.128	10.035
Impulsivity score	61.960	9.865

Notes

¹ Johannesburg includes Soweto, the East Rand and the West Rand

² Employment includes full-time, part-time and seasonal employment

³ Score on the Living Standards Measure (Range 0 - 10)



The preceding discussion has focussed on a snapshot of our sample on wave 1 of the study. Given the longitudinal nature of this project it is now worthwhile to focus on some measures of gambling involvement over time.

TABLE II

PROPORTION OF SAMPLE PLAYING EACH ACTIVITY ACROSS WAVES					
Activity	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Lucky draws excluding lottery	12.42%	9.62%	4.27%	3.70%	1.56%
Scratch cards	23.15%	18.21%	19.22%	15.56%	14.34%
Fafi / iChina	11.74%	7.56%	8.19%	8.52%	7.36%
Lotteries (e.g. Lotto, Powerball)	73.49%	71.82%	74.02%	67.78%	65.50%
Bingo	3.36%	2.06%	1.42%	2.22%	0.39%
Dice games for money	6.38%	6.87%	4.27%	5.56%	5.04%
Roulette	7.72%	6.53%	7.47%	9.26%	4.26%
Card games for money	13.09%	11.34%	7.83%	9.26%	3.88%
Slot machines	28.86%	23.02%	21.35%	22.22%	17.44%
Animal betting	8.72%	6.19%	4.98%	5.56%	5.81%
Sport betting	13.76%	8.93%	6.41%	7.04%	6.59%
Electronic gaming machines	9.06%	5.15%	2.85%	5.93%	3.10%
Other	1.34%	0.69%	0.36%	0.74%	0.39%

Table II shows the proportion of our sample that took part in various gambling activities in the month preceding each wave of data collection.

As one would expect more people played the lottery than any other form of gambling activity across all waves of the study. The second most popular form of gambling activity was slot machines, followed closely by scratch cards. Participation in other forms of gambling activity exhibited more variability across waves of the study. For example, 12.42% of research subjects participated in lucky draws in wave 1 of the study but only 1.56% did so by wave 5. Sport betting shows a similar but less pronounced downward trend which is possibly related to the cyclical nature of sports' seasons. Perhaps the most interesting observation in Table II is the downward trend in participation in all forms of gambling across waves of the study. The gambling activities which had the least pronounced declines in participation were: Fafi or iChina, dice games, betting on animals and roulette. This overall decrease in participation can be explained partly by sample attrition across waves of the study. 40 individuals dropped out of the study between waves 1 and 5 and the majority of these individuals came from the Moderate Risk and Problem Gambler categories. Specifically, 13 people in the No Risk category pulled out of the study compared with 5 in the Low Risk category and 27 in the Moderate Risk and Problem Gambler categories. Given that people in higher risk gambling categories tend to gamble more, it is not surprising that there was a downward trend in participation across waves of the study.

Table III shows the average number of times that subjects played the various gambling activities in the month prior to each wave. This table is particularly interesting because unlike the previous one it shows that conditional on partaking in a particular gambling activity, the number of times that that activity was played is far more stable across waves. For example, the average number of times that individuals purchased scratch cards in wave 1 of the study was 8.23; by wave 5 this fell slightly to 7.54. Other forms of gambling activity - like roulette, card

games, slot machines and sport betting - were actually played a greater number of times, on average, in wave 5 than they were in wave 1. The important thing to take away from Tables II and III then is that even though the proportion of research subjects participating in the various gambling activities declined over time, for those who participated their level of involvement remained very stable across waves of the study.

TABLE III

AVERAGE NUMBER OF TIMES EACH ACTIVITY WAS PLAYED LAST MONTH					
Activity	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Lucky draws excluding lottery	6.38	4.32	6.58	6.30	3.75
	(4.57)	(2.47)	(4.54)	(3.02)	(2.06)
Scratch cards	8.23	6.55	6.22	6.50	7.54
	(10.14)	(6.07)	(3.82)	(6.60)	(7.52)
Fafi / iChina	19.00	11.09	15.61	16.74	14.47
	(20.15)	(7.30)	(13.19)	(13.61)	(12.06)
Lotteries (e.g. Lotto, Powerball)	7.79	6.05	6.72	7.40	6.07
	(6.99)	(3.47)	(4.00)	(6.40)	(3.33)
Bingo	5.60	5.50	4.75	5.17	4.00
	(3.53)	(3.89)	(4.99)	(4.12)	(0.00)
Dice games for money	10.21	7.45	8.42	9.00	9.31
	(8.40)	(3.50)	(5.32)	(6.74)	(10.55)
Roulette	5.04	5.53	4.52	5.72	6.55
	(4.59)	(4.68)	(3.16)	(3.77)	(3.98)
Card games for money	7.72	6.52	8.77	6.80	8.10
	(7.44)	(6.49)	(6.33)	(7.31)	(6.84)
Slot machines	4.86	4.34	4.42	5.02	5.16
	(3.94)	(3.75)	(4.16)	(4.48)	(8.34)
Animal betting	9.31	8.17	6.07	4.80	6.64
	(8.87)	(7.15)	(5.83)	(2.91)	(7.38)
Sport betting	7.41	7.65	7.33	6.68	8.88
	(7.82)	(9.47)	(6.16)	(4.66)	(9.43)
Electronic gaming machines	5.19	4.93	6.38	5.50	5.25
	(3.60)	(3.33)	(5.21)	(4.10)	(5.23)
Other	11.25	2.50	4.00	1.00	6.00
	(12.09)	(2.12)	(0.00)	(0.00)	(0.00)

Standard deviation in parentheses

Table IV shows the average amount of money spent on gambling activities in the month prior to each wave. The table also includes the standard deviation of each average amount to aid comparisons over time. Given that the mean of a variable is very sensitive to outliers it is important to check the standard deviation of an estimate before drawing conclusions. For example, focussing purely on the average amount of money spent on Fafi across waves of the study, one could conclude that people were spending more on this activity over time. In an average sense this would be correct but if one looks at the standard deviations of these estimates you will notice that these increase over time too. Thus, the increase in the average amount spent on Fafi across waves of the study was driven largely by a few individuals who gambled excessively on this activity in later waves of the study. What this table shows, when accounting for both the mean and the standard deviation of the estimates, is that the average amount of money spent on the various gambling activities

was relatively stable across waves of the study. This result echoes that from Table III: although fewer people overall were partaking in the various gambling activities across waves of the study those that did participate played their preferred games a similar number of times and staked a similar amount of money over time.

In later reports we will analyze relationships between types of gambling activities and categorization of subjects for gambling severity, including changes in memberships in these categories across the waves. In the NUPSGB we found that problem gambling was most strongly associated with dice and card games and Fafi / iChina, and not significantly associated with lottery play in subjects who do not otherwise gamble. The NLSGB will provide a richer dataset in which to further investigate this finding. However, this must wait upon completion of the sixth wave and integration of the data from it, because it requires looking at specific subsets of observations, making data completeness crucial.

TABLE IV

AVERAGE AMOUNT SPENT ON EACH ACTIVITY IN LAST MONTH ACROSS WAVES					
Activity	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Lucky draws excluding lottery	R144.22 (255.49)	R89.46 (98.37)	R195.42 (253.07)	R259.50 (444.41)	R242.50 (245.27)
Scratch cards	R72.99 (101.51)	R117.49 (411.56)	R58.85 (62.53)	R73.55 (102.03)	R71.03 (97.95)
Fafi / iChina	R76.91 (65.37)	R82.09 (97.77)	R101.65 (131.15)	R91.52 (138.93)	R121.26 (160.13)
Lotteries (e.g. Lotto, Powerball)	R115.28 (201.49)	R153.37 (391.91)	R111.11 (194.45)	R167.99 (611.73)	R152.70 (351.47)
Bingo	R353.00 (319.38)	R52.00 (42.24)	R102.50 (133.01)	R781.67 (1578.99)	R15.00 (0.00)
Dice games for money	R364.11 (608.29)	R408.75 (615.76)	R262.50 (366.49)	R294.00 (279.48)	R705.38 (1045.81)
Roulette	R1 590.00 (2448.10)	R1 444.74 (1847.14)	R1 426.19 (2723.63)	R1 153.00 (1626.91)	R1 803.64 (2243.60)
Card games for money	R856.28 (2439.40)	R492.73 (665.52)	R939.09 (2012.30)	R1 391.12 (4121.44)	R1 405.50 (3729.18)
Slot machines	R1 068.69 (1984.38)	R1 056.49 (1774.50)	R1 287.67 (2428.52)	R1 312.50 (2319.82)	R1 104.00 (1868.24)
Animal betting	R1 467.27 (4010.34)	R1 365.94 (4664.14)	R1 550.86 (4459.40)	R2 866.53 (10274.15)	R3 190.71 (10606.69)
Sport betting	R464.46 (1588.78)	R696.00 (1944.87)	R216.72 (255.78)	R692.74 (2267.01)	R601.76 (1140.91)
Electronic gaming machines	R1 168.89 (2284.96)	R974.00 (1215.80)	R2 531.25 (5155.28)	R1 086.88 (1604.50)	R717.50 (988.02)
Other	R27.25 (16.88)	R504.00 (701.45)	R200.00 (0.00)	R30.00 (28.28)	R1 000.00 (0.00)

Standard deviation in parentheses

iv. *The Persistence of Gambling Severity over Time*

One of the major advantages of collecting panel as opposed to cross-sectional data is that it allows one to analyse trends in variables over time. Of particular interest in the present study is the stability or persistence in the classification of gambling severity over time. Given the relatively short time period between waves of the study, we can focus on the short run stability of gambling severity. This is relevant to understanding the etiology of gambling problems and it should help to inform treatments, prevention and other interventions aimed at reducing the extent of pathological gambling.

Table V presents a tabulation of the PGSI categories across all 5 waves of the NLSGB data. Note that this tabulation decomposes counts into between and within components in the panel data; this distinction will be discussed presently. The Overall part of the table summarises results in terms of person-years⁷. We have 557 person-years of data in which individuals were classified as No Risk gamblers and 216 person-years of data in which individuals were classified as Low Risk gamblers. With regards to the Moderate Risk and Problem Gambler categories, we have 300 and 325 person-years of data, respectively. What these figures mean is that in 39.84% of our data, individuals were classified as No Risk gamblers. Similarly, in 15.45%, 21.46% and 23.25% of our data, people were classified in the Low Risk, Moderate Risk and Problem Gambler categories, respectively.

The Between column in the table repeats this breakdown but does so in terms of people rather than person-years. Note that 213 people (71.48%) were ever classified as No Risk gamblers across the 5 waves of the study. Similarly, 141 people (47.32%) were classified in the Low Risk category, 170 people (57.05%) were classified in the Moderate Risk category, and 159 people (53.36%) were classified in the Problem Gambler category. Summing across these numbers yields a grand total of 683 individuals (229.19%). This may seem strange because our sample comprised, at most, 298 gamblers but what this means is that there are people in our sample who were sometimes classified into different categories of gambling severity.

Finally, the Within column in the table shows the fraction of time that people were classified in the various categories of gambling severity. Focussing on the No Risk category, the Within column tells us that conditional on a person ever having been classified as a No Risk gambler, 55.06% of that person's observations fell into that gambling severity category over time. Similarly, conditional on a person ever having been classified as a Low Risk gambler, 32.07% of that person's observations were in that gambling severity category. Finally, conditional on having ever been classified in the Moderate Risk or Problem Gambler categories 39.22% and 43.29%, respectively, of those people's observations fell into those categories. Note that these fractions are a measure of the stability of the various gambling severity categories. What this analysis shows us then is that the Low Risk category is the least stable, followed by the Moderate Risk, Problem Gambler and No Risk categories. In other words, individuals who were ever classified in the No Risk and Problem Gambler categories were more likely to stay in these categories than people in the Low Risk and Moderate Risk categories. The Total at the base of the Within column (43.29%) is the normalized between weighted average of the within percents – i.e. $(213 \times 55.06 + 141 \times 32.07 + 170 \times 39.22 + 159 \times 43.29) / 683$. It provides a measure of the overall stability of the gambling severity categories.

TABLE V

TABULATION OF PGSI CATEGORIES					
	Overall		Between		Within
Category	Frequency	Percent	Frequency	Percent	Percent
No Risk	557	39.84	213	71.48	55.06
Low Risk	216	15.45	141	47.32	32.07
Moderate Risk	300	21.46	170	57.05	39.22
Problem Gambler	325	23.25	159	53.36	43.29
Total	1398	100	683	229.19	43.63

⁷ This term is used in panel data contexts to refer to one observation at one point in time. Given that most longitudinal studies' waves are separated by at least 1 year this term is appropriate. In our study, waves were spaced 3 months apart so a more accurate term would be person-months.

TABLE VI

TRANSITION PROBABILITIES OF PGSI CATEGORIES					
	PGSI Category (Final Values)				
PGSI Category (Initial Values)	No Risk	Low Risk	Moderate Risk	Problem Gambler	Total
No Risk	65.51	15.63	9.93	8.93	100
Low Risk	42.70	26.40	17.98	12.92	100
Moderate Risk	22.98	16.94	37.10	22.98	100
Problem Gambler	23.62	10.33	23.25	42.80	100
Total	41.91	16.36	20.64	21.09	100

In sum, Table V shows that gambling severity classification is remarkably unstable over time. It is interesting that those people who are classified at the two ends of the severity continuum have a higher likelihood of staying there than those classified in the middle but even so there is a large amount of flux at both ends of the distribution.

To complement the preceding analysis, Table VI shows the transition probabilities of gambling severity categories across waves of the study. Note that the rows of the table represent the initial values while the columns represent the final values. What this means is that between each wave, approximately 65% of the No Risk gamblers remained in this gambling severity category while 16% shifted into the Low Risk category, 10% shifted into the Moderate Risk category and 9% shifted into the Problem Gambler category. The principal diagonal of the table therefore shows the likelihood that people who were classified in a particular gambling severity category in one wave would remain there by the next.

Looking at the Low Risk category we see that only 26% of people who fell into this category in one wave would remain there by the next whereas 43% would have shifted into the No Risk category, 18% into the Moderate Risk category and 13% into the Problem Gambler category. For the Moderate Risk category, 37% of people in this category in one wave would remain there by the next whereas 17% would have shifted into the Low Risk category. Interestingly, the same proportion of people (23%) would shift from the Moderate Risk category into the No Risk and Problem Gambler categories between waves. In other words, people were as likely to develop more severe gambling problems between waves as they were to experience no problems between waves.

Finally, approximately 43% of people who were in the Problem Gambler category in one wave would remain there by the next while 10% would have shifted into the Low Risk category. Like the previous result, problem gamblers were as likely to shift into the Moderate Risk category as they were to shift into the No Risk category between waves.

The results from this section show that the temporal stability of gambling severity is relatively low over short time spans. This is somewhat comforting if one focuses on the Problem Gambler category. Although approximately 65% of problem gamblers still suffered from relatively acute gambling problems across consecutive waves (i.e. would remain in the Moderate Risk and Problem Gambler categories), the remaining 35% shifted into gambling severity categories where they experienced relatively few problems. Less comforting is that approximately 19% of No Risk gamblers shifted into the two highest categories of gambling severity between waves and that 31% of Low Risk gamblers suffered from worse gambling problems between waves. These results therefore call into question the idea that compulsive gambling is a progressive disorder. Although certainly true for some individuals in our sample, the fact that Moderate Risk gamblers were as likely to become No Risk gamblers as they were to shift into the Problem Gambler category shows that gambling problems can be moderated over relatively short time periods.

It is useful to compare this finding with an analysis we did of data from the NUPSGB, in which we found that problem gamblers constitute a distinctive group with respect to their values on all of the demographic variables on which we obtained information in that study. At first glance, the result here might seem to be in tension with that finding. However, this is not necessarily the case. It might be that when we apply a similar analysis to the full set of NLSGB data, we will find that the distinctness attaches to all NLSGB who ever appear in the problem gambler category, or alternatively to subjects who are found there in some threshold proportion of waves. We will investigate this question following the completion of the sixth wave.

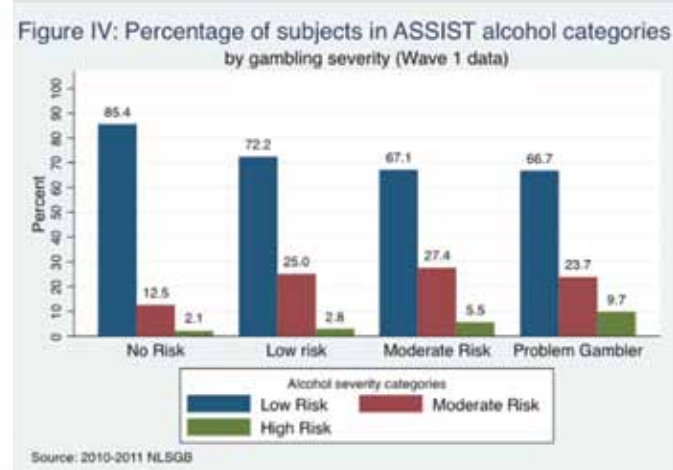
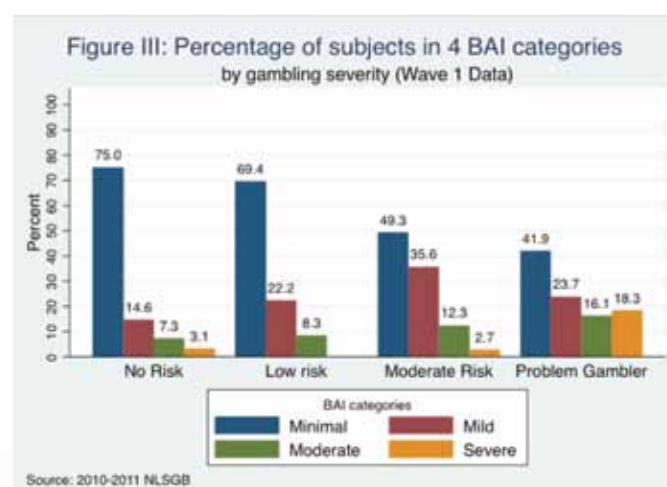
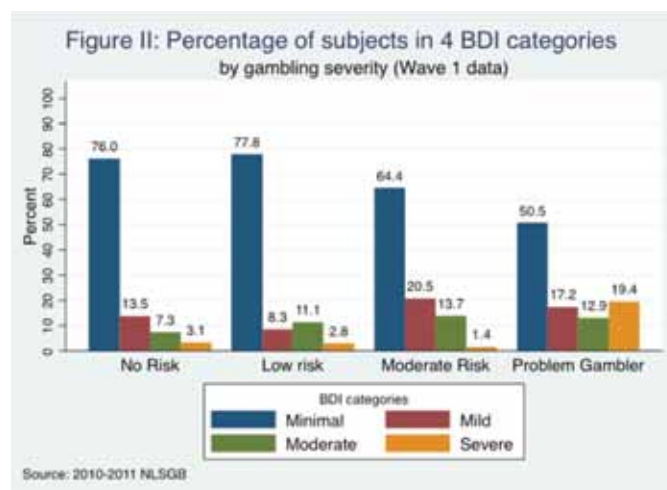
v. Comorbidity of Gambling Problems and Other Mental Disorders

A very active area of research in the field of gambling studies focuses on the association between gambling problems and other mental disorders. Numerous studies (see, for example, (Lawrence et al., 2009, Petry, 2001, Petry, 2005, Petry, 2007, Potenza, 2007)) have found that people with gambling problems also tend to suffer from anxiety, depression, other impulse control disorders and substance use disorders. As discussed previously, the survey instrument used in the NLSGB included a number of modules to assess these potentially comorbid mental disorders. For the purposes of this report, we will focus on the relationships between gambling and anxiety, depression, impulsivity, and alcohol and tobacco use.

Starting our analysis with depression, Figure II shows the distribution of the 4 Beck Depression Inventory – II (BDI-II) categories (minimal, mild, moderate and severe) by gambling severity in Wave 1⁸ of the NLSGB data. Differences in the severity of depressive symptoms according to gambling severity categories is stark. A χ^2 test shows that the distributions of BDI-II categories across gambling severity categories are significantly different ($\chi^2 = 34.26$; $p = 0.00$). Furthermore, we find that mean BDI-II scores are significantly lower among No Risk gamblers than they are among Moderate Risk gamblers ($F = 11.92$; $p = 0.00$) and problem gamblers ($F = 62.79$; $p = 0.00$). Similarly, we find that Low Risk gamblers have significantly lower depression scores than Moderate Risk gamblers ($F = 3.62$; $p = 0.06$) and people in the Problem Gambler category ($F = 40.38$; $p = 0.00$). Finally, Moderate Risk gamblers have significantly lower scores on the BDI-II than problem gamblers ($F = 23.81$; $p = 0.00$). Thus, we find that gambling problems and depression co-occur in our data and it is therefore crucial for clinicians, when diagnosing either depression or problem gambling, to screen for symptoms of the other disorder.

A similar pattern emerges when we graph the distributions of the Beck Anxiety Inventory (BAI) diagnoses (minimal, mild, moderate and severe) by gambling severity category from wave 1 of the NLSGB data. We observe a monotonic decline in the percentage of study participants who suffer from minimal anxiety as gambling severity rises. Of particular interest is the very high proportion of subjects who suffer from severe anxiety in the Problem Gambler category. A χ^2 test shows that the distribution of anxiety categories differ significantly according to gambling severity classification ($\chi^2 = 44.27$; $p = 0.00$). Furthermore, mean BAI scores are significantly lower among No Risk gamblers than every other gambling severity category (No Risk vs Low Risk: $F = 4.37$, $p = 0.04$; No Risk vs Moderate Risk: $F = 29.66$, $p = 0.00$; No Risk vs Problem Gambler: $F = 66.42$, $p = 0.00$). Similarly, Low Risk gamblers have significantly lower BAI scores than do people in the Moderate Risk and Problem Gambler categories (Low Risk vs Moderate Risk: $F = 8.55$, $p = 0.00$; Low Risk vs Problem Gambler: $F = 33.61$, $p = 0.00$). Finally, Moderate Risk gamblers have significantly lower scores on the anxiety inventory than problem gamblers ($F = 10.23$; $p = 0.00$). Thus, these results suggest that there is a strong and positive association between anxiety and gambling severity.

Figure IV shows the distribution of alcohol severity scores from the World Health Organisation's Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) by PGSI category. As is evident, the percentage of High Risk alcohol users among the Problem Gambler



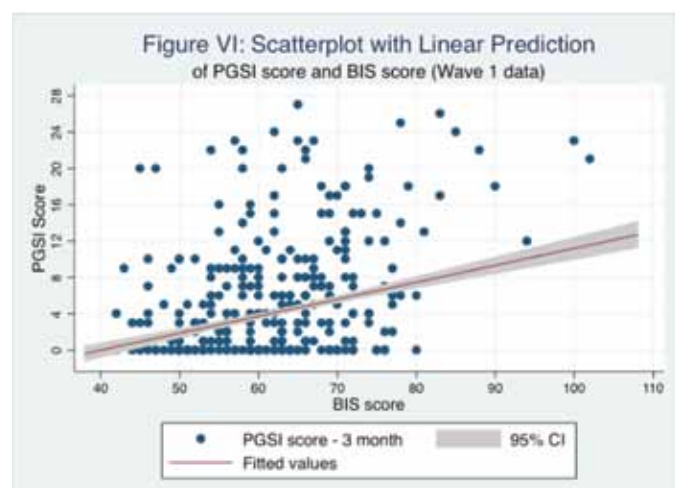
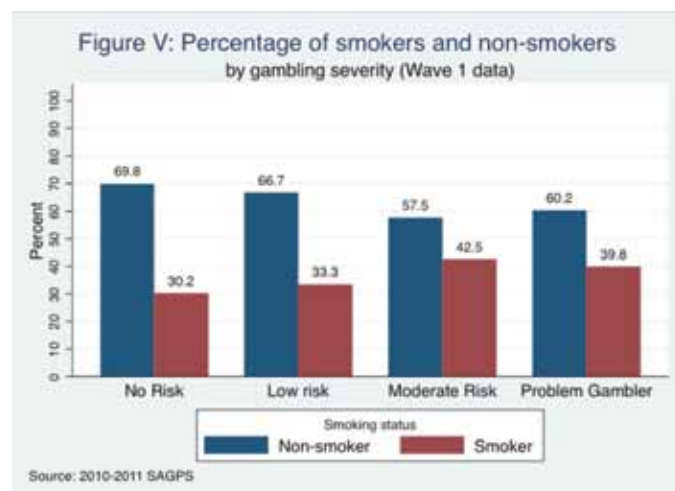
⁸ The distribution is qualitatively identical across all waves of the study so we only present figures with wave 1 data in this section.

category far exceeds the proportion in other gambling severity categories. We find that the distribution of alcohol severity diagnoses differ significantly according to gambling status ($\chi^2 = 13.72$; $p = 0.05$). In addition, mean ASSIST alcohol scores are significantly lower among No Risk gamblers than every other gambling severity category (No Risk vs Low Risk: $F = 4.30$; $p = 0.04$; No Risk vs Moderate Risk: $F = 42.00$; $p = 0.00$; No Risk vs Problem Gambler: $F = 26.56$; $p = 0.00$). Low Risk gamblers also have significantly lower alcohol scores than people in the Moderate Risk and Problem Gambler categories ($F = 14.03$, $p = 0.00$ and $F = 6.59$, $p = 0.01$, respectively). However, there is no significant difference between the mean alcohol scores of Moderate Risk and problem gamblers ($F = 1.46$; $p = 0.23$). Thus, the data suggest that severity of alcohol use and gambling disorders co-occur in our sample. This is particularly relevant to treatment because studies (see (Hodgins and el-Guebaly, 2010, Ladd and Petry, 2003)) have found that people with comorbid alcohol and gambling problem diagnoses suffer from more recalcitrant problems and are more prone to relapse than people with either disorder in isolation.

Figure V shows the distribution of smokers across gambling severity categories. As is evident, there is a greater percentage of smokers in the Moderate Risk and Problem Gambler categories than among the No Risk and Low Risk gamblers. However, there is a slightly higher proportion of smokers among people in the Moderate Risk category than in the Problem Gambler category. Interestingly, the distribution of smokers across the gambling severity categories is not significantly different according to a χ^2 test ($\chi^2 = 3.35$; $p = 0.34$). Furthermore, PGSI scores are not significantly different among smokers and non-smokers ($F = 2.55$; $p = 0.11$). Thus, unlike previous studies which have found a higher incidence of smoking among people suffering from gambling problems, this is not borne out in our data.

The final relationship that we will explore in this section is between gambling severity and impulsivity. An emerging consensus in the field of addiction studies is that many addictions may share a common underlying or predisposing factor (see, for example, (Verdejo-Garcia et al., 2008)). One such factor is impulsivity which has been found at higher levels among individuals suffering from gambling problems and substance use disorders. The screen that was used to measure impulsivity in our questionnaire is the Barratt Impulsiveness Scale 11 (BIS-11). Figure VI shows a scatterplot of PGSI score and BIS score, which includes a linear prediction and confidence interval, of the relationship between these variables. As is evident, there is a relatively strong positive association between gambling severity and impulsivity.

In this section we analysed the relationship between gambling severity and a number of comorbid mental disorders. The results suggest that gambling problems co-occur with anxiety, depression, alcohol use disorders and elevated levels of impulsivity. Somewhat surprisingly we found no relationship between smoking status and gambling severity.



The reader may wonder about the structure of possible causal relationships between gambling problems and co-occurring disorders. This is indeed something that cannot be investigated using a standard cross-sectional design, but which panel data *can*, under specific and favourable circumstances, shed light. We will briefly reconsider this question later in the present report.

vi. Factors Affecting Gambling Severity over Time

In the final section of this report we analyse the factors that affect gambling severity over time. To do so, it is necessary to build multivariate regression models which take into account a number of factors that may influence gambling behaviour over time. By including these variables in the model we control for or partial out their effects so that we can be confident in any relationships that emerge from the analysis. Please note that in these models we only include variables that change over time. Hence, we exclude variables like gender and population group because these are fixed and cannot be causal factors in changes in gambling severity over time.

Table VII presents the estimates from three different models of factors that may influence gambling behaviour over time. The first model, Pooled OLS, fits an ordinary least squares (OLS) line to the data but does not specifically take into account the panel structure of the dataset. This is why the term ‘pooled’ precedes OLS; in essence we are simply pooling all of the observations and fitting a regression line that minimises the sum of squared vertical distances between the observed responses in the dataset and the responses predicted by the linear approximation. Note that although this model does not specifically incorporate the panel structure of our data we have used cluster-robust standard errors in the model to ensure that the errors of our estimates take into account the fact that we have multiple observations on the same people over time.

Focussing on the estimates from the model, note that stars or asterisks next to an estimate imply that they have a statistically significant effect on the outcome or response variable; in our case PGSI score. By regressing PGSI score on a number of predictor or independent variables we can establish whether these variables have an effect on gambling severity, as measured by PGSI score, over time. The model suggests that employment has a positive and significant effect on gambling severity; we can see this by the positive coefficient estimate alongside the “Employed” variable which has 3 asterisks next to it. Similarly, we find that BDI score, BAI score and BIS score have a positive and significant effect on PGSI score. Recall that BDI score refers to the score a person received on the Beck Depression Inventory-II. What this means is that increases in depression, as measured by the BDI, tend to be associated with increases in gambling severity. Similarly the positive estimate on BAI score, which measures a person’s level of anxiety using the Beck Anxiety Inventory, implies that elevated levels of anxiety are associated with higher PGSI scores (i.e. more severe gambling problems). Finally, the positive estimate on BIS score, which is a measure of a person’s impulsivity derived from the Barratt Impulsiveness Scale, suggests that higher levels of impulsivity are associated with higher scores on the PGSI.

The final set of statistically significant estimates in this model are for variables which index the wave of the study. Note that wave 1, the first wave of the study, is the omitted category in this model. What this means is that the estimates on the variables “Wave 2”, “Wave 3” etc. are relative to the omitted category wave 1. The estimates on the Wave 2, Wave 3 and Wave 5 variables are all negative and statistically significant. What this means is that as the study progressed, the average score on the PGSI declined relative to the average score on this measure during wave 1 of the study. This provides some preliminary evidence that gambling severity declined over the course of our study.

TABLE VII

FACTORS AFFECTING GAMBLING SEVERITY OVER TIME			
	Pooled OLS	Random Effects	Fixed Effects
Education	0.161 (0.10)	0.234** (0.10)	0.222 (0.17)
Employed	0.855** (0.43)	0.22 (0.37)	-0.5 (0.49)
Age	0.025 (0.02)	0.033* (0.02)	-0.147 (0.28)
LSM score	0.198 (0.14)	-0.023 (0.12)	-0.362** (0.17)
ASSIST - alcohol score	0.029 (0.03)	0.045** (0.02)	0.054** (0.02)
Smoke	-0.191 (0.46)	-0.101 (0.40)	-0.089 (0.58)
BDI score	0.113** (0.05)	0.061** (0.03)	0.031 (0.02)
BAI score	0.072** (0.04)	0.083*** (0.03)	0.086*** (0.03)
BIS score	0.138*** (0.02)	0.139*** (0.02)	0.139*** (0.02)
Wave 2	-1.365*** (0.36)	-1.487*** (0.33)	-1.520*** (0.34)
Wave 3	-1.048** (0.42)	-1.209*** (0.37)	-1.188*** (0.36)
Wave 4	-0.396 (0.44)	-0.576 (0.39)	-0.503 (0.43)
Wave 5	-1.945*** (0.41)	-2.112*** (0.38)	-1.940*** (0.49)
Constant	-9.739*** (2.20)	-8.723*** (1.91)	1.321 (11.09)
N	1390	1390	1390
F-stat / χ^2	13.796	205.86	13.063
Prob > F	0.00	0.00	0.00

Results are robust to heteroskedasticity

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

The second set of estimates listed in Table VII are from a Random Effects model of the relationship between a number of predictor variables and our response or dependent variable PGSI score. A random effects model takes into account the panel structure of the NLSGB data and employs the assumption that the variation across people is random and uncorrelated with the predictor or independent variables included in the model (i.e. BAI score, BDI score etc.). This model is useful if you have reason to believe that differences across individuals have an influence on gambling severity over time. Although somewhat more attractive than a pooled OLS model, the random effects model rests on a number of very strong statistical assumptions which are often not fulfilled by a dataset. Nevertheless, we present the estimates from this model for comparative purposes.

The random effects model suggests that age and education have a positive and significant effect on gambling severity. In other words, older people with higher levels of education tend to suffer from more problems associated with gambling – at least as captured by the PGSI score variable - than younger people with less education. Although somewhat surprising this effect is likely driven by the composition of our sample.

The other estimates from the random effects model parallel those from the pooled OLS model: higher levels of depression, anxiety and impulsivity are associated with higher scores on the PGSI and gambling severity tended to decline over the course of the study. The only difference is that higher scores on the WHO ASSIST's alcohol module are positively and significantly related to gambling severity. This supports our earlier observation that people with gambling problems also tend to suffer from problems with alcohol use.

The final set of estimates in the table are from a Fixed Effects model of the relationship between a number of predictor variables and gambling severity over time. A fixed effects model incorporates the panel structure of our dataset and is used to analyse the impact of variables that change over time. Thus, the model explores the relationship between predictor and response variables within an individual; this is why the fixed effects model is often referred to as the 'within' estimator. When using this model we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. Simply, the fixed effects estimator removes the impact of any time-invariant characteristics of a person (for example, a genetic predisposition to gambling problems) from the predictor variables in a model which allows one to assess the predictor variable's net effect. The key insight from this model is that if we remove the effect of variables that do not change over time, then any changes in gambling severity must be due to influences other than those fixed characteristics. Of the three models included in Table VII, the fixed effects estimator arguably has the most appealing statistical characteristics.

The estimates from our fixed effect model show that age and education are not significant predictors of gambling severity. This is to be expected in a fixed effects context because age and education only change very slowly over time and they are thus unlikely to cause significant changes

in an individual over a period of 15 months – the length of the NLSGB study. Unlike the estimates from our pooled OLS and random effects models, we see that increases in a person's Living Standards Measure (LSM) score is associated with a decline in gambling severity over time. Thus, as individuals acquire more assets and become wealthier they tend to suffer less from gambling problems as measured by the PGSI.

Interestingly changes in depression do not affect gambling severity in our fixed effects model. Yet the reader will recall that we found correlation between depression and gambling severity in our random effects and pooled OLS models. This *might* reflect a tendency for people to move between gambling severity categories while remaining depressed throughout. This is an hypothesis we can only endeavour to investigate following the completion of the sixth wave. However, we find that alcohol use, anxiety and impulsivity all have a positive and significant effect on PGSI score over time. In addition, we find that the gambling severity tended to decline across waves of our study.

In sum, the models from this section point to a handful of factors that influence gambling behaviour over time. A robust finding across all models is that anxiety and impulsivity are positively related to gambling severity. Similarly, in all models we find that PGSI scores tended to decline across waves of the study. In the random effects and fixed effects models, alcohol use is positively related to gambling severity whereas in the pooled OLS and random effects models depression is associated with elevated scores on the PGSI.

In the previous section, we raised the question of possible causal relationships. The analysis displayed here still does not allow us to gain immediate insight on these. However, the fixed effects model takes us beyond mere correlation at a time and indicates some relationships – between gambling severity and alcohol use, anxiety and impulsivity – that involve co-occurring changes. This would motivate a search for causal structure relating them in subsequent studies. For this one would ideally identify and measure a variable that one would expect to be correlated with gambling severity but not with the co-occurring conditions. Alternatively, we can later attempt, after the completion of the sixth wave, to see how well the data support a model or models that build in explicit hypotheses about causal structure.

Many studies of a wide range of mental disorders, including problem gambling, from around the world suggest that presence of co-occurring disorders is the most important barrier to successful moderation of symptoms (Heyman 2009). It is therefore crucial to be informed about the extent of such co-occurrence when evaluating the relative effectiveness of any treatment or awareness interventions. Assessments of interventions against problem gambling in South Africa should control for the presence of the co-occurring disorders we have identified here, lest failures be incorrectly attributed to imagined misconception of the interventions themselves. One would ideally conduct such assessments using randomized clinical trials in a sample that has not self-selected. (It is known that people with co-occurring mental disorders are significantly more likely to seek clinical help than people experiencing only one disorder [Heyman 2009]).

vii. Conclusions

This report has provided a preliminary account of the data from NLSGB. The study was carefully designed to gather a wealth of information on the participants. We found that overall gambling involvement decreased across waves of the study but that the average amount of time that people gambled and the average amount of money that was spent on gambling remained relatively stable. One of the key insights from this study is the low persistence or stability of gambling severity classification over short time spans. In other words, people may switch quite rapidly from being at no risk for developing gambling problems to experiencing relatively severe gambling problems. In the other direction, people who suffer from acute gambling problems may experience few, if any, problems a few months later.

It does *not* follow from this that problem gambling screens such as the PGSI are ill-suited to cross-sectional prevalence studies (e.g., the NUPSGB), since individual people may move between categories while category proportions in the population remain approximately constant. The finding does suggest, however, limitations in such screens as diagnostic of a chronic condition in an individual. It is furthermore possible that individuals could move between categories while still possessing latent fixed characteristics that predict periodic or recurrent 'visits' to more severe categories. These are issues we will be able to explore in the NLSGB data after the sixth wave is completed. Analysis of the diary intervention data may also shed further light on these issues.

An analysis of the factors that contribute to gambling severity over time suggest that mental disorders like anxiety, depression, alcohol use and elevated levels of impulsivity tend to co-occur with gambling problems. Because co-occurring disorders predict resistance to interventions, it is crucial that assessments of interventions against problem gambling control for the presence of (at least) the disorders identified here.

Neuroscientific findings suggest that a small proportion of problem gamblers are *addicted* to gambling, in the sense that their brains have adapted to gambling in such a way that they have difficulty thinking about alternative sources of reward (Ross et al 2008). If this is correct, then one would hypothesize that if there are gambling addicts in the NLSGB sample, they are included in the group who do not transit in and out of that category in the present observations. This hypothesis warrants further study, ideally using neuroimaging methods.

Findings about South African gamblers summarized in this preliminary report are broadly consistent with observations of gamblers reported over the years from other countries. However, few such reports have been based on panel data. Thus our study shows initial promise, as hoped, for yielding new knowledge about influences on problem gambling and on its status as a chronic versus intermittent disorder. These issues will be investigated in the papers we expect to derive from the NLSGB data over approximately two years following completion of the sixth wave.

viii. References

- BECK, A. T., EPSTEIN, N., BROWN, G. & STEER, R. A. 1988. An inventory for measuring clinical anxiety: psychometric properties. *Journal of Consulting and Clinical Psychology*, 56, 893-7.
- BECK, A. T., STEER, R. A. & BROWN, G. K. 1996. *Beck Depression Inventory Manual*, San Antonio, TX, Psychological Corporation.
- BRUGHA, T., BEBBINGTON, P., TENNANT, C. & HURRY, J. 1985. The List of Threatening Experiences: a subset of 12 life event categories with considerable long-term contextual threat. *Psychological Medicine*, 15, 189-94.
- BRUGHA, T. S. & CRAGG, D. 1990. The List of Threatening Experiences: the reliability and validity of a brief life events questionnaire. *Acta Psychiatrica Scandinavica*, 82, 77-81.
- COHEN, S., KAMARCK, T. & MERMELSTEIN, R. 1983. A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 385-96.
- FERRIS, J. & WYNNE, H. 2001. The Canadian Problem Gambling Index: Final Report. Ottawa: Canadian Centre on Substance Abuse.
- FISHER, S. 2000. Measuring the Prevalence of Sector-Specific Problem Gambling: A Study of Casino Patrons. *Journal of Gambling Studies*, 16, 25-51.
- HEYMAN, G. 2009. *Addiction: A Disorder of Choice*. Cambridge, MA: Harvard University Press.
- HODGINS, D. C. & EL-GUEBALY, N. 2010. The influence of substance dependence and mood disorders on outcome from pathological gambling: five-year follow-up. *Journal of Gambling Studies*, 26, 117-27.
- KESSLER, R. C., ANDREWS, G., COLPE, L. J., HIRIPI, E., MROCZEK, D. K., NORMAND, S. L., WALTERS, E. E. & ZASLAVSKY, A. M. 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, 32, 959-76.
- LADD, G. T. & PETRY, N. M. 2003. A comparison of pathological gamblers with and without substance abuse treatment histories. *Experimental and Clinical Psychopharmacology*, 11, 202-9.
- LAWRENCE, A. J., LUTY, J., BOGDAN, N. A., SAHAKIAN, B. J. & CLARK, L. 2009. Problem gamblers share deficits in impulsive decision-making with alcohol-dependent individuals. *Addiction*, 104, 1006-15.
- PATTON, J. H., STANFORD, M. S. & BARRATT, E. S. 1995. Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology*, 51, 768-74.
- PETRY, N. M. 2001. Substance abuse, pathological gambling, and impulsiveness. *Drug and Alcohol Dependence*, 63, 29-38.
- PETRY, N. M. 2005. *Pathological Gambling: Etiology, Comorbidity and Treatment*, Washington, DC., American Psychological Association.
- PETRY, N. M. 2007. Gambling and substance use disorders: current status and future directions. *The American Journal on Addictions*, 16, 1-9.
- POTENZA, M. N. 2007. Impulsivity and compulsivity in pathological gambling and obsessive-compulsive disorder. *Revista Brasileira de Psiquiatria*, 29, 105-6.
- PROCIDANO, M. E. & HELLER, K. 1983. Measures of perceived social support from friends and from family: three validation studies. *Am J Community Psychol*, 11, 1-24.
- ROSS, D., SHARP, C., VUCHINICH, R.E., & SPURRETT, D. 2008. *Midbrain Mutiny: The Picoeconomics and Neuroeconomics of Disordered Gambling*. Cambridge, MA: MIT Press.
- SCHWARZER, R. & JERUSALEM, M. 1995. Generalized Self-Efficacy Scale. In: WEINMAN, J., WRIGHT, S. & JOHNSTON, M. (eds.) *Measures in health psychology: A user's portfolio. Causal and control beliefs*. Windsor, UK: NFER-NELSON.
- VERDEJO-GARCIA, A., LAWRENCE, A. J. & CLARK, L. 2008. Impulsivity as a vulnerability marker for substance-use disorders: review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience and Biobehavioral Reviews*, 32, 777-810.
- WHO ASSIST WORKING GROUP 2002. The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): development, reliability and feasibility. *Addiction*, 97, 1183 - 1194.
- WULFERT, E., HARTLEY, J., LEE, M., WANG, N., FRANCO, C. & SODANO, R. 2005. Gambling Screens: Does Shortening the Time Frame Affect their Psychometric Properties? *Journal of Gambling Studies*, 21, 521-536.



N A T I O N A L
**Responsible
Gambling**
P R O G R A M M E



Professor Peter Collins - Executive Director

Tel +27 21 83 625 6155 Fax +27 21 422 3490

Website: www.responsiblegambling.co.za Email: info@responsiblegambling.co.za

P O Box 16331 Vlaeberg 8018 South Africa