

## Gaming machine density is correlated with rates of help-seeking for problem gambling: a local area analysis in Victoria, Australia

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### Abstract

Local environment plays an important role in understanding gambling as a public health issue. This study uses help-seeking as an outcome measure for a local area analysis of problem gambling in Victoria, Australia. We used a cross-sectional ecological design to investigate the extent to which gaming industry and demographic, economic, and social factors are associated with rates of telephone and face-to-face counselling for problem gambling at the local government area level. Electronic gaming machine density was independently correlated with both types of help-seeking, with a range of local factors controlled. This study supports previous research that has consistently found an association between gaming machine density and problem gambling, using gaming machine expenditure as a proxy measure of harm. We build on previous work by confirming that this relationship exists when gambling harm is measured through two types of help-seeking.

### Résumé

L'environnement local joue un rôle important pour comprendre le jeu en tant que problème de santé publique. La présente étude se sert de la demande d'aide comme

mesure de résultats pour une analyse locale du jeu compulsif à Victoria, en Australie. Cette étude écologique transversale vise à étudier dans quelle mesure l'industrie du jeu et les facteurs démographiques, économiques et sociaux sont associés aux taux de consultations par téléphone et en tête-à-tête pour des problèmes de jeu compulsif à l'échelle des zones d'administration locale (LGA) [*local government area*]. La concentration d'appareils de jeu électroniques a été corrélée indépendamment avec les deux types de demandes d'aide et divers facteurs locaux ont été contrôlés. L'étude vient appuyer les recherches antérieures qui ont invariablement démontré une association entre la concentration d'appareils de jeu et le jeu compulsif en utilisant les sommes dépensées comme mesure de substitution des préjudices causés. Nous nous appuyons sur les travaux antérieurs pour confirmer l'existence de cette relation lorsque les méfaits associés au jeu sont mesurés à l'aide des deux types de recherche d'aide.

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## Introduction

Gambling is a significant industry in Australia, with an estimated 15% of adults regularly gambling (excluding Lotto and scratch tickets) and 5% of adults playing electronic gaming machines (EGMs) weekly or more often (Productivity Commission, 2010). In 2006–07, nearly 3% of the disposable income of Australian households was spent on gambling, totalling AU\$17.6 billion. Most of this money was spent playing EGMs (Office of Economic and Statistical Research, 2007, as cited in Storer, Abbott, & Stubbs, 2009). Between 0.5% and 1.0% of Australian adults experience “significant problems” and between 1.4% and 2.1% are at moderate risk of experiencing problems from their gambling in any year. Problem gamblers make up a small proportion of all gambling adults, yet they account for a disproportionately high share of total gaming spending (about 40%, with estimates ranging from 20% to 60%; Productivity Commission, 2010). Significant problems were defined by the Productivity Commission as occurring when a person experienced any of the following as a result of gambling: always felt he or she had a problem, often or always experienced adverse health effects, always experienced financial difficulties, always felt guilty, always adversely affected job performance, self-rated their problems as 5 or more on a scale of 1 to 10, had self-excluded, tried to get help, or experienced suicidal ideation. A person did not need to have all of these present, but must have had at least one to be rated as harmed (p. 4.18).

Victoria is the second largest state in Australia in terms of population, accounting for about a quarter of the nation's total, though it is the second smallest in area. EGMs were introduced into the state only in 1992, and in 1994 a large casino was opened in Melbourne, the state capital. Prior to this, these types of gambling activity were not permissible in the state. In 2008, 1% of the adult population in Victoria

were estimated to be problem gamblers, 2% moderate-risk gamblers, 6% low-risk gamblers, 64% non-problem gamblers, and 27% non-gamblers (Hare, 2009). The average gambling expenditure per annum for Victorian problem gamblers has been estimated at AU\$12,356, compared with AU\$2,676 for moderate-risk, AU\$1,078 for low-risk, and AU\$322 for non-problem gamblers (Productivity Commission, 2010, p. B20). It has been shown that 91% of problem gamblers had played EGMs in the last 12 months, compared with only 21% of the total adult population (Hare, 2009).

As a consequence of the risk profile of EGMs, they have become the focus of most research and policy responses in the area of gambling in Australia. In 1995, laws were passed to limit the total number of EGMs in Victoria to 27,500, excluding Melbourne's only casino (Marshall & Baker, 2002). In 2001, the density of EGMs was capped at 10 per 1,000 adults in regions of Victoria identified as the most vulnerable to problem gambling (Victoria Government Gazette, 2001). In 2006, the EGM density cap of 10 per 1,000 adults was extended to include 19 regions of the state of Victoria (Victoria Government Gazette, 2006), and in 2009, density caps applicable to each region were reduced (Victoria Government Gazette, 2009). In 2010, gaming machine density was capped at 10 per 1,000 adults across all local government areas (LGAs) except the central business district of Melbourne.

Local environment and circumstances play a critical role in understanding gambling as a public health issue. Local characteristics create the conditions or context of problem gambling; influence the type, extent, and severity of gambling problems; and affect the response capacity of the affected community (Marshall, 2009). In this paper, we use a cross-sectional ecological design to investigate the extent to which local area characteristics are associated with rates of telephone and face-to-face counselling for problem gambling.

### **Defining and Measuring Problem Gambling for Area Analyses**

Defining and measuring problem gambling is complex, especially within local area gambling research. From a public health perspective, the focus is on the harms people experience as a consequence of gambling behaviour. A more formal definition has been adopted by many Australian institutes and researchers: "Problem gambling is characterised by difficulties in limiting money and/or time spent on gambling which leads to adverse consequences for the gambler, others, or for the community" (Neal, Delfabbro, & O'Neil, 2005, p. i). In individual-level research, the Canadian Problem Gambling Index is considered to be the preferred instrument for measuring problem gambling (Neal et al., 2005). In local area research, prevalence surveys of problem gamblers are impractical, as very large sample sizes would be required to achieve an adequate estimate of problem gambling at the LGA level. For example, in a probability sample of 15,000 with a prevalence of 0.7% problem gambling (e.g., in Victoria; Hare, 2009), only 105 people would have been identified as problem gamblers. Dividing this subsample by the 79

Victorian LGAs would result in an average of 1.3 problem gamblers per LGA. It would not be statistically viable to subject a sample that is this small to analysis.

The large sample sizes required for individual-level analyses of conditions with a low population prevalence has resulted in the use of proxy measures of problem gambling. For example, the net expenditure on EGMs is automatically collected by gaming venues and is available at the LGA level in Victoria and other parts of Australia. Gaming machine expenditure has, therefore, been used as a proxy measure of gambling harm in local area research; however, it is inaccurate to assume that more expenditure necessarily represents more problems within a specific local area (Marshall, McMillen, Niemeyer, & Doran, 2004; McMillen & Doran, 2006). An increase in expenditure may indicate that a larger number of people are gambling in a non-problematic way or that a smaller number of people are gambling in a more problematic way. Furthermore, venue expenditure may not arise from local residents. Although it has been shown that most gamblers play EGMs within 5 km of their residence (Delfabbro, 2008; Hare, 2009), many people also travel long distances to gamble. Location is not the only characteristic of a gaming venue that attracts consumers. Other attractions of specific venues include the types and combinations of machines, the presence of other community facilities, and venue marketing strategies (Marshall et al., 2004).

Another measure of gambling at the local level is the residence of individuals seeking treatment for problem gambling. Although this measure has rarely been used, one exception is the work by Delfabbro (2002, as cited in Delfabbro, 2008) in South Australia. Delfabbro reported a moderate positive bivariate relationship between the density of problem gambling service clients and gaming machines when analysed at the smaller statistical local area level ( $r = .49$ ) and a larger positive bivariate relationship when analysed at the larger LGA level ( $r = .78$ ).

Although researchers acknowledge this work, the lack of alternative measures of problem gambling at a local area level is still commonly mentioned as a limitation of studies in this field (Marshall et al., 2004; McMillen & Doran, 2006). Our study is the first to investigate the local distribution of two measures of help-seeking (telephone and face-to-face counselling) as proxy measures of gambling-related harm and the first to do so by controlling for other local area social indicators. To our knowledge, no analyses using gambling helpline data have been published to date.

### **Correlates of Problem Gambling**

Problem gambling is one of a group of health conditions in which etiology is associated with lifestyle/behavioural practices, which are in turn correlated with local area characteristics. Other such conditions include obesity (e.g., King, Kavanagh, Jolley, Turrell, & Crawford, 2006), alcohol-related harm (e.g., M. Livingston, Chikritzhs, & Room, 2007), sexually transmitted infections (e.g., Cohen et al., 2000), and a variety of other health and social behaviours (e.g., see Adams et

al., 2009). The main findings from this body of work are that local areas with higher availability (i.e., of fast food, alcohol outlets, etc.) and lower socio-economic status tend to have worse health and social outcomes. Further, studies where both area-level and individual-level data were available demonstrated that these community characteristics are mediated by characteristics of the individual (e.g., Adams et al., 2009; M. Livingston, Laslett, & Dietze, 2008).

Unsurprisingly then, the expenditure per gaming machine increases with higher densities of EGMs. This is true at the state (Productivity Commission, 2010), LGA (Delfabbro, 2002; Diamond, 2009; Stubbs & Storer, 2003), and census district levels (Marshall et al., 2004), although detailed census-district-level research in Victoria failed to replicate these findings (McMillen & Doran, 2006). At the macro level, using Australian states as geographical units, the Productivity Commission found that the number of EGMs per adult accounted for 69% of the variance in EGM expenditure in 1998–99 and 60% in 2006–07 (Productivity Commission, 2010). A recent meta-analysis of 34 surveys of problem gambling from Australia and New Zealand supported a linear relationship between machine density and prevalence of problem gambling (Storer et al., 2009). Unfortunately, because of the problems already discussed regarding the local measurement of problem gambling, most of the studies reviewed by Storer and colleagues (2009) used large area units, usually states or regions. The present study adds to this research by modelling two different measures of local rates of self-identified problem gamblers at the LGA level.

Socio-economic disadvantage has also been associated with higher machine density and higher per capita gaming expenditure. This relationship is consistent at the LGA level in Victoria (Diamond, 2009; Doughney, 2002; C. Livingstone, 2001; Marshall & Baker, 2002) and the Canadian city of Montreal (Gilliland & Ross, 2005; Robitaille & Herjean, 2008), although similar research in New South Wales found only weak correlations between gaming machine density and socio-economic disadvantage (Stubbs & Storer, 2003). The present study also tests the extent to which rates of self-identified problem gamblers are associated with socio-economic disadvantage at the LGA level.

## **Aim**

Our aim was to determine the extent to which local area characteristics are associated with self-identified problem gambling, as assessed through rates of telephone and face-to-face gambling counselling, by controlling for a range of local area social indicators.

## **Method**

A cross-sectional ecological design was used to explore the extent to which area-level factors are correlated with help-seeking for problem gambling across Victoria. The measures and analyses used are outlined below.

## Measures

**Geographic units.** Data were analysed at the LGA level. LGAs were selected as the geographic unit because the smallest level of government in Victoria is organised around LGA boundaries, and these local governments are also the most likely to develop and implement community interventions and policies to respond to local issues such as problem gambling (Dietze et al., 2009; McMillen & Doran, 2006). Data for some small LGAs were merged for confidentiality reasons by the auspicing agency and were therefore analysed in aggregate groupings for some LGAs. The LGAs of Melbourne and Indigo were also omitted from the regression analyses for the following reasons. The Melbourne LGA, which includes the main commercial, tourist, and entertainment precinct of Victoria, was excluded because this area is qualitatively different from other LGAs in this data set, with much of the activity in the central business district arising from non-residents, leading to inflated rate values. The Shire of Indigo was also excluded when it was found to have one of the highest rates of gambling service clients in Victoria, yet no gaming venues appeared to be licensed within the LGA. Indigo is located on the border of Victoria and New South Wales; thus we assumed that residents of Indigo travelled across the border to access gaming venues and machines. Thus, the final models used 70 LGAs and combined LGAs from 77 possible LGAs (after the exclusion of two LGAs).

### **Help-seeking for problem gambling.**

*Gambler's Helpline.* Gambler's Helpline provides telephone counselling services to problem gamblers and their families across the state of Victoria. There were 2,001 counselling calls to Gambler's Helpline Victoria in 2007. Calls from those living interstate, with no known postcode, or from family members or relatives (as opposed to calls from the individual who was engaging in problem gambling behaviours) were excluded. After Melbourne and Indigo were removed, the final number of calls was reduced to 1,908.

*Gambler's Help.* Gambler's Help provides face-to-face personal and financial counselling services to problem gamblers and their families from approximately 100 sites across the state of Victoria. There were 3,741 clients of Gambler's Help between July 2006 and June 2007 who sought counselling for their own gambling. After excluding non-Victorian clients, those with missing location information, and residents of the LGAs of Melbourne and Indigo, the final number of Gambler's Help clients was reduced to 3,529.

**Gaming industry indicators.** Data on the number of EGMs, gaming venues, and EGM expenditure in each LGA for 2006–07 were sourced from the Victorian Commission for Gambling Regulation. The number of gaming machines per LGA was divided by the number of gaming venues in that LGA to measure the extent to which LGAs have large venues with many machines or small venues with lower numbers of EGMs. Expenditure was defined as the net amount lost through using EGMs, that is, the amount spent minus any winnings.

**Demographic, social, and economic indicators.** A wide range of social indicators were included in the analyses. Although the inclusion of indicators of social disadvantage followed from prior research, other variables were included as an exploration of potential local area factors that may be associated with problem gambling help-seeking rates.

*Remoteness.* The remoteness measure was based on the Accessibility Remoteness Index of Australia (ARIA; Australian Bureau of Statistics [ABS], 2005). ARIA values are based on road distances to various service centres. Remoteness values for populated localities are derived from the road distance to service centres and then interpolated to a 1-km grid representing the whole of Australia. LGAs were divided into three categories: major city (ARIA between 0 and 0.2), inner-regional (ARIA between 0.2 and 2.4), and regional and remote (ARIA greater than 2.4).

*Demographic indicators from the census.* For each LGA, the following indicators were extracted from the 2006 census data: median age, percentage male, proportion of the population of each LGA aged 25 or over who have obtained at least one non-school qualification (including university degrees, technical qualifications, and trade certificates), median equivalised household income, proportion of households with housing costs equal to 30% or more of their gross household income, percentage of residents who speak a language other than English at home, unemployment rate, and labour force participation rate (ABS, 2008a).

*Socio-economic disadvantage.* The Index of Relative Socio-Economic Disadvantage from the ABS Socio-Economic Indexes for Areas (SEIFA) was used to measure the relative advantage of the LGAs in the study (ABS, 2008b). LGAs were assigned scores from deciles of the index of relative disadvantage. These deciles divide Victoria's LGAs into 10 groups of roughly equal population sizes on the basis of characteristics of census collection districts, such as income level, education level, and unemployment rate. LGA SEIFA scores are population-weighted averages of the scores of the collection districts within them. Lower deciles represent greater disadvantage. These data were extracted from the 2006 census (ABS, 2008a).

*Demographic indicators from the Community Indicators Victoria.* The Community Indicators Victoria population survey sampled 23,700 adults in 2007, with a response rate of 40%. Data were weighted at the LGA level by age and sex. For each LGA, financial stress, community satisfaction, perceptions of safety, self-reported health, and personal wellbeing were extracted from the Community Indicators Victoria. The measure of financial stress used was the proportion of adults in each LGA who could not definitely raise \$2,000 in 2 days in an emergency. Community satisfaction was assessed by respondents' ratings of how satisfied they were with feeling part of their community. Perception of safety was defined as the

percentage of people who felt safe or very safe when walking alone in their local area at night. Self-reported health was the percentage who reported their health as excellent or very good. The Personal Wellbeing Index (PWI) is a validated measure of subjective wellbeing (Cummins, Eckersley, Pallant, van Vugt, & Misajon, 2003; Cummins et al., 2008). The PWI is a 7-item scale, resulting in a score between 0 (*lowest wellbeing*) and 100 (*highest wellbeing*).

*Social support.* Social support was measured by using an indicator that assesses how easily people in each LGA can get help quickly. The proportion of the adult population who said that they could “definitely” get help from friends, family, or neighbours when needed was used. The data were collected as part of a survey conducted by the Department of Planning and Community Development between 2004 and 2006.

*Assaults and domestic violence.* Data on assaults and domestic violence were sourced from the Victoria Police Law Enforcement Assistance Program (LEAP) database, which captures information on crime reported to police. Instances of assault and domestic violence were assigned to LGAs by location of incidence.

*Drug and property crime.* Data on the number of drug-related offences (including possession, manufacturing, cultivating, trafficking, and use) and property offences (including aggravated, residential, and other burglary; theft from motor vehicle; shop-steal; and theft of motor vehicle, bicycle, or other) during 2006–07 were provided by Victoria Police.

*Alcohol and other drug treatment episodes.* Courses of treatment where either alcohol or other illicit drugs were identified as the primary drugs of concern during 2006–07 were extracted from the Alcohol and Drug Information System (ADIS), a mandated database contributed to by government-funded alcohol and drug treatment services. Clients may receive more than one course of treatment in any one year.

*Liquor licences.* The numbers of on-premise, packaged, and general liquor licences in 2006 were provided by Responsible Alcohol Victoria. On-premise liquor licences encompass all outlets that sell alcohol for on-premise consumption only (e.g., nightclubs, bars, cafes, restaurants). Packaged liquor licences allow the sale of alcohol for off-premise consumption only (e.g., bottle shops). General liquor licences are for hotels and taverns and allow alcohol to be sold both for on- and off-premise consumption.

## **Analyses**

Rates were calculated by using the estimated residential population aged 18 and over at June 30, 2006 (ABS, 2007a). Where necessary, postcode level data were aggregated into LGAs by using the ABS 2006 concordance data (ABS, 2007b). This approach

assigns proportions of postcodes to LGAs from the distribution of population within postcodes. In other words, where a postcode had 75% of its population in one LGA and 25% in another, we assigned 75% of calls to Gambler's Helpline to the first LGA and 25% to the other. All rates were per 1,000 adult residents.

Statistical analyses were undertaken with the R software package (R Development Core Team, 2006). The *spdep* package was used for all of the spatial analyses (Bivand, 2006). Geographic data specifying the neighbour relationships between the LGAs in the study were produced with the spatial statistics program *Geoda* (Anselin, 2003).

Initial descriptive statistics were used to assess the suitability of variables for inclusion in the models. This assessment focused upon the relationships between independent variables, the aim being to remove variables highly correlated with other variables to keep the models as simple as possible. Furthermore, highly correlated independent variables in a linear regression model produce problems with multicollinearity. Such models may fail to find significant effects (StataCorp, 2005). Therefore, the variables were assessed to determine which should be excluded.

The gaming industry indicators were examined first. As expected, the rate of EGMs and gaming venues were highly correlated ( $r = .78$ ). Since rates of EGMs provide a better measure of availability and are used in most studies, the rate of gambling venues was dropped from the analysis. Unsurprisingly, per capita gaming expenditure and the rate of EGMs were also highly correlated ( $r = .87$ ). Furthermore, per capita gaming expenditure has often been used as a proxy measure of gambling-related harm. Indeed, both measures of gambling problems in this study showed high correlations with per capita expenditure. In multivariate analyses, it is important to ensure that independent variables are not so similar to the dependent variable as to explain almost all of its variance. Thus, per capita expenditure was dropped from the analysis. The positive association between density of EGMs and the average number of EGMs per venue was medium-to-high ( $r = .61$ ). Strong negative associations were also found between EGMs per venue and measures of community and safety, as well as rates of off-premise liquor licences. Because of this collinearity, EGMs per venue was also omitted from the regression analyses.

Correlations between the remaining 25 demographic, social, and economic variables were inspected to identify variables that were highly correlated with each other and would be good candidates to drop from the regression analyses. Variables with correlation coefficients of .75 or above (or  $-.75$  and below) were considered highly correlated. Perceptions of community ( $r = .90$ ) and safety ( $r = .81$ ) were highly correlated with the PWI, and the proportion of non-English speaking background residents was strongly negatively correlated with the PWI ( $r = -.78$ ). As the PWI is a well-established scale, it is likely to be more reliable than single item measures; thus the PWI was retained and the community, safety, and non-English speaking background measures were removed. Income ( $r = .80$ ) and education ( $r = .82$ ) were

highly correlated with the SEIFA index of socio-economic disadvantage. This composite measure, which is based upon income and education among other measures, was retained and income and education were omitted. Financial housing stress was highly correlated with median age ( $r = -.82$ ), such that areas with an older median age were less likely to experience housing stress. Financial housing stress was also strongly related to community ( $r = .78$ ) and safety ( $r = .81$ ) measures and was also removed from the regression analyses. Rates of assaults and domestic violence were highly correlated ( $r = .80$ ). As these two rates measured similar constructs, they were combined into an aggregate measure of violence. Packaged liquor and general licence rates were also highly correlated ( $r = .76$ ), and so they were combined into a measure of off-premises liquor licences. Of the 29 independent variables, 13 were rejected and 16 were retained, but two composite variables were added, giving a total of 18 independent variables (see Table 1).

The initial models examined the impact that gambling accessibility and locality remoteness had on rates of problem gambling without controlling for confounders. These models were then expanded to incorporate economic, demographic, and social variables. Variables for the expanded model were included in stepwise linear regressions, with the final models selected by repeatedly excluding the least important independent variables until all of the variables in the final model were significant (at  $p < .05$ ). The models were examined for evidence of spatial autocorrelation by using the Lagrange Multiplier diagnostics for spatial dependence (see Anselin, Bera, Florax, & Yoon, 1996). Spatial autocorrelation was marginally significant for the model of calls to Gamblers Helpline. A corrected model was run; however, it was not meaningfully different from the standard linear regression model, and so only the standard model is shown. All variables included in the extended models were assessed for multicollinearity by using the variance inflation factor (VIF) diagnostic. None of the independent variables in the extended models had VIFs above 3. The occurrence of VIFs above 10 indicates severe multicollinearity (Neter, Kutner, Nachtsheim, & Wasserman, 1996). Visual diagnostic checks were also undertaken (data not shown).

The bivariate relationships between all gaming industry variables and both measures of problem gambling were further explored by using scatterplots (data not shown). There was no evidence of non-linear relationships between problem gambling measures and gaming industry measures. Quadratic and cubic terms were, therefore, not included in the subsequent regression models.

## **Results**

### **Bivariate Correlations**

The two help-seeking indicators were weakly positively correlated ( $r = .276$ ,  $CI = 0.044-0.480$ ,  $p = .021$ ). Table 1 displays correlation coefficients for both problem gambling indicators for each independent variable.

Table 1  
*Simple Bivariate Correlations With Help-Seeking Indicators (N = 70)*

Variable/Indicator	Gambler's Helpline Calls	Gambler's Help Clients
<i>Gaming industry indicators</i>		
EGMs, rate <sup>a</sup>	0.46**	0.70**
Gaming venues, rate	0.04	0.59**
Average number of EGMs per venue	0.70**	0.40**
Gaming expenditure per capita (\$)	0.71**	0.65**
<i>Demographic, social, &amp; economic indicators</i>		
ARIA (remoteness) <sup>a</sup>	-0.68**	-0.20
Age (median) <sup>a</sup>	-0.60**	0.41**
Male (%) <sup>a</sup>	-0.36**	-0.19
Education (% with post-school qualification)	0.37**	-0.01
Equivalised household income (median, \$)	0.45**	-0.01
Financial stress (%) <sup>a</sup>	0.38**	0.23
Financial housing stress (%)	0.69**	0.45**
Index of relative socio-economic disadvantage (SEIFA) <sup>a</sup>	0.22	-0.15
Non-English speaking background (%)	0.73**	0.22
Unemployment (%) <sup>a</sup>	0.37**	0.37**
Participation in labour force (%) <sup>a</sup>	0.16*	-0.03
Personal Wellbeing Index <sup>a</sup>	-0.77**	-0.35**
Community	-0.79**	-0.32**
Social support (%) <sup>a</sup>	-0.51**	-0.12
Perceptions of safety (%)	-0.72**	-0.49**
Self-rated health (%) <sup>a</sup>	-0.16	-0.21
Assaults, rate <sup>b</sup>	0.12	0.61**
Domestic violence, rate <sup>b</sup>	0.14	0.34**
Drug-related crime, rate <sup>a</sup>	0.22	0.43**
Property crime, rate <sup>a</sup>	0.66**	0.37**
Alcohol-related episodes of care, rate <sup>a</sup>	-0.13	0.39**
Other drug-related episodes of care, rate <sup>a</sup>	0.13	0.18
On-premises liquor licences, rate <sup>a</sup>	-0.01	0.05
Packaged liquor licences, rate <sup>b</sup>	-0.52**	-0.28*
General liquor licences, rate <sup>b</sup>	-0.61**	-0.42**

*Note.* Pearson's product moment correlation coefficient. ARIA = Accessibility Remoteness Index of Australia; EGMs = electronic gaming machines; SEIFA = Socio-Economic Indexes for Areas.

<sup>a</sup> These variables were included in regression models.

<sup>b</sup> Variables included in the models as composites: assaults and domestic violence aggregated into a composite variable representing "violence"; packaged and general liquor licences aggregated into a composite variable representing "off-premise liquor licences."

\*  $p < .05$ . \*\*  $p < .01$ .

A range of the factors under consideration were related to rates of problem gambling. General trends across both variables include a strong positive relationship between gaming industry penetration and problem gambling rates; positive relationships between financial housing stress, unemployment rates, and rates of crime with problem gambling rates; negative relationships between median age, community, safety, and personal wellbeing indicators and problem gambling rates;

and negative relationships between off-premises liquor licensing rates and problem gambling. Gamblers in LGAs with larger gambling venues (with a higher than average number of machines) were more likely to seek help and treatment for gambling problems, especially using Gambler’s Helpline.

Stronger relationships were found between most demographic, social, and economic variables and rates of calls to Gambler’s Helpline compared with the rate of Gambler’s Help services. The exceptions to this trend were unemployment and rates for assault, domestic violence, drug-related crime, and alcohol-related episodes of care. The rate of calls to Gambler’s Helpline was positively associated with education, median income, and labour force participation. The rate of alcohol-related treatment episodes was positively associated with the rate of Gambler’s Help clients, but unrelated to the rate of calls to Gambler’s Helpline. All types of crime rates showed medium-strength positive correlations with rates of clients using Gambler’s Help services, whereas property crime rate was the only crime variable strongly correlated with rate of calls to Gambler’s Helpline (see Table 1).

### Telephone Counselling Models

The first model was constructed to test which local area variables were correlated with the rate of telephone counselling conducted through the Gambler’s Helpline. The initial linear model included only the rate of EGMs and the remoteness measure as correlates of the rate of Gambler’s Helpline counselling calls in Victorian LGAs (see Table 2). The model estimates that for each extra machine per 1,000 adult residents in an LGA, the rate of calls to Gambler’s Helpline will increase by 0.02 per 1,000 adult residents. The initial model also finds that the farther from Melbourne an LGA is, the lower the rate of calls to Gambler’s Helpline. This may represent a reduced level of problem gambling, but it may also relate to gamblers’ knowledge of the service or preference to use it.

Table 2  
*Initial Model: Gambler’s Helpline Calls*

Variable/Indicator	Estimate	Confidence Interval	Standardised Coefficient (beta)
Intercept	0.42***	(0.32, 0.52)	n.a.
EGMs, rate	0.02***	(0.01, 0.04)	0.32
Remoteness (reference – urban)			
Regional	–0.25***	(–0.34, –0.17)	–0.86
Remote	–0.35***	(–0.45, –0.26)	–4.77
Adjusted R-squared = .55			

*Note.* EGMs = electronic gaming machines; n.a. = not applicable.  
\*\*\*  $p < .001$ .

An expanded model was created by incorporating the variables identified in Table 1. Stepwise regression as described above produced a final model with three independent variables (see Table 3). According to this model, the rate of EGMs in a local area is still independently associated with the rate of calls to Gambler’s Helpline, despite the inclusion of other local area social indicators. Two other social indicators were significantly associated with unique variance in the rate of calls to Gambler’s Helpline: Lower rates of calls to Gambler’s Helpline were associated with higher levels of personal wellbeing, and rates of calls were lower in regional and remote areas compared with urban areas. The expanded linear model explained 65% of the variance in the rate of calls to Gambler’s Helpline, a substantial improvement on the initial model.

### Face-to-face Counselling Models

The second model tested which local area variables were associated with the rate of clients receiving face-to-face problem gambling counselling. The initial linear model included only the rate of EGMs and the remoteness measure as correlates of the rate of Gambler’s Help clients in Victorian LGAs (see Table 4). The model estimates that for each extra machine per 1,000 adult residents in an LGA, the rate of clients using Gambler’s Help will increase by 0.1 per 1,000 adult residents. The initial model found no relationship between remoteness of the LGA and rate of problem gambling clients.

An expanded model was created by incorporating the variables identified in Table 1. Variables were excluded from the regression models until a final model with two independent variables was identified (see Table 5). According to this model, the rate of EGMs in a local area is still independently correlated with the rate of clients using Gambler’s Help, despite the inclusion of other significant social indicators. The rate of violence was associated with unique variance in the rate of problem gambling clients at a statistically significant level in the final model, but the inclusion of this

Table 3  
*Expanded Model: Gambler’s Helpline Calls*

Variable/Indicator	Estimate	Confidence Interval	Standardised Coefficient (beta)
Intercept	4.38***	(2.47, 6.29)	n.a.
EGMs, rate	0.02**	(0.01, 0.03)	0.21
Personal Wellbeing Index	-0.05***	(-0.08, -0.03)	-0.46
Remoteness (reference – urban)			
Regional	-0.14**	(-0.23, -0.04)	-0.46
Remote	-0.16*	(-0.29, -0.04)	-2.22
Adjusted R-squared = .65			

*Note.* EGMs = electronic gaming machines; n.a. = not applicable.

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

Table 4  
*Initial Model: Gambler's Help Clients*

Variable/Indicator	Estimate	Confidence Interval	Standardised Coefficient (beta)
Intercept	0.18	(-0.04, 0.40)	n.a.
EGMs, rate	0.10***	(0.08, 0.13)	0.69
Remoteness (reference – urban)			
Regional	0.11	(-0.08, 0.28)	0.17
Remote	-0.05	(-0.25, 0.16)	-0.33
Adjusted R-squared = .49			

*Note.* EGMs = electronic gaming machines; n.a. = not applicable.  
 \*\*\*  $p < .001$ .

variable had little impact on the EGM rate effect size. Somewhat surprisingly, neither socio-economic disadvantage nor rurality was significantly associated with Gambler's Help use. The expanded linear model explained 55% of the variance in the rate of clients using Gambler's Help. The explanatory power of the expanded model increased by 6% compared with the initial model.

### Discussion

This study is the first to use two help-seeking measures as outcomes for a local area analysis of problem gambling. Gaming machine density was associated with rates of both telephone and face-to-face counselling for problem gambling in Victorian LGAs. Lower socio-economic status was significantly associated with higher rates of face-to-face help-seeking, whereas lower rates of personal wellbeing were significantly associated with higher rates of telephone counselling. The only common significant correlate of both forms of problem gambling help-seeking was gaming machine density. The relationships between machine density, expenditure, and rates of self-identified problem gamblers were all positive and medium to large in size. These results support the exposure model of gambling problems, which

Table 5  
*Expanded Model: Gambler's Help Clients*

Variable/Indicator	Estimate	Confidence Interval	Standardised Coefficient (beta)
Intercept	0.02	(-0.22, 0.18)	n.a.
EGMs, rate	0.08***	(0.05, 0.10)	0.53
Violence, rate	0.03**	(0.01, 0.04)	0.32
Adjusted R-squared = .55			

*Note.* EGMs = electronic gaming machines; n.a. = not applicable.  
 \*\*  $p < .01$ . \*\*\*  $p < .001$ .

predicts that increased access results in increased problems (Storer et al., 2009). The magnitude of the effects found here is not small. At mean levels, our final models predict that a 10% increase in the number of EGMs per capita in a region would result in increases of 6.0% in rates of problem gamblers seeking face-to-face counselling and 3.3% seeking telephone counselling. Given that only a small proportion of problem gamblers seek treatment (Productivity Commission, 2010, p. 7.1), these effect sizes are likely to be underestimates of the actual effect on problem gambling rates.

The two measures of problem gambling help-seeking were only weakly positively correlated. Face-to-face and telephone counselling may access different populations of problem gamblers. It is also likely that knowledge of specific services, and the attraction of telephone or face-to-face counselling, varies across localities. Either of these reasons may explain why gamblers in urban areas were much more likely to utilise telephone counselling services. These differences may also be partially accounted for by the helpline data representing call numbers, but the Gambler's Help data being based on clients. Given all of these factors, it is not surprising that the models built on these two measures of gambling help-seeking were different. Indeed, it adds more robustness to our results that we have found a strong association between help-seeking and gaming machine density by using two weakly correlated measures. Research specifically designed to explore the extent to which different populations access face-to-face versus telephone counselling for problem gambling would be worthwhile to better understand these results.

This study supports previous research that has found a strong link between gaming machine density and problem gambling using gaming machine expenditure as a proxy measure of harm (Delfabbro, 2002; Diamond, 2009; Stubbs & Storer, 2003). This study confirms that this relationship exists when gambling harm is measured through two types of help-seeking.

These findings should be viewed alongside the limitations of cross-sectional, ecological designs. The relationships between variables measured in this study are likely to be multi-directional and complex. The relationship between gaming machine density and rates of help-seeking for gambling problems could have resulted from three causal mechanisms: (1) Increased gaming machine density may cause increased rates of help-seeking; (2) increased rates of help-seeking may cause increased gaming machine density (e.g., more EGMs are placed in areas where people have a higher propensity to gamble); or (3) a third variable (e.g., social deprivation) may be the cause of both. All of these mechanisms may be operating to produce this association, although in this analysis, we have controlled for a range of social indicators and still find a unique association between gaming machine density and rates of help-seeking. Nevertheless, cross-sectional studies are unable to tease out the direction of these relationships. Better access to more refined data across time would allow the performance of time series analyses, which would be better able to detect temporal associations and causal pathways (Livingston, 2008).

This study also used LGAs as the unit of analysis. Changing the size of the local area of analysis has also been shown to influence relationships between variables because of individual effects being masked through aggregation (McMillen & Doran, 2006; Young & Tyler, 2008). Multi-level analysis, in which local area factors are included alongside data about the habits and practices of individual problem gamblers, has the potential to produce a more accurate picture of a complex situation (Doran & Young, 2010; McMillen & Doran, 2006; Young & Tyler, 2008). It may also be beneficial to use smaller local units to enable neighbourhood agencies to use the findings to develop appropriate services in specific localities. Applying findings to local situations on the basis of aggregate data can miss the mark when the variation within LGAs is large.

Although service use approximates gambling harm, it is likely to vastly underestimate the prevalence of problem gambling. The Productivity Commission (2010) reports that about 13,500 people attended gambling counselling and treatment services for their own gambling in 2007–08, or between 8% and 15% of problem gamblers in Australia. Rates of treatment seeking are similarly low internationally (Slutske, 2006; Suurvali, Cordingley, Hodgins, & Cunningham, 2009). Rates of treatment may indicate different levels of treatment access, exposure to service promotion, and cultural differences in defining problematic gambling and in the appropriateness of seeking treatment, as well as the underlying prevalence of problem gambling in a local area. By using helpline data in these analyses, it is expected that some of the bias resulting from treatment service availability may be ameliorated.

While acknowledging the limitations just discussed, we suggest that these findings support the Victorian government's ongoing efforts to cap EGM density at the local level. Not only is EGM density associated with gaming machine expenditure, but it is also associated with two measures of help-seeking for gambling problems. The simple implication of this work is that further reductions in EGM density are likely to be associated with further reductions of gambling problems at a local area level. Although research designed with the capacity to reveal temporal associations is required to test this premise, in the meantime, our research suggests that governments should aim to reduce gaming machine density in areas most affected by problem gambling.

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