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Relationships between socioeconomic status and lottery gambling across lottery types: neighborhood-level evidence from a large city

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Abstract

Background and aims: Lottery gambling participation tends to be higher among lower socioeconomic status (SES) individuals, but it is unclear how this relationship differs as a function of lottery type. We estimated how the relationship between SES and lottery gambling rates varies across different types of lottery gambling: fixed-prize, progressive-prize (jackpot), and instant-win (scratch card) lottery tickets in a large Canadian city.

Design: Neighborhood-level lottery purchase data obtained from the Ontario Lottery and Gaming Commission were analysed in conjunction with demographic data. Mixed-effects regression was used to assess simultaneously how neighborhood-level SES predicts per-person lottery gambling rates across fixed-prize, progressive-prize lottery, and instant-win lotteries.

Setting and participants: Neighbourhoods in Toronto, Ontario, Canada in the years 2012-2015.

Measurements: Per-capita sales in dollars (CAD) of fixed-prize lottery, progressive-prize lottery, and instant-win tickets in Toronto postal codes. Socio-economic status was estimated as a composite of income, years of education, and white-collar employment.

Findings: Lower-SES neighborhoods engaged in higher rates of lottery gambling overall (β=-0.084,SE=0.24,p=0.0007). The predictive effect of SES varied significantly by lottery type (fixed-prize: β=-0.105,SE=0.004,p<0.0001, instant-win: β=-0.054,SE=004, p<0.0001; relative to progressive-prize). The predictive effect of SES was strongest for fixed-prize lotteries and weakest for progressive-prize lotteries such that we did not observe a significant predictive effect of SES for progressive-prize lotteries (β=-0.031,SE=0.024,p=0.198).

Conclusions: People in lower socioeconomic status neighbourhoods in Canada appear to engage in more lottery gambling than those in higher socioeconomic status neighbourhoods with the difference being largest for fixed prize lotteries followed by instant win lotteries, and no clear difference for progressive prize lotteries.

Lottery gambling has enjoyed worldwide appeal, owing to the low cost of participation and compelling prize sizes (1)—for example, in Canada, lottery gambling is the most popular form of legal gambling (2–4). Despite that fact that it is known that increased gambling participation is associated with increased risk of gambling related problems (5), existing gambling literature suggests that lottery is not a high-risk activity for problem gambling (6–8). However, studies rarely differentiate between lottery subtypes (e.g., progressive-prize versus versus "instant-win") and recent empirical evidence suggests that grouping different categories of gambling/gamblers may mask the effects of more harmful forms of gambling. For example, Costes et al. (7) found that grouping exclusive lottery gamblers and non-exclusive lottery gamblers may bias data and dilute the gambling associated problems in surveys. When considering specific forms of lottery gambling, recent survey-based research has found that the frequency of instant-win gambling predicted problem gambling severity and number of gambling activities, whereas lottery (i.e., progressive-prize) gambling does not (9). Together, these studies suggest that progressive-prize, fixed-prized, and instant-win lottery gambling might be better examined as separate forms of gambling, and accordingly, might have different sociodemographic correlates.

Lottery gambling encompasses several forms, including the most pervasive, and well-known progressive-prize lotteries (e.g., 'Lotto 649' in Ontario, Canada), which is relatively inexpensive to participate in, and offer potentially large jackpot prizes (e.g. ranging from $5,000,000 to $64,000,000 CAD) but very small chances of winning (e.g. 1:13,983,816). These lotteries are defined by a jackpot that accumulates over time, with winning numbers being drawn at weekly or bi-weekly intervals. Also included in the category of lottery gambling is also the "fixed-prize lottery" (e.g., daily lottery, 'Pick 2', 'Pick 4', 'Daily Keno'). In contrast to

progressive-prize lotteries, fixed-prize lotteries offer smaller jackpots, but a larger probability of winning the top prize (e.g. 1:10,000 for Pick 4), and winning combinations are drawn more frequently (e.g., once or twice per day). In fixed-prize lotteries, unlike progressive-prize lotteries, winners do not share prize money with other participants who chose the same winning numbers. Finally, Instant-win tickets (also known as Scratch Cards; e.g. 'Bingo') have highly variable payout amounts and odds; the key features unique to instant-win tickets are that—as payouts are provided instantly at the point of sale—there are no subsequent drawings for winning combinations, and the ticket's effective payout is predetermined rather than dependent on the gambler's choice of numbers.

Interestingly, survey-based studies consistently find that low-SES individuals engage in higher rates of lottery gambling than higher-SES individuals (10–12). As variable-prize versus instant-win lottery gambling rates are differentially associated with problem gambling rates (9,13), one might also expect that the relationship between SES and lottery gambling rates also differ as a function of lottery form (i.e., variable-payout, fixed-payout, and instant-win). To our knowledge, little work has addressed this question directly. Here we examine datasets of neighborhood-level lottery purchase rates of these three classes of lottery products—obtained from the Ontario lottery commission—across diverse and demographically well-characterized neighborhoods of a large Canadian city (Toronto; population: ~3M). Taking this approach to examine lottery gambling in New York City, we recently demonstrated that neighborhood SES negatively predicted per-capita purchase rates of fixed-prize lottery tickets (14). In light of this work, and other survey-based studies examining lottery participation more broadly (10,11), we hypothesized that overall lottery gambling rates—irrespective of game type—should be higher in lower-SES neighborhoods. As variable-payout, fixed-payout, and instant-win games differ

considerably in payouts, playing experience, and risk profiles associated with frequent players (1,9,15), we might expect to see salient differences in the relationships between neighborhood SES and rates of lottery play across these forms of lottery gambling. Accordingly, here we estimate 1) the effect of SES on each of the three lottery types, and examine 2) whether the effects of SES differ as a function of lottery type.

Methods

Ontario Lottery and Gaming Corporation (OLG) Data

We acquired data for lottery products (3 progressive-prize, 9 fixed-prize, and 124 instant-win) purchases from the years 2012-2015 in the city of Toronto and immediate surrounding areas (including, for example, Scarborough, North York, and Etobicoke), sorted by forward sortation area (FSA) from the OLG via an Access to Information Act request. FSAs are geographic regions defined by the first three digits of a postal code (e.g., M1C), roughly corresponding to city neighborhoods. This data contained daily sales data across all Toronto FSAs for fixed-prize lottery products (e.g. 'Daily Keno', 'Pick2', 'Pick4') and progressive-prize lottery products ('Lotto 649', 'Lotto Max', 'Lottario), and instant-win tickets (e.g. 'Cashingo', 'Crossword', 'Bingo'). OLG does not record daily sales for instant-win tickets, but rather 'activations,' which represents the sale price of a package of a particular instant-win product made available for purchase each day. Thus, aggregated over time, these activations can be taken as customer sales (16). We excluded sales data for 'Pick 3' and 'Ontario 49' as 'Pick 3' had the draw schedule of a fixed-prize lottery, but a pay-off structure of progressive prize lottery, whereas 'Ontario 49' had the draw schedule of a progressive prize lottery, but a fixed payout.

Demographic Data

From the Statistics Canada 2011 Census Profile (17), we obtained the number of adult residents, per capita income levels, highest completed level of education for the population 25 years and over, and the proportion of residents 15 years or older with white-collar employment. White-collar employment was defined by the proportion of residents over 15 years employed in management, business finance and administration; health; education, law, social community and government services, Art, culture, recreation and sport, Natural and applied sciences and related occupations according to the National Occupational Classification (18). Each FSA's composite Socioeconomic Status (SES) was computed as the sum of the z-scores of its per-capita income, years of education, and proportion of white-collar workers, following prior work (19).

Data Analysis Approach

To mitigate the possibility of analyzing purchasing behavior of FSAs being comprised of mostly industrial or commercial properties—whose lottery purchase rates primarily reflect the behaviour of non-residents—we excluded FSAs with less than 1000 adult residents according to Statistics Canada 2011 Census Profile (17), which left 95 FSAs for analysis. Our data set also included sales for 'add-on gambles', which are optional gambles which the consumer can pay extra to participate (e.g. 'Poker Lotto All in', 'Spiel Lotto Max', 'Spiel Daily Keno'). We removed these 'add-on gambles' from our analysis as they were of no particular interest to our research question.

For each FSA we aggregated the dollar sales value of the three types of lottery over each of the four years of interest (2012-2015), then divided this aggregate value it by the number of adult residents in each FSA to control for population differences across FSAs (14,20,21). This composite measure was then (natural) log-transformed to yield our dependent measure, log purchase rate.

We computed mixed-effect linear regressions using 'lmerTest' package for the R programming language (22), with each FSA's purchase rate taken as the outcome variable in the four years of interest (4 observations per FSA), and taking each FSA's SES as a predictor variable. In all models, we took random intercepts over FSAs. In an initial regression model, we estimated the main effects of two lottery types (Fixed-prize and Instant-win) with respect to Progressive-prize lotteries, as well as the main effect of SES (coefficient estimates reported in Table 1). A subsequent model considered the interactions between lottery type and SES (Table 2). A final model considered each lottery type separately, with dummy variables corresponding to each of the three lottery types (progressive-prize, fixed-prize, and instant-win), using the following syntax:

$$purchase = 0 + \ instant\_win + fluctuating\_prize + fixed\_prize + instant\_win{:}\,SES +$$

$$fluctuating\_prize{:}\,SES \ + fixed\_prize : SES \ \ + (1\,|FSA)$$

We took linear contrasts were directly between the three interaction terms—representing the strength of the SES-purchasing rate relationship for each lottery type—and adjusted the p-values for multiple comparisons using the Benjamini-Hochberg (23) procedure. We note that because this analysis was not pre-registered, the results reported below should be considered exploratory.

Results

Across the 95 socioeconomically diverse neighbourhoods examined in the Greater Toronto Area, we examined how the per-capita purchase rates of the three classes of lottery products varies with SES. Figure 1 depicts the purchase rate of each FSA for each lottery type. As can be seen from the overall purchase rates (i.e., the intercept of each of the regression lines),

progressive-prize lotteries were purchased at the overall highest rate, followed by instant-win, followed by fixed-prize. In a model predicting taking sales per capita per year in dollars instead of log purchase rates, the intercept terms for progressive-prize, fixed-prize, and instant-win lottery products were estimated to be 215.98, 62.06, and 126.00 respectively.

More interestingly, the strength of the negative relationship between SES and lottery participation rates (represented by the slopes of the regression lines) appeared to differ dramatically between the three classes of gambles, echoing the overall purchase rates. In particular, the predictive relationship between SES and lottery participant appears strongest for fixed-prize lotteries and the least strong for progressive-prize lottery, with instant-win occupying the intermediate.

An initial mixed-effects linear regression revealed that SES exerted a significant negative predictive effect on lottery ticket sales overall (Table 1), and that Fixed-Prize and Instant-win lottery products were purchased at significantly lower rates than Progressive Prize products. A subsequent model considering the interaction between lottery type and SES (Table 2) revealed that the relationships between fixed-prize and instant-win lottery purchase rates and SES were significantly stronger than the relationship between Progressive-prize lottery purchases and SES (evidenced by the 'Fixed-prize × SES' and 'Instant-win × SES' terms, ps<0.0001). In the final model (Table 3), we directly compared the predictive effect of SES across the three types of lotteries, finding that the predictive effect of SES was significantly stronger for fixed-prize, than for progressive-prize (linear contrast, p<0.0001) or instant-win lottery purchase rates (p<0.0001). Finally, the predictive effect of SES was stronger for instant-win than for variable-prize lotteries (p < 0.0001; all contrast p-values corrected for false discovery rate).

Discussion

Our results demonstrate that the relationship between SES and lottery gambling rates varies considerably across the three forms of lottery gambling considered here (i.e., instant-win, fixed-prize, and progressive-prize lottery). Current literature suggests that participation in traditional lottery gambling—fixed-payout and progressive-prize payouts—is a relatively harmless form of gambling but instant-win ticket gambling is related to problem gambling (7,9). Our finding that instant-win, progressive-prize, and fixed-prize lottery participation rates are differentially predicted by SES implies that these categories of lottery gambling might be best studied separately.

Moving forward, it would be beneficial to use this neighborhood-level approach to examine other demographic factors whose relationships with lottery gambling may also differ across lottery forms. For example, different age groups prefer different forms of gambling, adults aged 18-24 have the highest participation rate in instant win tickets at 35.5%, while lottery ticket gambling was most popular with the 45-64 age group at 70.2%; in addition, people aged 65+ report higher overall gambling rates (3,24). Further, achieving a fine-grained understanding of these predictive relationships, longitudinally, may yield important insights for targeted prevention. For example, combined with existing evidence that gambling participation rates are also associated with other social and health issues (25,26), our findings may be helpful when developing government policy/intervention to help combat problem gambling in low SES neighbourhoods.

Lotteries are thought to provide a rare opportunity for lower-SES individuals to radically increase their wealth (27,28). Moreover, the prospect of more immediate rewards—as in fixed-prize lotteries, whose drawings occur at least daily— might be more appealing to those experiencing socio-economic deprivation (29), as even the smaller prizes tied to instant-win

lotteries might exert a greater impact on wealth. Another potential explanation for the relationship between SES and fixed-prize lottery gambling might be that lower-SES individuals misrepresent the odds of winning as being higher for fixed-prize lotteries compared to progressive-prize lotteries, which itself might be attributable to the heightened influence of and/or exposure to lottery advertising in these communities, possibly owing to greater exposure (30,31). Still, we observed that progressive-prize lotteries are, by and large, the most popular form of lottery gambling across the SES spectrum and accordingly, could exert disproportionately large effects on poorer lottery participants as these expenditures make up a larger portion of their income, although these purchase rates—across the SES spectrum—are also observed to be dependent on the prize amounts (20,32).

Finally, analyzing neighborhood-level purchasing data as a direct indicator of gambling behavior, rather than relying on self-report may yield important advantages, as gamblers have been found to overreport gambling expenditures (33), perhaps due in part to ambiguities surrounding the survey questions used to estimate individuals' gambling-related expenditures (34). Further, examination of prize draws for the lottery products investigated here could afford assessment of erroneous beliefs about random chance that are held by gamblers (35).

At the same time, a potential limitation of this approach is that aggregated purchase rates do not afford examination of whether neighborhood-level gambling rates are driven by the behavior of small number of habitual individuals gambling heavily extreme versus a large number of gamblers making smaller and more occasional expenditures.

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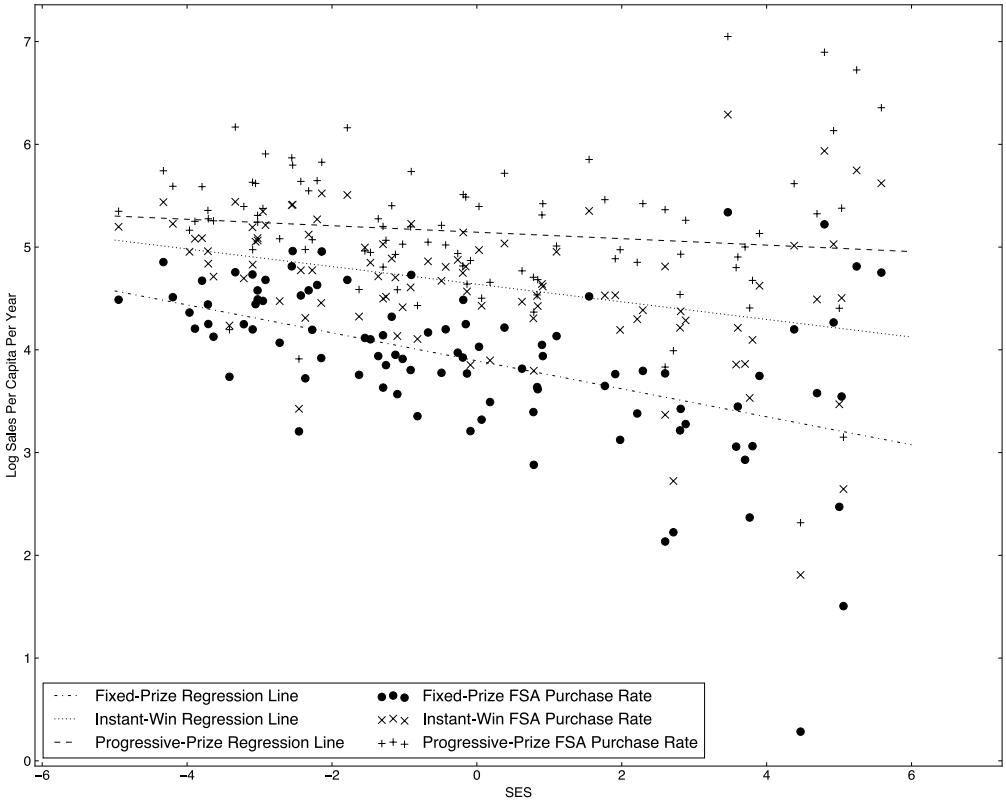

Figure 1. At the neighborhood (FSA) level, SES negatively predicted overall lottery gambling. Each FSAs computed SES and log per capita lottery purchase rate is plotted for the three lotter types. Across all lottery types, lower-SES neighborhoods exhibit higher per capita lottery gambling than higher-SES neighborhoods, as measured in dollars per day per adult resident. The negative predictive effect of SES upon per capita lottery purchase rates is the strongest for fixed-prize lottery games and least strong for progressive-prize lottery games. Regression lines are computed from the fixed-effect of SES for each lottery game type.

Table 1. Regression coefficients for model estimating main effects of SES and lottery type upon sales, with progressive-prize purchase rates taken as the intercept.

Coefficient	*Estimate*	*Std. Error*	*t value*	*p-value*
Progressive-prize (Intercept)	5.143	0.068	75.466	<0.0001
Fixed-prize	-1.247	0.015	-84.505	<0.0001
Instant-win	-0.504	0.015	-34.120	<0.0001
SES	-0.084	0.024	-3.498	0.0007

Table 2. Regression coefficients for model including the interaction effects of SES upon lottery tickets, with progressive-prize as intercept.

Coefficient	*Estimate*	*Std. Error*	*t value*	*p-value*
Progressive-prize (Intercept)	5.145	0.068	75.724	<0.0001
Fixed-prize	-1.252	0.012	-107.484	<0.0001
Instant-win	-0.506	0.012	-43.444	<0.0001
SES	-0.031	0.024	-1.296	0.198
Fixed-prize × SES	-0.105	0.004	-25.178	<0.0001
Instant-win × SES	-0.054	0.004	-13.062	<0.0001

Table 3. Regression coefficients for model including the interaction effects of SES upon lottery tickets for each lottery type considered separately.

Coefficient	*Estimate*	*Std. Error*	*t value*	*p-value*
Progressive-prize	5.145	0.068	75.724	<0.0001
Fixed-prize	3.893	0.068	57.298	<0.0001
Instant-win	4.639	0.068	68.277	<0.0001
Progressive-prize × SES	-0.031	0.024	-1.296	0.1982
Fixed-prize × SES	-0.136	0.024	-5.612	<0.0001
Instant-win × SES	-0.086	0.024	-3.535	0.0006