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The total consumption model applied to gambling: an analysis of gambling accounts records in Norway

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ABSTRACT

Background: The total consumption model (TCM) posits a positive association between total consumption and rate of excessive consumption or related problems in a population. In this study we examined whether TCM applies to gambling.

Method: We employed tracking data from 40 000 customers at a Norwegian gambling monopolist, Norsk Tipping (NT). For 14 population groups, we examined distribution characteristics of total net losses on gambling in a calendar year; total consumption (mean) and dispersion (percentile values) and rates of excessive gambling (i.e. exceeding the 95th or 98th percentile in the total sample). Associations between total consumption on the one hand and rates of excessive gambling and percentile values on the other were estimated in linear regression models.

Results: We found positive and statistically significant associations between mean gambling consumption and rates of excessive gambling. We also observed positive and statistically significant associations between population mean and percentile values (25th, 50th, 75th, 90th and 95th) and thus a clear pattern of regularity in the distribution of gambling losses across populations with different total gambling consumption.

Conclusion: The findings lend support to the validity of the total consumption model with regard to gambling.

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Gambling losses; distribution; population mean; collective displacement; tracking data; Norway

Introduction

Gambling is a highly prevalent activity across numerous countries and jurisdictions and while a large fraction take part in gambling, a smaller proportion meet criteria for gambling disorder/pathological gambling or problem gambling (Calado and Griffiths 2016; Gabellini et al. 2023). The risk of gambling disorder, problem gambling or harms from gambling increases with gambling frequency and intensity and thus, the risk of harm is most elevated among those who gamble the most (Kesaite et al. 2024). Harms from gambling pertain to various kinds, including financial, relationship, emotional, health, cultural, work, educational and legal harms (Langham et al. 2016; Delfabbro and King 2019). Consequently, gambling related harms are not only experienced by the person who gambles but also by their family members, employers and neighborhoods and by society at large (Sulkunen et al. 2018; Castrén et al. 2021) and thus, harms from gambling affect a large proportion of the population. An increasing number of studies attest to the fact that gambling is a public health issue (Johnstone and Regan 2020; Ukhova et al. 2024; Wardle et al. 2024).

A dominant discourse around gambling harm prevention and reduction has been to focus on individual responsibility and specifically target interventions at those gambling excessively or experiencing harms (Livingstone and Rintoul 2020). This kind of case-centered approach, both in public discourse and in research, includes a focus on individual risk factors for problem gambling and individual-targeted prevention strategies (Livingstone and Rintoul 2020; Van Schalkwyk et al. 2021).

Another strand of thinking and a contesting paradigm is the total consumption model (TCM), focusing on populations, not individuals, with universal prevention measures addressing changing population behaviors. The TCM is conceptualized in two ways: i) the basic version, which we apply in the present study, predicts a close association between total consumption (e.g. mean consumption) and excessive levels of consumption, and ii) the extended version predicts an association between total consumption and consumption-related harms in a population (Kesaite et al. 2024). The extended version of the TCM applies when individual harm risk increases with increasing individual consumption.

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In its origin, the TCM pertained to alcohol consumption, postulating a close association between total consumption of alcohol in a society (i.e. the mean consumption among drinkers) and the rate of people who drink excessively. The TCM also contends that the distribution of consumption has a relatively fixed shape and is strongly skewed to the right. In Skog's seminal work (1985), the TCM was expanded to a theory of collectivity of alcohol consumption, predicting a clear pattern of regularity in the distribution of alcohol consumption across populations in the sense that the shape of the distribution is relatively fixed across populations: it is smooth and skewed with a long right tail (Kehoe et al. 2012; Rossow and Mäkelä 2021). As an illustration, we may consider a population at two different time points: at time 1 total consumption (mean consumption) is low and at time 2 total consumption is high. At both time points the consumption curve will be smooth and with a long right tail, but at time 2 the curve will be more stretched out toward higher consumption levels with the right tail longer and/or thicker. This implies that when total consumption increases, consumption will increase for all consumer groups – from those who drink quite little to those who drink very heavily. Correspondingly, consumption will decrease in all consumer groups when total consumption decreases (Skog 1985). This shift in consumption going in the same direction for all consumer groups, is referred to as *collective displacement*.

Empirical studies have demonstrated consistent findings in support of the TCM for alcohol consumption, both the basic and the extended version, and for the regularity in the distribution of alcohol consumption across populations (see (Rossow and Mäkelä 2021) for an overview). Along with the understanding of alcohol problems as an integral part of the total consumption of alcohol in a society, comes the implications of the TCM for seeking population-targeted preventive strategies and policy measures aimed at curbing total consumption of alcohol (Rossow and Mäkelä 2021; Babor et al. 2023).

A similar public health approach is advocated for gambling (Sulkunen et al. 2018; Livingstone and Rintoul 2020; Van Schalkwyk et al. 2021; Wardle et al. 2021; Ukhova et al. 2024). An emerging – yet still meager – literature found empirical support for the TCM applied to gambling (Rossow 2019; Kesaite et al. 2024). Specifically, among 12 studies (reviewed in Kesaite et al. (2024; Rossow 2019), 11 studies provided support for the TCM. Three studies reported a positive association between total gambling and prevalence of excessive gambling (basic version of the TCM), six studies found a positive association between total gambling and prevalence of problem gambling (extended version), and three studies provided support for both versions. But, what does this association mean, what are the underlying mechanisms and what is the implication for prevention strategy? In theory, we may observe a positive association between total gambling and rate of excessive or problem gambling, without necessarily any collective displacement at all levels of gambling. The skewed distribution of gambling implies that a small fraction of people who gamble excessively or people experiencing problem gambling account for quite a large fraction of total gambling (Kesaite et al. 2024; Rossow et al. 2024). Therefore, the variation in prevalence of excessive gambling is bound to co-vary with total gambling, yet the level of gambling among other, non-excessive, people who gamble may not necessarily co-vary with total gambling. If this were the case, high risk prevention strategies targeting those in the right tail of the distribution, may be the most appropriate approach. Alternatively, there may be a collective displacement at all levels of gambling, among those who gamble excessively as well as among those gambling non-excessively, much in parallel to that observed for alcohol consumption (Skog 1985; Rossow et al. 2014). In that case, population targeted prevention strategies may be the most appropriate approach. To this end, and to the best of our knowledge (Rossow 2019; Kesaite et al. 2024), only one previous study examined collective displacement of distributions of gambling behavior (Hansen and Rossow 2012). That study found a clear pattern of regularity in the distribution of self-reported gambling frequency among teenagers. Gambling frequency at all levels, from light and moderate to frequent and excessive gambling, varied systematically with mean gambling frequency. Consequently, a change in the population mean was accompanied by a systematic displacement at all levels of gambling frequency, and not only at high to excessive levels of gambling (Hansen and Rossow 2012).

In the present study, we aim to examine the validity of the TCM and the regularity of the distribution of gambling consumption. Specifically, we employed tracking data on gambling provided by a state monopoly gambling operator (Norsk Tipping, NT) to examine at the population level whether mean gambling losses are associated with prevalence of excessive gambling losses, and if so, whether this association reflects collective displacements of the consumption distribution. NT does not collect information on an individual's consumer status according to a validated screen for gambling disorder, therefore, our analyses focus on the basic version of the TCM (where total consumption is associated with excessive consumption).

Methods

We obtained data from Norsk Tipping AS (NT), a state owned monopolist in Norway. NT is the largest of the two gambling monopolists and offers most of the legal gambling activities, including a variety of land-based and online gambling products. As part of their responsible gambling policy, several restrictions pertain to gambling at NT as well as for specific games (see Rossow et al. 2024 for details). Registered play is mandatory for all games offered by NT, except for paper scratch cards. The minimum legal age for gambling on NT's products is 18 years, and all customers are required to register and provide an ID check online *via* bank ID authorization. Each gambler's activities are electronically recorded by product and date and data are stored for up to five years (Norsk Tipping AS 2023). NT provided the data in 2022 upon request from the study PI (first author) at the

Norwegian Institute of Public Health (NIPH). Data were provided without any restrictions or obligations to NIPH.

Sample

We requested individual data from NT for a random sample of all registered customers aged 18 and over who had gambled on at least on one of NT's products at least once in 2019. We chose this calendar year to avoid any impact on gambling activities due to COVID-19 restrictions (Auer et al. 2023). Compared to 2018, NT's net turnover in 2019 increased by 0.2% (Lotteri- og stiftelsestilsynet 2020). In 2019, NT accounted for 77% of the net turnover in the legal gambling market in Norway (Lotteri- og stiftelsestilsynet 2020) and approximately 65% of the total gambling market (Norsk Tipping 2020b). An analyst at NT conducted a random sample draw of 2% of all NT customers in 2019 ($N = 2$ 040 000), resulting in a sample of 39 995 persons. There were no restrictions on individuals included in this random sample. Our sample resembled all NT customers in 2019 regarding proportions participating in each game (Norsk Tipping 2020a) and total gambling losses; arithmetic mean was less than 1% higher in our sample compared to all NT customers (NT analyst, personal communication).

The variable of interest from this dataset was gambling losses (i.e. net expenditures on gambling when winnings were subtracted) accumulated during the calendar year 2019. Data on gambling losses were obtained for each of all NT's games ($n = 14$) (see (Rossow et al. 2024) for details) and for the main analysis, these were summarized across all games. For additional analyses, we employed data on net losses for i) five games with high concentration (i.e. very skewed distribution) (Rossow et al. 2024) and ii) for nine non-continuous games (i.e. lotteries and sports games (Rossow et al. 2024) which are – in contrast to fast continuous games – considered to pose less harm and lower losses (Harris and Griffiths 2018; Delfabbro and Parke 2021). For the present study, we employed data only for those with net losses (in Norwegian currency; NOK) across all products ($n = 39$ 475), hence those with net wins were deleted from the analyses. For each customer, we obtained data on gender (male/female), age group (18-25, 26-35, 36-45, 46-55, 56-65, 66-75 and 76 or older), and county of residence ($n = 11$ counties in 2020).

Measures

We examined distribution measures for net total gambling losses by population groups, based on age group and gender ($N = 14$). In line with previous studies of collective displacement (Skog 1985; Hansen and Rossow 2012; Rossow et al. 2014), we obtained the following distribution measures for each population group: the mean and the 25th, the 50th, the 75th, the 90th and the 95th percentile values. A percentile value is a measure used to indicate the value below which a given percentage of observations in a group of observations falls. For example, 25% of the sample with least total losses are found below the 25th percentile value.

In the present study, we consider these percentile values as illustrating the level of net gambling losses for light, moderate, medium, near-heavy and heavy gambling. Based on the total sample of NT customers ($n = 39$ 475), we categorized those gambling excessively as those exceeding the 95th percentile on total net losses (i.e. all those in the total sample with net losses $>$ 13 000 NOK per year; 10 NOK $\sim$ 1 US $). People gambling highly excessively were defined as those exceeding the 98th percentile on net losses in the total sample (i.e. all those in the total sample with net losses $>$ 25 600 NOK per year). In a recent study by Jonsson et al. (2022), based on data from NT customers in 2019 and 2020 who completed an online GamTest self-assessment, the authors found that those exceeding total net losses of, approximately 15 000 and 28 000 NOK per year were at considerably increased risk of experiencing two or more harms from gambling. Approximately 30% and 50% of those exceeding these amounts, respectively, reported such harm level. Hence, we assumed that exceeding the 95th or the 98th percentile on total net losses in our study, was indicative of substantial risk of harms from gambling. The proportions of people gambling excessively and highly excessively were added to the aggregate dataset.

Statistical analyses

We employed linear regression models on aggregate level data. First, we examined whether mean gambling losses are associated with prevalence of excessive gambling losses and hence proportions of people who gamble excessively/highly excessively were regressed on population group mean of total net losses. Next, we examined whether the abovementioned association reflects collective displacements of the consumption distribution. This was done in line with previous statistical analyses of distribution patterns of alcohol consumption and examination of collective displacement (Skog 1985; Rossow et al. 2014). We regressed log-transformed (natural log) percentile values (for each of the percentiles X_{25}, X_{50}, X_{75}, X_{90}, and X_{95}) on log-transformed mean total losses. Hence, the regression coefficient expresses the relative change in percentile value given a one percent increase in mean total losses. A positive and statistically significant coefficient for all these associations suggests a collective displacement.

Finally, in order to illustrate collective displacement graphically, we used logged (natural log) data on total net losses to plot percentile values (Y-axis) on mean values (X-axis) for each population group. With a skewed distribution of total net losses (as shown for these data in a previous publication; Rossow et al. 2024), we assumed fairly linear associations between logged percentile values and logged mean values.

Sensitivity analyses

The analyses were conducted also for aggregate data for population groups based on county of residence ($N = 11$). By doing so, we explored whether the findings were robust

across different categorizations of population groups. Additionally, we estimated associations between mean net losses and proportion of people who gamble excessively and percentile values for gambling on specific games. The rationale for this approach is that the concentration of gambling losses (i.e. the extent to which gambling losses are concentrated among relatively few individuals) and the alledged addictive potential of games is known to vary based on various structural characteristics (Kesaite et al. 2024). This may imply that the TCM applies mainly or only to some gambling products, that is, games with high concentration of gambling losses and/or games that are assumed to be more addictive. To explore this, we examined the associations for games with high concentration of gambling losses (five games, as shown in a previous publication from this data set; Rossow et al. 2024) and for non-continuous games (which are considered less addictive; i.e. lotteries, sports bets, etc.). Those who gamble on games with high concentration of gambling losses and those who gamble on non-continuous games do in part overlap. For these analyses, we analyzed customers with net losses only. As net wins occurred for all continuous games and for only three out of nine non-continuous games, the number of customers with total net losses was larger for those engaging in non-continuous games only ($n = 39\ 626$) compared with the total number of customers with net losses across all games ($n = 39\ 475$).

Results

A total of 39 475 NT customers had net total losses on their gambling across all games in 2019 (i.e. 98.7% of the total sample). The number of customers with net total losses varied by age-gender group; from 1 126 (men, 76 years or older) to 4 401 (men, 46 – 55 years old). Mean total net losses varied from 1 240 NOK (in the group women 18 – 25 years) to 5 929 NOK (in the group men 56 – 65 years) (Table 1). Correspondingly, a substantial variation in percentile values and proportion with excessive and highly excessive gambling was observed across age-gender groups (Table 1).

We regressed the proportion of people who gamble excessively or highly excessively (outcome variables) on mean total net losses (in thousand NOK) (input variable) in linear regression models (Table 2). A positive and statistically significant association was found for both outcome measures (prevalence of people exceeding 95th and 98th percentile value). These associations are also illustrated in Figure 1. Similar associations were found also for net losses on high concentration games and for non-continuous games (Table 2).

Next, we regressed logged percentile values on logged mean net losses and we found positive and statistically significant associations (Table 3). These findings applied to total net losses on gambling as well as to net losses on high concentration games and to non-continuous games (Table 3). The pattern of collective displacement of distribution measures by mean consumption for total net losses is illustrated in Figure 2. For total net losses and for losses on non-continuous games, the regression coefficients decreased from above unity for the lowest percentile (25th) to well below unity for the highest percentiles (90th and 95th) (Table 3). Thus, an increase in mean net losses by 1% implied an increase by more than 1% among those with relatively low net losses and it implied an increase by less than 1% among those with the highest net losses. A steeper slope for the lowest as compared to the highest percentile is also illustrated in Figure 2.

Finally, we re-ran the analyses using county of residence ($N = 11$) as unit of analysis. The variation in mean total net losses was smaller across population groups by county residence (Suppl Table 1) as compared to those by age and gender groups. Also for this set of analyses, we found positive and statistically significant associations between mean total losses on the one hand and prevalence of excessive gambling on the other (Suppl Table 2). Moreover, with one exception, we found also positive and statistically significant associations between logged mean total net losses and the logged percentile values (Suppl Table 3). While the magnitude of

Table 1. Descriptive statistics by measures of net gambling losses (in NOK) for gender and age group populations ($N = 14$).

	Total net losses	Net losses on high concentration games	Net losses on non-continuous games
Mean losses, grand mean	3 944	3 650	3 313
Range mean	1 240 – 5 929	770 – 5 264	952 – 5 147
25th percentile, all	633	80	599
Range	127 – 1 406	45 – 238	126 – 1 397
50th percentile, all	1 778	307	1 704
Range	412 – 3 137	100 – 876	401 – 3 074
75th percentile, all	4 058	1 549	3 834
Range	1 094 – 6 087	264 – 3 707	1 015 – 5 841
90th percentile, all	7 946	7 492	7 099
Range	2 502 – 12 419	1 046 – 12 967	2 094 – 10 875
95th percentile, all	13 025	18 258	10 544
Range	4 195 – 20 161	2 513 – 30 652	3 354- 16 507
Proportion exceeding 95 percentile, all (per cent)	5.0	5.0	5.0
Range	1.3 – 9.2	0.9 – 7.9	0.7 – 10.5
Proportion exceeding 98 percentile, all (per cent)	2.0	2.0	2.0
Range	0.20 – 3.7	0.0 – 3.1	0.2 – 4.4
Bases:			
Total sample (N)	39 475	10 688	39 626
Range for each age/sex population groups (N)	1 126 – 4 401	98 – 1 821	1 125 – 4 430

Note: The range presents the lowest and the highest value across the 14 population groups.

Table 2. Associations between mean consumption (total net losses in thousand NOK) (independent variable) and prevalence of excessive gambling (dependent variable) by consumption category and criterion for excessive gambling; linear regression models; regression coefficients (B) standard error of estimate (SE) and test of statistical significance (t- and P-values). Aggregate data for gender and age group populations ($N = 14$).

	Execssive gambling = exceeding 95 percentile of total net losses				Excessive gambling = exceeding 98 percentile of total net losses			
	B	SE	T	P	B	SE	T	P
Mean total net losses	1.760	0.113	15.60	<.001	0.696	0.098	7.11	<.001
Mean net losses on high concentration games	1.436	0.153	9.38	<.001	0.699	0.123	5.69	<.001
Mean net losses on non-continuous games	3.465	0.167	20.736	<.001	1.934	0.145	13.355	<.001

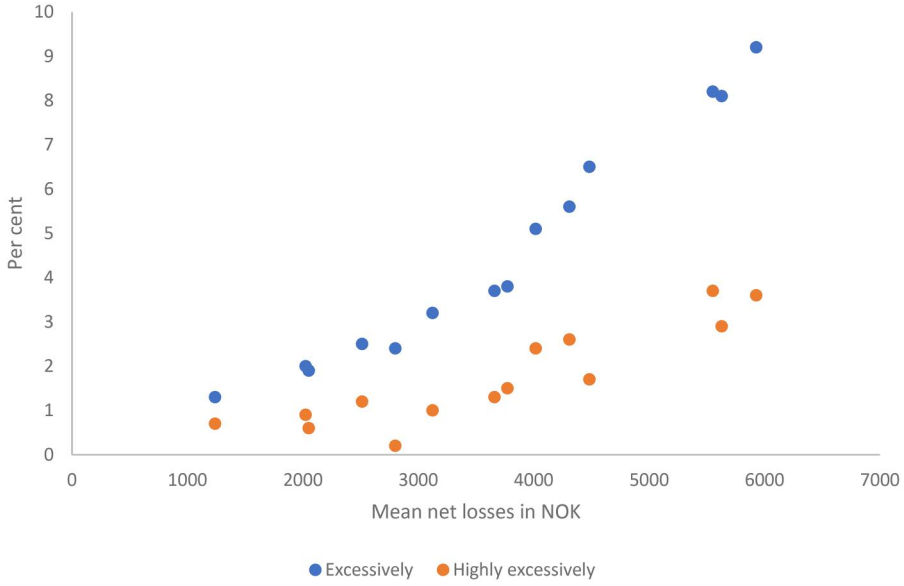

Figure 1. Proportion of people who gamble excessively and highly excessively by mean net losses in NOK by gender-age group populations ($n = 14$).

Table 3. Associations between mean consumption in NOK (natural log) (input variable) and percentile values (natural log) (outcome variables) by consumption category; linear regression models; regression coefficients (B) standard error of estimate (SE) and test of statistical significance (t- and p-values). Aggregate data for age by gender group populations ($n = 14$).

	Total net losses				Net losses on high concentration games				Net losses on non-continuous games			
Percentiles	B	SE	t	P	B	SE	t	P	B	SE	t	P
X_{25}	1.274	0.057	22.17	<.001	0.870	0.109	7.94	<.001	1.439	0.141	10.20	<.001
X_{50}	1.022	0.017	61.80	<.001	1.175	0.074	15.89	<.001	1.188	0.070	17.03	<.001
X_{75}	0.838	0.029	28.80	<.001	1.319	0.059	22.45	<.001	0.997	0.043	23.33	<.001
X_{90}	0.753	0.051	14.83	<.001	1.007	0.208	4.85	<.001	0.924	0.026	35.42	<.001
X_{95}	0.737	0.083	8.92	<.001	0.831	0.280	2.97	.012	0.911	0.027	34.35	<.001

parameter estimates was comparable to that for the analyses using gender and age group as unit of analysis, standard errors were larger, and hence the estimates were less precise.

Discussion

Using gambling accounts records data for a large sample of gambling customers in Norway, we found that the variation in mean gambling consumption between population groups (age and gender) showed a positive and statistically significant association with rates of excessive gambling as well as with distribution measures. Thus, we observed a clear pattern of regularity in the distribution of gambling losses and a systematic upward displacement at all levels of gambling losses with increasing population mean. The findings were robust and consistent across different categorizations of population groups (i.e. by age/gender or by region) and the findings applied to gambling on all games, as well as to non-continuous games only and high concentration games only.

These findings are in line with those reported by Hansen and Rossow (2012) for gambling and similar studies pertaining to alcohol consumption (Skog 1985; Rossow et al. 2014) and also other health risks/behaviors, including addictive drug use (Rossow and Bramness 2015), salt intake, blood pressure and body mass (Rose and Day 1990). Empirical support for the TCM is previously reported in several studies; see (Rossow 2019; Kesaite et al. 2024), however, most of these studies were based on self-reports of gambling

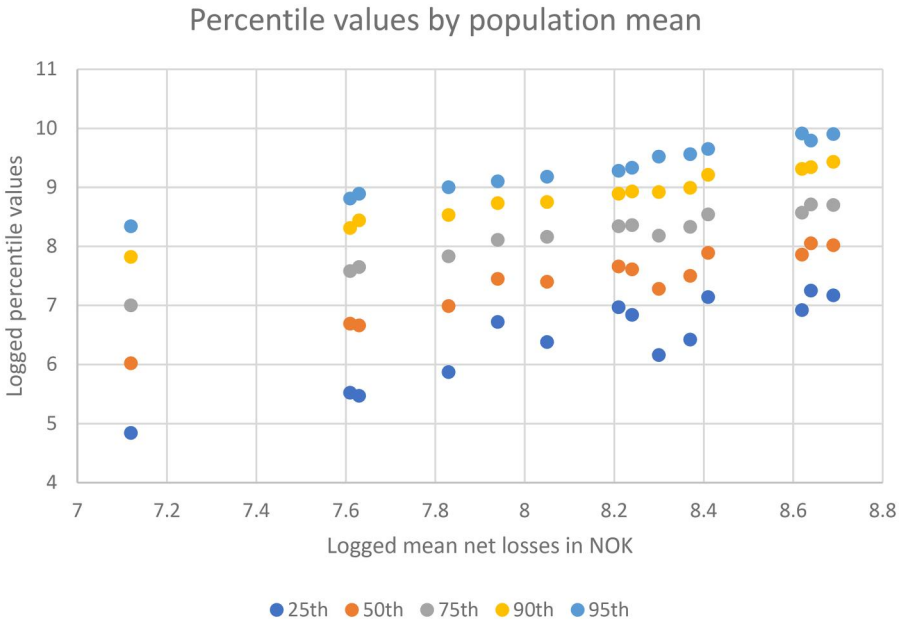

Figure 2. Percentile values (log-transformed) for 25th, 50th, 75th, 90th and 95th percentile by mean net losses in NOK (log-transformed) for gender-age group populations ($n = 14$).

behavior. Notably, the study by Markham et al. (2014) employed hybrid data; that is recorded data on gambling expenditures as well as self-report data on gambling problems. Most previous studies that found empirical support for the TCM employed measures of overall gambling expenditures or gambling frequency (Rossow 2019; Kesaite et al. 2024), whereas a few studies employed measures of gambling expenditures for one specific product type (EGMs) (Abbott 2006; Hansen and Rossow 2008, 2010). To the best of our knowledge, no previous study examined the validity of the TCM across different product categories.

Our findings suggest that the distribution of gambling behavior – in terms of gambling losses – follows a clear pattern of regularity across populations with different total gambling consumption. In line with this, the rate of people experiencing excessive gambling and hence the prevalence of those at higher risk of harms from gambling was closely associated with total amount of gambling losses (i.e. the population mean). This pattern of regularity was found for total gambling losses as well for losses on specific product groups. These findings suggest that the rate of excessive gambling is not only reflecting individual predisposing factors, but is also a result of factors at the society level that impact all those who gamble and thereby contributes toward shifting the whole distribution in one direction or another. Concluding from similar findings to ours, although in other health areas, Rose and Day (1990) stated that "the population mean predicts the number of deviant individuals". They noted implications of their findings in three domains: i) for research, ii) for prevention, and iii) for society and government. First, there is a need for more research to better understand the determinants of population averages and the dynamics of the interactions between the majority and the so-called 'deviants' in a population in various health areas (Rose and Day 1990). In gambling research, further studies examining the TCM and collective displacement with longitudinal data is needed (Rossow 2019; Kesaite et al. 2024) along with further explorations of the validity of the TCM for various gambling products. Second, prevention should aim at targeting the whole population, that is: "[in order] to help the minority the "normal" majority must change" (Rose and Day 1990). With regard to gambling, interventions should focus on the whole continuum of gambling activities, including regulations of availability and access to gambling (Regan et al. 2022) and this approach is as such in line with the public health model (Price et al. 2021). While we found empirical support for the TCM – in its basic version – across different product categories, potential for harm prevention may certainly vary across product categories in line with varying harm risk across these categories. And third, the findings support the idea that an acceptance of collective responsibility for the populations' health is needed (Rose and Day 1990). Our understanding of problem gambling as not just a result of individual vulnerability but also that of overall gambling in society which implies that society at large and governments also carry responsibility for preventing gambling harms by limiting total gambling consumption (Kesaite et al. 2024).

These findings lend support for changing population patterns of gambling consumption to prevent harms. This means implementing measures that reduce gambling consumption for the whole population, not just those who gamble heavily or excessively. A strong gambling harm prevention strategy would still focus on those experiencing gambling harms, and in particular to support those experiencing adverse consequences, but would not focus on this group alone. Data presented here suggest that universal measures targeting population consumption may have utility also, in line with several assessments of likely effective preventive measures (Williams et al. 2012; Gainsbury et al. 2014; Regan et al. 2022). However, most of the empirical effect evaluation literature to date pertains to individual-

focused (high risk strategy) interventions with a paucity of research on supply reduction interventions (McMahon et al. 2019; Blank et al. 2021).

Study limitations

One important limitation is that our data included only gambling activities on legal games in Norway. It is, however, likely that those who gamble excessively on illegal games (provided by operators abroad) also gamble excessively on legal games (mainly games provided by NT). The latest national gambling and gaming problem survey in Norway found that the number of games gambled increased with gambling problem category (Pallesen et al. 2023). Moreover, various restrictions on games provided by NT, including maximum limits on losses, are bound to curb the right tail of the distribution of gambling consumption (in terms of losses), and hence it is likely that even more skewed distributions of gambling losses can be observed in other populations of gamblers with fewer or none such restrictions.

Another limitation relates to the measure of gambling losses and gambling related harm. While gambling losses is one indicator of exposure to risk of harm from gambling, it is confounded by income. Ideally, we would include measure of income as well as several other measures of gambling activities, including time spent on gambling. However, income data is unavailable in this dataset. An additional concern pertains to the number of statistical regression analyses (altogether 21) which may produce a false positive result (with a 5% level of statistical significance, we may expect that one out of 20 analyses may yield a false positive result, i.e. a Type I error).

In our study, all estimated associations were statistically significant, and most of them with a p-value less than 0.001, suggesting that the overall pattern of associations did not result from a Type I error. Finally, our findings pertain to populations (or population groups) observed cross-sectionally and reflect differences between populations. Future research, should examine distribution characteristics within a population over time, and thus make a stronger case for inferring implications of change in total consumption within a population (Hansen and Rossow 2012; Rossow et al. 2014).

Conclusion

Overall, the findings lend strong support to the validity of the total consumption model with regard to gambling. Total gambling consumption was positively associated with rates of excessive gambling and variation in total gambling consumption was accompanied by collective displacement at all levels of consumption. This study provides a novel contribution to the field of gambling research, not only by examining the validity of the total consumption model employing high quality tracking data, but also by doing so across different product categories. The findings suggest that intensive gambling, which is associated with high risk of harms from gambling, is not merely a reflection of individual vulnerability to intensive gambling but also an integral part of total gambling in a society. Moreover, the findings support the need for effective universal prevention strategies to curb gambling and gambling risk at all levels of gambling.

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Ethical statement

The research in this paper does not require ethics board approval.

Disclosure statement

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In researching the gambling industry and their practices, HW declares occasional attendance at events where gambling industry actors are present (including industry-sponsored conferences). As part of her work on the Gambling Survey for Great Britain, HW is required by the Gambling Commission (the funder) to participate in events disseminating research findings to their stakeholders, which includes the industry. Her attendance at events where industry is present is independently funded and does not involve collaborations or partnerships with industry.

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