International Journal of Environmental Research and Public Health

MDPI

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Social ecological model of problem gambling: A cross-national survey study of young people in the United States, South Korea, Spain, and Finland

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Abstract: Problem gambling among young people is an emerging trend globally. The online environment in particular offers various possibilities for gambling engagement. This is the first cross-national survey study using the social ecological model to analyze problem gambling, especially in the online context. The aim was to analyze how different social ecological spheres explain problem gambling. Participants were young people aged 15–25 in the United States (n = 1,212), South Korea (n = 1,192), Spain (n = 1,212), and Finland (n = 1,200). The South Oaks Gambling Screen (SOGS) instrument was used as a measure for problem gambling. Regression models predicted problem gambling with measures of intrapersonal, interpersonal, organizational, and societal spheres. Spanish participants had the highest SOGS score for problem gambling. Out of the spheres, organizational-sphere measures best explained the variation in problem gambling in all countries (26%) when compared to the societal (3%), interpersonal (5%) and intrapersonal (11%) spheres. In the full model, organizational-sphere measures had strong associations with problem gambling. These included consumer debt, online gambling community participation, online casino participation, and exposure to online pop-up advertisements. Other robust predictors of problem gambling included conformity to group norms in the interpersonal sphere and male gender and impulsivity in the intrapersonal sphere. Cross-national results were similar in different countries. The online context plays a major role in problem gambling behavior. The social ecological model is a useful tool by which to tackle problem gambling and develop preventative measures.

Keywords: pathological gambling, social ecological model, adolescents, emerging adults, Internet, online communities, online casinos, consumer debt, advertising, impulsivity

Citation: Oksanen, A., Sirola, A., Savolainen, I., Koivula, A., Kaakinen, M., Vuorinen, I., Zych, I., Paek, H-J. Social ecological model of problem gambling: A Cross-national survey study of young people in the United States, South Korea, Spain, and Finland. *Int. J. Environ. Res. Public Health* **2021**, *18*, x. https://doi.org/10.3390/xxxxx

 doi:10.20944/preprints202101.0595.v1

1. Introduction

Problems caused by excessive gambling are a global concern [1–3]. Currently, gambling and gaming increasingly take place online [4–6] and mainstream social media sites expose users to gambling content and activities [7–9]. Young people are the most active users of the Internet and social media sites and hence at particular risk [10].

Due to the rapidly changing online environment, major gaps exist in research. Studies that aim to understand behavioral and situational factors affecting gambling behavior and development of gambling problems are lacking. This cross-national survey study analyzes problem gambling using a social ecological model of gambling problems among people ages 15 to 25.

2.1. Social ecological model for gambling problems

The need for understanding different types of social contexts of human behavior is grounded on social psychology. Out of the classics of social psychology, Kurt Levin, for example, postulated the classic equation $B = f(P, E)$, noting that behavior is a function of a person and their environment [11]. This has been—and continues to serve as—a starting point for various social ecological models that aim to understand human behavior from a holistic framework.

The most well-known example of a social ecological theory is Urie Bronfennerbrenner's ecological systems theory of child development that analyzes wellbeing using overlapping micro-, meso-, exo-, and macrosystems [12–14]. Later on, he also added a chronosystem reflecting time as a context [15]. Bronfenbrenner's core idea is that human development takes place within these ecological systems. His theory and ideas have been widely applied in various social ecological models that have in common the idea that nested levels or spheres influence human behavior. The model generally has had a major influence on health promotion [16].

Bronfenbrenner's work has also been applied in addiction research. The social ecological framework has been used in investigations of e-cigarette use [17], alcohol consumption [18–19], substance use [20–22], and high-risk sexual behavior [23], but not on gambling. Another research gap involves the Internet as a social ecological sphere. The social ecological framework has not been used in addiction research to understand the growing influence of the Internet on behavior. More work has been done in other fields, and the usefulness of the social ecological framework applied to online context has been demonstrated in research on bullying [24].

Blaszczynski and Nower [25] noted ecological factors in the pathways model of problem and pathological gambling, but the theory only considers ecology as availability. Addiction theories do, however, involve a risk of simplifying human behavior and neglecting the importance of contexts in behavior. Some of them, such as those by Orford and West [26–27], comment on the relevance of societal and cultural contexts, but the core ideas are not social ecological. From a more social ecological point of view, addictions are formed only via settings that activate people to carry on certain activities despite their harmfulness [28].

A social ecological model for problem gambling considers the development of gambling problems from the perspective of nested spheres that combine both individual and situational factors. The spheres are grounded on general ideas provided by social ecological theory indicating that human behavior and development takes place in different types of contexts from micro to macro and depends on a person's individual characteristics [14–15]. The intrapersonal sphere involves biopsychological factors such as age, gender, and personality. The interpersonal sphere involves an individual's interactions with others. The organizational (i.e., institutional) sphere includes potentially influencing factors available for individuals via social institutions. These meso-type factors include, for example, wider communities and institutional settings and affordances. The societal sphere represents the macro level and includes public policies and cultural values. These four spheres are presented in Figure 1.

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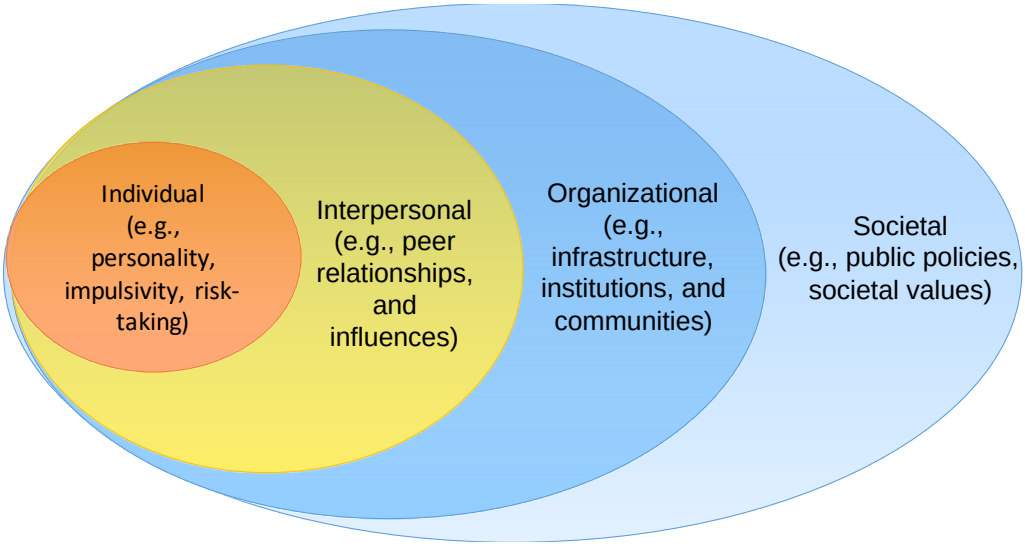

Figure 1. Social ecological model for investigating problem-gambling behavior.

2.2. Evidence on problem gambling in different spheres

Intrapersonal factors for gambling behavior have been well established in research. Males gamble more than females do in general, and gambling causes more problems for males than it does females [1, 29]. Problem gambling is more common among younger individuals [1, 3]. Other intrapersonal variables related to personality are also important for understanding problem gambling. For example, impulsivity is a risk factor for problem gambling [29–31]. Similarly, some people are more likely to take risks and this has been associated with problem gambling [31]. Financial risk-taking is also common among young people [32–33]. Research also indicates that people with low self-esteem could be motivated to gamble.

Interpersonal factors include people's social ties. Problem gamblers report lower perceived social support in various studies [34–36]. Although offline social ties provide a protective factor against problem gambling, online social ties involve risk [37]. Furthermore, especially on social media, people easily become involved in various social cliques or bubbles [10, 38] that could also pose a risk for problem gambling [39]. In addition, conformity to social norms has an influence on gambling behavior [7, 40].

Organizational factors include wider infrastructure, institutions, and communities that are not restricted to few individuals. Gambling venues such as online casinos are one example of such institutions. Access to casinos and other gambling content is fast and easy online. Online casinos in particular function both legally and illegally [2, 6, 41]. Furthermore, gambling communities often focus on sharing gambling tips. These types of communities were considered a risk factor for problem gambling in a previous study from Finland that also noted these communities, which young people visit online, most often focused on gambling activities and tips rather than harm caused by gambling or recovery from gambling problems [9].

Other organizational factors also influence gambling behavior. New types of opportunities for money lending and consumer credit, such as instant or payday loans, have been considered a major risk for financial difficulties, especially for young people [32–33]. These easy-access loans have also been identified as a problem in gambling research [42–43]. These loans occur via the Internet, and they are heavily marketed to users. Studies have also recognized the wide existence and ubiquity of online gambling marketing and advertising [44–46]. Moreover, problem gamblers seem to receive more gambling advertisements, which is likely to increase their gambling [47–48]. Currently, online marketing offers more targeting and customization than ever, and problem gamblers likely receive advertisements about both gambling opportunities and instant loans on their social media

 doi:10.20944/preprints202101.0595.v1

feed. Problem gamblers often operate in a bubble [39], an d escaping such bubble is very difficult when marketing algorithms constantly target them for gambling advertisements.

The societal sphere is grounded on the idea of societies or broader unions (e.g., the EU) as macrosystems that influence people's daily lives. This involves legislation in particular, but cultural and societal factors also play a role. Globally, the prevalence of problem gambling ranges from 0 to 6%, and despite some differences in prevalence rates, findings across countries are quite consistent [1]. Recent findings show that gambling problems are particularly high among young people in Spain [49–50], whereas the United States, South Korea, and Finland are somewhat more analogous in their youth problem-gambling prevalence rates [1, 51–52].

2.3. This study

This is the first cross-national survey study using a social ecological model to analyze problem gambling. Our study was grounded on cross-national comparison between countries that are societally and culturally different.

The United States, South Korea, Spain, and Finland represent different areas on the Inglehart-Welzel world cultural map and are clearly distinct as societies [53–54]. Yet, young people in these countries widely use the Internet and social media. Gambling is also a common activity in these countries. South Korea differs from the other three countries due to its significantly stricter legislation on gambling. The countries also differ in terms of collectivism, with South Korea and Spain representing more collectivistic cultures than the United States and Finland do [55–56]. Self-expression values are highest in Finland. Finland and South Korea are score highly on secular-rational values in comparison to Spain and the United States. [53–54].

The country selection gave an excellent starting point to this study because it enabled us to estimate the functionality of the social ecological model in different societal settings. The study also focused on the online context and young people aged 15 to 25.

The research questions were as follow:

1) How do the intrapersonal, interpersonal, organizational, and societal spheres explain problem gambling among young people?
2) What are the main similarities and differences between countries?

2. Materials and Methods

2.1. Participants and procedure

Empirical evidence is based on cross-national survey data collected from 4,816 young people aged 15 to 25 in the United States (n = 1212, 50.17% female), South Korea (n = 1192, 50.42% female), Spain (n = 1212, 48.76% female), and Finland (n = 1,200, 50.0% female).

Data were collected from Finland in 2017, the United States in 2018, South Korea in 2018, and Spain in 2019 using identical YouGamble surveys focused on gambling, social media use, and wellbeing. Study respondents were recruited using the Survey Sampling International (currently Dynata) research panel, which provides data solutions for research purposes globally. Using research panels has become commonplace in social sciences and they are considered a good alternative due to the difficulty of accessing hard-to-reach populations such as emerging adults [57]. The online data-collection method has the benefit of avoiding bias caused by traditional means such as phone surveys, especially when studying gambling problems [58].

The research group administrated all data collection and ran the survey using the Tampere University server. Survey Sampling International sent a link to respondents via email. Sampling quotas were used to ensure that the data matched the population of young people aged 15 to 25 in all the countries, especially in terms of age and gender, but

 doi:10.20944/preprints202101.0595.v1

also living area. Comparison of country samples with the population showed only minor deviations; hence, analytical weights were not applied [42, 58–59].

Survey languages were Finnish in Finland, English in the United States, Korean in South Korea, and Spanish in Spain. The original YouGamble survey was in Finnish and translated to English by professional-level translators. Professional-level translators translated the Korean and Spanish surveys from the English version, and we used the back-translation process to confirm the accuracy of translations.

All four YouGamble surveys were collected using LimeSurvey software, and they were optimized for computers and mobile devices. All respondents were volunteers and gave their consent for participation. They were informed about the study and were aware they could withdraw at any time. The median survey response time was 894 seconds (14.54 minutes): 930 seconds in Finland, 889 seconds in the United States, 752 seconds in South Korea, and 1007 seconds in Spain. Additional data quality checks were run with both response time and attention check questions included in the questionnaire. The online survey format allowed us to make questions mandatory and hence no data are missing.

2.2. Measures

2.2.1. Problem gambling

The outcome measure of our study was problem gambling, which we measured with the South Oaks Gambling Screen (SOGS). SOGS is among the most used measures for problem gambling [60–61]. The scale had excellent inter-item reliability of 0.88 based on McDonald's Ω: Ω_{FIN} = 0.89, Ω_{US} = 0.88, Ω_{SK} = 0.87, Ω_{SPA} = 0.86). SOGS reviews gambling activities from the past 12 months and scrutinizes factors indicating potential gambling problems from 20 scoring items. SOGS scores range from 0 to 20, and higher scores indicated problem gambling. We used SOGS as a continuous measure in the analysis, but we also report results based on the cutoff of ≥8 for disordered gambling. A higher cut-off is considered better due to the potential for false positives with lower cut-offs [62].

2.2.2. Intrapersonal sphere

Besides gender and age measures of the intrapersonal sphere, this study included impulsivity, self-esteem, and risk-taking.

Impulsivity was measured with the Eysenck Impulsiveness Scale [30, 63], with higher scores indicating higher impulsiveness. Response options were no (0) and yes (1) for all questions. The measure showed acceptable inter-item reliability: Ω = 0.69 (Ω_{FIN} = 0.75, Ω_{US} = 0.70, Ω_{SK} = 0.64, Ω_{SPA} = 0.67). In addition, the polychoric ordinal alpha coefficients for inter-item reliability of dichotomous scale were adequate: α_{FIN} = 0.87, α_{US} = 0.81, α_{SK} = .77 α_{SPA} = .80.

Self-esteem was measured with a single-item self-esteem scale [64]. Participants responded to the statement "I have high self-esteem" on a scale from 1 (*not very true of me*) to 10 (*very true of me*).

Risk-taking was measured with a single-item statement ("I enjoy taking risks"), which was adapted from the National Longitudinal Survey of Youth 1979 (NLSY79) [65] and widely validated in various studies [66–67]. Response options ranged from 1 (*not very true of me*) to 10 (*very true of me*).

2.2.3. Interpersonal sphere

Interpersonal sphere measures included perceived social support, sense of belonging offline and online, involvement in social media identity bubbles, and conformity to group norms. These measures reflect the behavior of individuals in their close relationships and intimate groups.

Perceived social support was measured with a single-item: "Do you feel that you receive support from your close ones when you need it?" The answer options were

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"never," "sometimes," and "often." The options were categorized into a dummy variable indicating high social support (0 = *never* or *sometimes*, 1 = *often*).

Offline belonging was measured with three items to indicate how strongly respondents felt they belonged to their close family members, friends, and school or work peers [68–69]. All three items had response options from 1 (*not at all*) to 10 (*very strongly*). The scale showed good inter-item reliability: $\Omega = 0.79$ ($\Omega_{FIN} = 0.77$, $\Omega_{US} = 0.83$, $\Omega_{SK} = 0.82$, $\Omega_{SPA} = 0.76$). The scale was adjusted to a range of 1 to 10. A similar measure was used for online belonging. It asked how strongly participants felt they belonged to an online community [39]. Responses ranged from 1 (*not at all*) to 10 (*very strongly*).

The six-item Identity Bubble Reinforcement Scale (IBRS-6) was used to measure involvement in social media identity bubbles (i.e., social cliques) [38]. The scale consists of items such as "On social media, I belong to a community or communities that are important parts of my identity" rated from 1 (*does not describe me at all*) to 10 (*describes me completely*): The IBR-6 had high inter-item reliability: $\Omega = 0.88$ ($\Omega_{FIN} = 0.79$, $\Omega_{US} = 0.90$, $\Omega_{SK} = 0.93$, $\Omega_{SPA} = 0.86$). The scale was adjusted to range from 1 to 10.

Conformity to group norms was also included in the interpersonal sphere. This measure was based on an online experiment that was included in the middle of the survey [7]. The experiment simulated a social media setting and showed respondents gambling messages they could either like (thumps up), dislike (thumps down), or ignore. In the style of messages on social media, they were shown how other people had reacted to the same message. Numbers of likes and dislikes presented as reactions from other participants were manipulated in the experiment. Different gambling messages were shown four times. The scale ranged from 0 to 4, indicating the number of times respondents had agreed with the majority of others (i.e., selected the same response as about 85% of the other respondents). A higher score indicates higher conformity with the group norm. The scale had good inter-item reliability: $\Omega = 0.79$ ($\Omega_{FIN} = 0.76$, $\Omega_{US} = 0.78$, $\Omega_{SK} = 0.82$, $\Omega_{SPA} = 0.72$).

2.2.4 Organizational sphere

Organizational sphere measures included consumer debt, participation in online casinos, participation in online gambling communities, and exposure to online pop-up gambling advertisements. These were considered wider than interpersonal factors are and were related to institutions.

Participants in all of the countries were asked whether they had taken payday loans or consumer debt in the past. In the Finnish survey, respondents were ask, "Have you ever taken instant loans, payday loans, or consumer credit?" Answer options were yes or no. These were categorized into a dummy variable: 0 = no consumer debt and 1 = consumer debt. In other surveys, respondents were asked whether they had taken a loan and then specified the type of loan taken: personal loans, consumer or credit card loans, cash advance loans, and payday loans were categorized as consumer debt. A dummy variable was created: 0 = no consumer debt, 1 = consumer debt.

Online casino participation was measured with the question "How often do you use online casino sites or other sites by gambling companies?" The answer options were "never," "seldom," "daily" or "many times a day." The answers were categorized into a dummy variable: 0 = no (never) and 1 = yes (at least seldom).

Online gambling community participation was measured with the question "How often do you use gambling-related discussion forums or communities?" The answer options were "never," "seldom," "daily" or "many times a day" and the response options were categorized into a dummy variable: 0 = no (never) and 1 = yes (at least seldom). Those who had participated in such communities were also asked a multiple-choice question on the content of such communities with options "gambling tips," "users' gambling experiences," "gambling problems and recovery," "gambling in general," and "other issues." The respondents were able to select multiple options.

Exposure to pop-up gambling advertisements was measured with the question "Have you received online advertisements or announcements related to gambling (e.g., advertising messages from online casinos or pop-up windows)?" The answer options

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ranged from never to daily. Options were categorized into never, monthly (several times a month or less), or weekly (once a week or more often).

2.2.5 Societal sphere

The societal sphere in our cross-national investigation refers to the four countries' societal spheres at the national level; hence, in this study, the societal sphere only reflects the macro level.

2.3. Statistical modelling

Statistical analyses were run with Stata 16.1 software. The article reports descriptive results in Table 1 and text. We used χ^2 test for the descriptive results. The main analyses focus on the regression models investigating how different social ecological spheres are associated with problem gambling in the four countries. Linear regression was chosen for the main method of estimating how well different spheres predicted gambling problems due to the comparability of results. We report standardized beta coefficients (β) that equal the correlation between the predictors and outcome variable and are comparable across models. In addition, coefficients of determination (R^2) and p values for statistical significance are reported. Models are reported both separately for each country and by using aggregated data (N = 4816). Besides the regression coefficients, we also report partial eta squared (η^2_p) effect sizes in the text.

We did not detect problematic multicollinearity. The Breusch-Pagan test for heteroscedasticity showed some problems with heteroscedasticity of residuals, and we ran the models using robust estimators of variance (i.e., sandwich estimator and Huber-White estimator). Additional checks for robustness were run because outliers were detected by looking at Cook's distance measure, where values greater than 4/n may cause problems. We report the final model without outliers in the appendix. In addition, country interactions were tested separately for each variable.

The appendix also includes an alternative logistic regression model that uses a cutoff of ≥8 for problem gambling. We report odds ratios (ORs), their 95% confidence intervals, and p values for statistical significance. We also report a zero-inflated negative binomial (ZINB) regression model that takes overdispersion and excess zeroes of the outcome variable into account. ZINB is considered the most consistent model in these circumstances [70]. ZINB models were run with robust estimation as suggested by statistical literature [71]. ZINB models report the incidence rate ratios (IRR) that are interpreted similarly ORs in binary logistic regression (IRR > 1 indicates higher risk, and IRR < 1 lower risk). We also report McFadden's pseudo R^2 coefficients, but these figures should be interpreted with caution and they are not comparable to linear regression coefficients.

3. Results

Descriptive statistics and information about measures are reported in Table 1. SOGS score was highest among participants from Spain, followed by Finland, the United States, and South Korea. Based on a SOGS cut-off score of ≥8, 3.84% of the participants were disordered gamblers. The proportion of disordered gamblers was highest in Spain and lowest in South Korea (χ^2 [3, N = 4816] = 33.56, p < 0.001).

Remarkable differences appeared, especially in the organizational sphere. For example, 42.33% of Finnish participants have visited online casino sites: 91% of them had been exposed to online pop-up gambling advertisements, and 12.17% had taken consumer debt. The figures in South Korea were very low, but participants from Spain and the United States also reported lower figures.

Online gambling community participation was highest among Spanish participants (25.58%), but also high among participants from Finland (14.42%) and the United States (13.94%), and low in South Korea (7.13%) (χ^2 [3, N = 4816] = 162.59, p < 0.001). These communities were generally about gambling advice, tips, and experiences from other users

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and hence they could be considered pro-gambling communities. Only 20.62% of the participants had selected gambling problems or gambling problem recovery as topics of such communities.

Table 1. Descriptive statistics of study variables

		Finland	US	SK	Spain	All
Dependent variable	**Scale**	**M/%**	**M/%**	**M/%**	**M/%**	**M/%**
Problem gambling (SOGS)	0–20	1.59	1.26	0.73	1.81	1.35
	≥ 8 points	3.67%	3.63%	1.76%	6.27%	3.84%
Independent variables						
Intrapersonal	**Scale**	**M/%**	**M/%**	**M/%**	**M/%**	**M/%**
Gender (male)	F/M	50.00%	49.83%	49.58%	51.24%	50.17%
Age	15–25	21.29	20.05	20.61	20.07	20.50
Impulsivity	0–5	1.96	1.90	1.56	2.05	1.87
Self-esteem	1–10	5.99	6.04	5.81	6.10	5.99
Risk-taking	1–10	5.12	5.74	4.21	5.41	5.12
Interpersonal	**Scale**	**M/%**	**M/%**	**M/%**	**M/%**	**M/%**
Perceived social support (high)	low/high	52.92%	41.34%	23.07%	48.76%	41.57%
Belonging offline	1–10	6.73	6.78	6.69	7.11	6.83
Belonging online	1–10	5.04	5.38	4.38	4.91	4.93
Social media identity bubble	1–10	4.63	5.96	5.26	5.75	5.40
Conformity to group norm	0–4	1.27	1.66	1.67	1.79	1.60
Organizational	**Scale**	**%**	**%**	**%**	**%**	**%**
Consumer debt	No/yes	12.17%	9.32%	5.54%	8.83	8.97
Online casino participation	No/yes	42.33%	18.23%	8.05%	28.22%	24.23%
Online gambling community participation	No/yes	14.42%	13.94%	7.13%	25.58%	15.30%
Pop-up gambling advertisements	Never	9.00%	27.15%	37.58%	8.17%	20.43%
	Max monthly	59.58%	53.80%	49.92%	53.71%	54.26%
	Weekly	31.42%	19.06%	12.5%	38.12%	25.31%

Table 2 reports the findings of the linear OLS regression investigating the association of problem gambling and intrapersonal, interpersonal, organizational, and societal spheres. Results showed the organizational sphere (27%) and intrapersonal sphere (11%) best explained the variance of SOGS score. Interpersonal (5%) and societal (3%) spheres were not as strong predictors. It is notable that the models of the different spheres are very similar in each country and only minor differences exist among them. All the significant effects have the same direction in all models. Robust predictors of problem gambling include, for example, male gender, impulsivity, risk-taking, conformity to group norms, and gambling community participation, which were statistically significant in all countries.

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Table 2. Problem gambling explained by intrapersonal, interpersonal, organizational, and societal spheres in separate linear regression models

	Finland		United States		South Korea		Spain		All	
Intrapersonal	**β**	**p**	**B**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
Male gender	0.23	0.000	0.14	0.000	0.14	0.000	0.22	0.000	0.18	0.000
Age	0.05	0.060	0.18	0.000	-0.06	0.073	0.15	0.000	0.09	0.000
Impulsivity	0.19	0.000	0.21	0.000	0.12	0.000	0.20	0.000	0.19	0.000
Self-esteem	-0.15	0.000	0.03	0.383	-0.07	0.012	-0.05	0.097	-0.06	0.000
Risk-taking	0.11	0.002	0.10	0.001	0.19	0.000	0.17	0.000	0.16	0.000
Model adjusted R^2	12%		11%		8%		15%		11%	
Interpersonal	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
Perceived social support (high)	-0.08	0.012	-0.16	0.000	-0.04	0.193	-0.20	0.000	-0.09	0.000
Belonging offline	-0.13	0.001	-0.03	0.418	-0.11	0.000	-0.03	0.399	-0.08	0.000
Belonging online	0.04	0.149	0.10	0.001	0.13	0.000	0.16	0.000	0.13	0.000
Social media identity bubble	0.02	0.630	0.08	0.008	0.08	0.002	0.12	0.000	0.07	0.000
Conformity to group norm	0.14	0.000	0.10	0.000	0.08	0.002	0.06	0.014	0.08	0.000
Model adjusted R^2	5%		6%		4%		11%		5%	
Organizational	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**	**β**	**p**
Consumer debt	0.19	0.000	0.06	0.07	0.18	0.000	0.10	0.004	0.12	0.000
Online casino participation	0.22	0.000	0.17	0	0.12	0.175	0.22	0.000	0.20	0.000
Online gambling community partic.	0.25	0.000	0.26	0.000	0.33	0.001	0.26	0.000	0.28	0.000
Online pop-up gambling advertise-ments (ref. never)										
Max monthly	-0.04	0.504	0.07	0	0.05	0.01	0.06	0.018	0.05	0.000
Weekly	-0.03	0.650	0.17	0.000	0.11	0	0.18	0.000	0.13	0.000
Model adjusted R^2	22%		23%		29%		26%		26%	
Societal									**β**	**p**
Country difference (ref. Spain)										
Finland	-	-	-	-	-	-	-	-	-0.04	0.049
United States	-	-	-	-	-	-	-	-	-0.09	0.000
South Korea	-	-	-	-	-	-	-	-	-0.18	0.000
Model adjusted R^2									3%	

Table 3. Problem gambling explained by the full social ecological model in linear regression models

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	Finland		United States		South Korea		Spain		All	
Intrapersonal	**β**	**P**	**β**	**P**	**β**	**P**	**β**	**P**	**β**	**P**
Male gender	0.12	0.000	0.08	0.001	0.08	0.000	0.13	0.000	0.11	0.000
Age	-0.06	0.015	0.10	0.001	-0.08	0.009	0.06	0.026	0.01	0.398
Impulsivity	0.13	0.000	0.14	0.000	0.04	0.102	0.13	0.000	0.12	0.000
Self-esteem	-0.06	0.027	0.01	0.867	-0.06	0.028	-0.03	0.289	-0.03	0.048
Risk-taking	0.05	0.094	0.05	0.092	0.07	0.010	0.07	0.003	0.07	0.000
Interpersonal										
Perceived social support (high)	-0.03	0.206	-0.06	0.053	0.02	0.490	-0.09	0.003	-0.06	0.000
Belonging offline	-0.07	0.029	-0.01	0.864	-0.04	0.236	-0.02	0.596	-0.04	0.030
Belonging online	-0.02	0.411	0.02	0.494	0.00	0.908	0.08	0.003	0.03	0.033
Social media identity bubble	0.02	0.446	0.00	0.946	0.03	0.158	0.02	0.368	0.03	0.058
Conformity to group norm	0.06	0.037	0.04	0.089	0.06	0.002	0.02	0.435	0.04	0.000
Organizational										
Consumer debt	0.16	0.000	0.03	0.352	0.18	0.000	0.07	0.034	0.11	0.000
Online casino participation	0.22	0.000	0.14	0.011	0.11	0.214	0.16	0.000	0.17	0.000
Online gambling comm. partic.	0.20	0.000	0.23	0.000	0.31	0.002	0.21	0.000	0.23	0.000
Online pop-up gambling advertisements (ref. never)										
Max monthly	-0.02	0.739	0.04	0.045	0.03	0.106	0.04	0.205	0.02	0.073
Weekly	-0.02	0.790	0.13	0.000	0.09	0.008	0.13	0.000	0.09	0.000
Societal										
Country difference (ref. Spain)										
Finland	-	-	-	-	-	-	-	-	-0.01	0.446
United States	-	-	-	-	-	-	-	-	-0.03	0.056
South Korea	-	-	-	-	-	-	-	-	-0.05	0.004
Model adjusted R^2	28%		27%		31%		33%		31%	

Table 3 reports full models for all four countries and the complete aggregated dataset. Male gender, impulsivity, and risk-taking were statistically significant predictors of problem gambling in the intrapersonal sphere. None of the interpersonal sphere measures was significant in any of the countries and effect sizes were small where significant. Out of organizational sphere predictors, online gambling community participation was significant in all countries and in the aggregated model. Online casino participation was not significant in South Korea, but remained significant in all other models even after adjusting for the number of factors.

Gambling community participation in particular has the strongest correlation with gambling problems (β = 0.23). The age-, gender-, and country-adjusted effect size of online gambling community participation was large in all countries and in the aggregated model (η^2_p = 0.20). Online casino participation also had relatively large effect sizes. In Finland, the association of online casino participation and problem gambling was strongest (β =

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0.23, age and gender adjusted $\eta^2_p = 0.11$). In addition, consumer debt was statistically significant in all the countries except the United States. Similarly, those who were exposed to pop-up gambling advertisements on a weekly basis reported higher problem gambling than others in all the countries did except Finland. The full model that controlled all the spheres only showed a statistically significant difference between Spain and South Korea.

We ran robustness analyses first with linear regression by omitting outliers (see Table A in Appendix A). The model (n = 4546) explained 38% of the variance of problem gambling. The results were very consistent with the previous models, except some coefficients were higher, such as online gambling community participation ($\beta = 0.28$, $p < 0.001$). Robustness of our findings was further verified by analyses run with logistic regression and ZINB regression. These findings showed male gender, high impulsivity, and low self-esteem predicted problem gambling. In addition, consumer debt, online casino participation, online gambling community participation, and weekly exposure to pop-up gambling advertisements were associated with problem gambling. These findings generally underline the relevance of both the intrapersonal and organizational spheres in explaining problem-gambling behavior.

Further country differences were analyzed with country interactions in the full linear model (N = 4816) with significant predictors. No differences occurred between women among the countries, but Spanish males had higher problem gambling than males in the United States ($\beta = 0.05$, $p = 0.042$) and South Korea ($\beta = 0.06$, $p = 0.005$) did. Impulsivity was not as strongly associated with problem gambling in South Korea as it was in Spain ($\beta = -.19$, $p = 0.001$). Exposure to pop-up gambling advertisements was not associated with problem gambling in Finland as it was in other countries. This finding is also shown in the Tables 2 and 3, but the difference was also significant in the final model.

4. Discussion

This cross-national survey study was the first to use the social ecological model to analyze problem gambling. Focus was on the Internet as a setting for gambling. We found that the social ecological model is useful in investigations of problem gambling. For the purposes of this study, different systems were analyzed as spheres. Within our study, measures in organizational and intrapersonal spheres best explained the variance of the problem gambling in all four countries. Significant and consistent predictors of problem gambling were online gambling community participation, male gender, and impulsivity. In addition, the interpersonal sphere and societal sphere partly explained problem gambling. Conformity to group norm explained problem gambling in all countries. Participants from South Korea gambled less than others did.

Out of all measures included, online gambling community participation had the strongest relation between problem gambling in the study. This finding confirms the results gained in previous empirical research focused on Finland [9]. Online gambling communities can hence portray a major risk for problem gambling. Within our study, these communities generally focused on supporting gambling activities, and not discussing potential gambling harm. Other studies focused on gambling and gaming communities had similar findings, according to a systematic literature review [6]. Results suggest online communities for ex-gamblers and people wishing to decrease or stop gambling would be important. The benefits of online self-help groups and communities have been noted in other studies [72–73]. Online communities should also be noted in prevention and treatment of problem gambling.

The findings generally underline similarities across different countries, although problem gambling per se was less common in South Korea. Gender difference was bigger in Spain compared to other countries. The role of impulsivity was less significant in South Korea. Furthermore, exposure to pop-up gambling advertisements was not statistically significant among Finnish participants who also had very high exposure to such advertisement.

Our results indicated several issues that could be regulated with policies, such as consumer debt, online casinos, and online advertisements. Payday loans and other short-term loans have been under serious discussion in countries such as Finland where they pose a major risk for young people [32, 42]. Online casinos have raised concern because they offer relatively easy access to gambling activities, in particular for younger people [5]. National strategies on regulating online casinos and advertising of gambling differ significantly even within the EU. Bypassing restrictions and accessing offshore online casinos is also relatively easy [74]. Previous studies also call for new evidence and policies on regulating gambling advertising [46].

Within our study, we observed major differences in rates of young people accessing online casinos (e.g., Finland 42% vs. South Korea 8%). In South Korea, casino participation was rare compared to other countries, and it was not a significant predictor of gambling problems. South Korea differs by stricter legislation from other investigated countries, and hence our results suggest strict laws might be an effective way to protect young people from gambling harm. Similarly, South Korean young people within our data saw fewer online pop-up gambling advertisements on a weekly basis (13%) than young people from Spain (38%), Finland (31%), and the United States (19%) did. These exposure rates, especially in Spain and Finland, are very high and indicate a need to find ways to regulate gambling marketing better.

Findings of this study are limited to four countries investigated with a cross-sectional design. The study is also limited by self-reported information that is potentially sensitive to social desirability bias when asking about problem gambling [75]. Particularly, in the case of South Korea, stricter legislation on gambling possibly affects responses. Longitudinal and experimental designs should be used in future studies to confirm our results. Moreover, measures of the study were not designed only for the purposes of the social ecological model, although we were able to use a wide range of measures to help understand personal, interpersonal, organizational, and societal factors. Future studies should continue using the social ecological model to examine problem gambling. In addition, a particular need for studies on online gambling is growing.

5. Conclusions

The findings of this cross-national study underline the benefits of social ecological models in understanding and tackling problem-gambling behavior. The results indicate the importance of online digital infrastructure's influence on gambling behavior. In our study, online gambling communities, online casinos, and online pop-up advertising of gambling, as well as fast access to financial resources such as payday loans, were associated with problem gambling. Problem gambling as a phenomenon is relatively similar in the countries representing Europe, North America, and Asia in this study. All countries have to tackle the growing issues related to online gambling.

Author Contributions: Conceptualization, A.O.; methodology, A.O., A.K., M.K., and I.V.; software, A.O.; validation, A.O. A.S., M.K., I.S., H.P., and I.Z.; formal analysis, A.O.; investigation, A.O., M.K., A.S., I.S.; resources, A.O., A.S., I.S., M.K.; data curation, A.O., A.S., M.K., I.S., H.P., I.Z.; writing—original draft preparation, A.O., A.S., I.S., A.K., M.K., I.V., I.Z., and H.P.; writing—review and editing, A.O., A.S., I.S., A.K., M.K., I.V., I.Z., and H.P.; visualization, A.O.; supervision, A.O.; project administration, A.O.; funding acquisition, A.O., A.S., I.S., and M.K. All authors have read and agreed to the published version of the manuscript.

Funding: The Finnish Foundation for Alcohol Studies, Problem Gambling, and Social Media Project 2017–2020 funded this research. PI: Atte Oksanen.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki. The Tampere region ethics committee reviewed the research protocol before implementation and stated that the research did not involve any ethical issues (Decision 62/2016).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: *YouGamble 2017 – Finnish Data* is publicly available in the Finnish Social Science Data Archive [76]. Data from the United States, South Korea, and Spain will be made publicly available in the Finnish Social Science Data Archive during 2021. The data are available from the corresponding author with a reasonable request.

Conflicts of Interest: The authors declare no conflict of interest. The funder had no role in the design of the study; the collection, analyses, or interpretation of data; the writing of the manuscript; or the decision to publish the results.

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Appendix A

Table A. Alternative linear, logistic, and zero-inflated negative binomial regression models predicting gambling problems

	Linear		Logistic				ZINB			
	β	p	OR	95%	CI	p	IRR	95%	CI	p
Intrapersonal										
Male gender	0.11	0.000	1.96	1.36	2.82	0.000	1.30	1.20	1.40	0.000
Age	0.02	0.145	1.01	0.95	1.07	0.725	0.99	0.97	1.00	0.039
Impulsivity	0.10	0.000	1.33	1.19	1.48	0.000	1.08	1.06	1.11	0.000
Self-esteem	-0.03	0.042	0.90	0.82	0.99	0.030	0.97	0.95	0.99	0.005
Risk-taking	0.08	0.000	1.07	0.99	1.17	0.099	1.03	1.01	1.04	0.007
Interpersonal										
Perceived social support (high)	-0.07	0.000	0.70	0.47	1.04	0.076	0.90	0.82	0.98	0.018
Belonging offline	-0.02	0.178	0.91	0.81	1.01	0.080	0.96	0.94	0.99	0.004
Belonging online	0.03	0.052	1.08	0.99	1.17	0.068	1.02	1.00	1.04	0.013
Social media identity bubble	0.03	0.029	1.13	1.01	1.26	0.035	1.02	1.00	1.05	0.074
Conformity to group norm	0.04	0.000	1.08	0.92	1.27	0.349	1.04	1.01	1.08	0.016
Organizational										
Consumer debt	0.11	0.000	2.91	2.00	4.23	0.000	1.23	1.11	1.36	0.000
Online casino participation	0.22	0.000	2.56	1.58	4.14	0.000	1.20	1.09	1.32	0.000
Online gambling comm. partic.	0.28	0.000	2.68	1.70	4.20	0.000	1.39	1.26	1.54	0.000
Pop-up gambling adv. (ref. never)										
Max monthly	0.03	0.014	1.39	0.67	2.90	0.381	1.02	0.88	1.19	0.748
Weekly	0.09	0.000	2.41	1.13	5.14	0.022	1.17	1.00	1.36	0.047
Societal										
Country difference (ref. Spain)										
Finland	0.00	0.929	0.76	0.48	1.20	0.24	1.06	0.94	1.18	0.348
The U.S.	-0.05	0.003	0.80	0.52	1.22	0.3	0.90	0.79	1.03	0.135
South Korea	-0.06	0.000	0.66	0.38	1.13	0.13	1.07	0.97	1.18	0.195
Model N	4546*		4816				4816			
Adjusted R^2	38%									
Pseudo adj. R^2 (McFadden)			24%				42%			

Note. * Outliers omitted from the linear regression model.