Gambling Environment and the Risk for Gambling Addiction:
A Bioecological Perspective on the Role of Adolescents' Beliefs and Value System

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Abstract

Since the monopoly system of Macao Gambling Industry ended in 2002, adolescents have been exposed to the openness of the gambling environment. The purpose of this study is to identify how environmental factors influence the role of adolescents' beliefs and value systems, from which adolescents might be subject to the risk of gambling addiction from a bioecological perspective of Bronfenbrenner. Quantitative data on Form 4 (Grade 10) students were collected and analysed to identify the characteristics of the gambling environment of Macao; to identify the risk and protective factors under the risk of addiction; and to identify how environmental factors in different environments (Hong Kong and Porto) affect the risk of gambling addiction, as compared to Macao.

Results showed that the availability and accessibility of gambling activities, and the low level of family function satisfaction contribute to the risk of gambling addiction of adolescents in Macao. Compared to Hong Kong and Porto, (1) Macao has higher youth gambling participation rate; entertainment as gambling motive is higher; started to gamble earlier; spent more time and money on gambling, family functions' satisfaction is lower and more parents working on shift, which are contributing factors to gambling disorder; (2) Macao scored significantly lower in gamblers' belief in illusion of control; but gambling disorder participants in Macau and Hong Kong scored higher in Luck/Perseverance; (3) adolescents from Macao was least Open-to-Change, less Self-Transcendent and less Self-Enhanced. An Explanatory Model is developed to illustrate the impacts of gambling on the development of adolescents in the context of Macao. Overall, this study contributes to the understanding of the unique situation in Macao regarding adolescents who are subject to the risk of gambling addiction from a bioecological perspective.

Keywords: Adolescents, Belief, Bioecological System, Gambling Disorder, Value

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Introduction

Since the monopoly system of Macao Gambling Industry ended in 2002, rapid growth of the gambling industry has brought along significant changes and has become the major source of income (Macao SAR Gaming Inspection and Coordination Bureau 2022i). Gambling are found to have culturally specific expressions and the rates of severe gambling problems amongst the Chinese people in Hong Kong and Macao are up to 4%, which is higher than that in Caucasian cultures (Lim & Rogers, 2017). The openness of the gambling environment might potentially contribute to the risk of gambling addiction of adolescents. From a micro perspective: (1) family relationships: parents working on shift might have reduced family time together as 21.2% of the population worked in the gambling industry, and 92.7% of them required to work on shift in 2018 (Macao SAR Statistics and Census Service, 2018a, 2018b); (2) susceptibility to gambling addiction: gambling venues (42 casinos and 5 slot machine in 2022) are in close vicinity to the household (Macao SAR Gaming Inspection and Coordination Bureau, 2022h). From a macro perspective, Government policies, economic prosperity, etc. might have affect adolescents' belief and value in terms of addiction. The objectives of this study were to identify the characteristics of the gambling environment of Macao; to explore the belief and value of adolescents who are exposed to the environment; to identify the risk and protective factors under the risk of addiction; and how environmental factors in different places (Hong Kong and Porto) affect the risk of gambling addiction, as compared to Macao.

Literature Review

Gambling is considered to be originated from divinatory, to know the future and the intentions of the gods through casting of lots (Schwartz, 2013). The earliest concrete evidence of gambling was from unearthed tiles in Ancient China in around 2300BC used for a rudimentary game of chance. The earliest gambling house appeared in the 17th century in Italy. There was a gradual shift of official attitude towards gambling since the 18th century, from seeing it as a sin to seeing it as a vice and a human weakness, and then as a mostly harmless and even entertaining activity (Derevensky & Griffiths, 2019; Glimne, 2021; Schwartz, 2013; Taylor, 2019). The rapid development of gambling industry raised the alarm of psychiatric professionals and eventually led to the classification of gambling addiction as a category of addiction disorder in DSM-V. Core components of addiction include (a) continued engagement in a behaviour despite adverse consequences, (b) diminished self-control over engagement in the behaviour, (c) compulsive engagement in the behaviour, and (d) an appetitive urge or craving state before engagement in the behaviour (Grant et al., 2012). The causes of addiction are multifactorial, comprised of the confluence of psychological, sociological, and neurobiological perspectives (Shaffer et al., 2012).

The Bioecological Approach refers to the evolving interaction between the developing

person and the environment. The ecological environment is conceived as a set of nested structures, each inside the next. Bronfenbrenner called the temporal dimension of his model the chronosystem. It involves the way the passage of time, including historical events and more gradual historical changes, which affect human development, and the transitions occur over the life course (Berk, 2014; Feldman, 2017). The macrosystem represents the larger cultural influences, referring to factors such as society in general, types of governments, religious and political value system. The exosystem represents broader influences, encompassing societal institutions such as local government, the community, schools, religious institutions, etc., which can have an immediate, and major, impact on personal development, and each affect how the microsystem and mesosystem operate. The innermost microsystem involves the immediate surroundings of the developing person, and through the mesosystem, the various aspects of the microsystem are connected (Berk, 2014; Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006; Feldman, 2017).

1. Gambling Environment

Gambling prevalence studies showed that gambling disorder in Macao is higher than many other jurisdictions and this might be explained by the increased accessibility and availability of gambling opportunities in Macao, supported by the close proximity and large number of casinos (Chan et al., 2019). Blaszczynski and Nower (2002) also supported that early availability and accessibility are crucial in the pathways development of problem gambling. Environment plays an important role in shaping developmental process. Adolescence's engagement in risky behaviours frequently attributed to the environmental risk factors that undermine achievement and mental health (Sameroff, 1998). Participation in organized activities (a conventional endeavour that is highly valued, challenging, and exciting) is a protective factor by reducing problem behaviours. They promote affiliations with nondeviant peers, and mentoring from adult leaders (Mahoney et al., 2005).

Gambling is illegal in China, except the state-run Social Welfare Lottery. Macao is the only place in China where casinos are legal. Gambling is generally unlawful in Hong Kong with the Hong Kong Jockey Club as the sole authorised gambling operator, offering horse race betting, football betting and Mark Six Lottery. In Portugal, operation of games of chance can only take place in casinos located in gambling areas, but online gambling and betting was approved in 2015, making it increasingly popular among adolescents (Turismo de Portugal, 2020). Each mentioned city has its own historical and cultural background, and political condition, etc. which shape the unique characteristics of its own gambling environment. Although there are many similarities between Macao and Hong Kong, there are fundamental and structural differences. Given Macao's historical and cultural connection with Portugal, with all the similarities and differences that this entails, the comparison of Macao's reality with a Portuguese region (Porto) becomes entirely pertinent.

2. Gambling-related Belief

Gambling-related cognitive distortions refers to a wide array of mistaken beliefs and perceptions about gambling (Donati et al., 2018). Cognitive distortions predicted problem gambling and biases in interpreting gambling outcomes play an important role in the maintenance of gambling behaviour (Cosenza et al., 2018; Lévesque et al., 2018). Steenbergh et al. (2002) identified two major factors, Luck/Perseverance (involves a set of beliefs that lead gamblers to overestimate their chance of winning) and Illusion of Control (the belief that one can influence the outcome of a chance-determined event), contributed to the belief system of problem gamblers. Adolescent probable pathological gamblers were more susceptible to erroneous beliefs of randomness and chance, and they believed their skills could control over them (Ariyabuddhiphongs, 2013; Moore & Ohtsuka, 1999; Oh et al., 2017). In terms of prevention, Oh et al. (2017) found that educational-based programs targeting risk factors such as cognitive distortions have shown consistent effect in increasing knowledge and correcting misconceptions.

3. Value System

The Value Theory specifies six main features of values: 1) are concepts or beliefs; 2) refer to desirable goals; 3) transcend specific actions and situations; 4) serve as standards or criteria, guiding selection or evaluation of behaviour and events; 5) are ordered by importance; and 6) the relative importance of multiple values guides action (Schwartz, 1992, 2012; Schwartz & Bilsky, 1987). Adolescents who identify themselves with the ideological, social, economic and political values of a society which is gambling-permissive will be more likely to perceive gambling as a normative and accepted behaviour, and consequently as an activity that they may choose to engage with. It is believed that living in a gambling environment may shape the human values and beliefs and in turn affects adolescents to have a higher risk of becoming addicted (Shead et al., 2011). Lau (2003) emphasized on the value development of adolescents as one of the most important protective factors for gambling addiction.

Methodology

This study was formulated based on the assumption that different environmental factors (independent variables), including socio-demographic, gambling behaviours, family function, gambling beliefs, and human values, affect the gambling disorder (dependent variable) of adolescents in Macao.

1. Hypotheses

HS2.1 – Parental attitudes towards gambling and family relationship, from a microsystem perspective, affect the risk for gambling addiction of adolescents; HS2.2 – Parents work environment, specially working in gambling related industry and working on shift, from an exosystem perspective, affect the risk for gambling addiction of adolescents; HS2.3 – The belief system of participants in terms of gambling, from a macrosystem perspective, affect the risk for gambling addiction. That is, the more the gambling related cognition are distorted, the more the risk for gambling addiction; HS2.4 – The value system of participants in terms of gambling, from a macrosystem perspective, affect the risk for gambling addiction. That is, people with certain values of certain cultures are more prone to the risk for gambling addiction.

2. Method

Cross-cities comparison was made. Quantitative Data were collected cross-sectionally between September 2020 to August 2021, through Bosco Youth Service Network's youth gambling prevention program (BYS-YGPP), Hong Kong Caritas Institute of Higher Institution, and Universidade Católica Portuguesa Porto.

Participants: Students attending Form 4 (See Table 1). Owing to the difficulty in data collection due to COVID-19, Form 5 participants were also recruited in Hong Kong (F4: 1,015, F5: 118, Missing: 5).

Table 1. Demographic Data

		Macao		Hong Kong		Porto	
		n	%	n	%	n	%
Gender	Male	297	45.4	87	36.6	83	37.7
	Female	357	54.6	151	63.4	137	62.3
	Missing	19	2.8	3	1.2	4	1.8
Age	13-14	25	3.7	0	0.0	0	0.0
	15	374	55.6	41	17.2	114	51.6
	16	158	23.5	104	43.5	98	44.3
	17-20	116	17.1	94	39.4	9	4.1
	Missing	0	0.0	2	0.8	3	1.3
Total N=1,138		673	59.0	241	21.1	224	19.6

3. Instruments

Assessment Tool for Gambling Addiction: The Chinese version of the DSM-V Gambling Disorder assessment tool was used. The internal consistency reliability was

adequate (Cronbach's Alpha = 0.75). Score 0 = No risk, score 1-3 = At Risk, score 4 or above = probable Gambling Disorder (American Psychiatric Association, 2013).

Assessment of Family Function: Satisfaction level of family function was assessed by Chinese version Family APGAR on five parameters: Adaption, Partnership, Growth, Affection and Resolve. It was validated, and reliability tested with Cronbach's Alpha results of 0.8 to 0.86. The instrument was recoded into range from 0 to 10: 0–3 = severely dysfunction, 4–7 = moderately dysfunction, and 8–10 = functional (Smilkstein et al., 1982).

Assessment tool for belief system: The Gamblers' Beliefs Questionnaire (GBQ) is a self-report measure of gamblers' cognitive distortions. It is a 7-point Likert scale with 21 items. It has of 2 factors: Luck/Perseverance and Illusion of Control (Steenbergh et al., 2002). This research adopted the Chinese translated version developed by Wong and Tsang (2012). The GBQ-C scale ranged from 1-strongly disagree to 7-strongly agree.

Assessment tool for value system: The 6-point Likert scale Portrait Values Questionnaire (PVQ) (21 items) of Schwartz was adopted, and the higher the rating, the more important the value to the respondent (Schwartz, 2012, Cieciuch & Davidov, 2012). The ten basic values are further organised into a two-dimensional circular continuum under four higher-order values, portraying the total pattern of relations of conflict and congruity among values: "Openness to Change" (self-direction, stimulation, and hedonism), "Conservation" (conformity, security, and tradition), "Self-Transcendence" (benevolence, and universalism), and "Self-Enhancement" (power, and achievement) (Schwartz, 2012). The Cronbach's alpha ranged from 0.74 to 0.81, which were reliable (Schwartz, 2003). The Chinese version of PVQ-21 was adopted from Gao et al. (2016) retrieved from the internet.

4. Data Analysis

SPSS28.0 was used for statistical analyses. Significance testing of the difference between the two groups was conducted using one-way ANOVA for continuous variables and chi-square test for categorical variables. An alpha of 0.05 ($p < 0.05$) was considered statistically significant. For non-parametric data, Kruskal-Wallis H tests were used with Mann-Whitney U tests as post-hoc tests. Effect sizes were reported for the chi-square analysis. Scatter Plot was used to display relationships between variables.

5. Procedure

Macao: Data were collected in September to December 2020 through the BYS-YGPP workshops. There were 4,496 students attending Form 4 in the 2020/21 scholastic year (Macao SAR Education and Youth Development Bureau, 2023). With confidence level at

95% and confidence interval of 4, the required sample size is 530 (Cohen et al., 2018). 677 samples (673 valid) were received from 7 schools (response rate: 99.4%).

Hong Kong: All 506 schools were contacted by email but received no responses. Two schools from a convenience sample of personal networks participated. All the data were collected by the end of July 2021.

Porto: The research was approved by the Portuguese Educational Bureau and data was collected between April and June 2021. The Portuguese versions scales were used with approval and other contents went through the process of translation from Chinese to Portuguese and back translation. The back-translated version was then compared with the Chinese version. Culture and location specific items were replaced. Four of the 12 convenience sample schools participated out of 147 secondary schools in the Porto metropolitan area (amporto, 2023). A total of 224 valid cases received (response rate 30.1 %).

6. Results

37.7% participants' mother in Macao worked directly related to gambling industry, which is the highest among the occupations. Macao also has more mothers who required to work on shift (46.2%). About 60% of participants in Porto never gambled, which was significantly higher (p <.001). For those who have gambled, most participants started at age 12-14, and the most common reason to gamble was "to seek entertainment". Family members and friends were the two groups who normally gamble with the participants, but friends were outstandingly higher in Macao (p <.001). Participants in Macao had higher spending on gambling activities: 8.3% participants spent more than $500 in Macao, while no one in Hong Kong and 2% in Porto (p <.001). The main source of gambling money was "Pocket Money" in Macao (64.5%) and Hong Kong (58%), but only 0.8% in Porto.

Gambling Disorder

The result of the overall Gambling Disorder in the three cities is shown in table 1. Macao has significantly more participants who were 'At Risk' (18.3%) and with 'Gambling Disorder' (2.5%) (p = .015).

Table 2. The Results of Gambling Disorder in DSM in the Three Cities

DSM Score	Macao		Hong Kong		Porto	
	n	%	n	%	n	%
No	533	79.2	208	86.7	162	85.3
At Risk	123	18.3	30	12.5	28	14.7
Gam. Dis.	17	2.5	2	0.8	0	0

Family Function

There were significantly more "severely dysfunctional" families in Macao (13%) than Hong Kong (3.0%) and Porto (0.5%) (p <.001).

Gamblers' Beliefs Questionnaire (GBQ)

A high Cronbach's Alpha (0.94) of GBQ were obtained for Macao and Hong Kong, and $\alpha = 0.899$ for Porto which showed the scale was reliable. One-way ANOVA were performed and found that there were significant differences in GBQ. Games-Howell Post Hoc Test showed significant differences between Macao and Hong Kong (p = .001), and between Macao and Porto (p = .009). The effect size was weak (Eta-squared = 0.015). No significant differences were found on Luck/Perseverance (p = .327). One-way ANOVA on Illusion of Control showed significant differences. Games-Howell Post Hoc Test showed significant differences between Macao and Hong Kong, and between Macao and Porto (p < .001). The effect size was weak to medium (Eta-squared = 0.045).

Portrait Values Questionnaire (PVQ)

The reliability level was acceptable with Cronbach's Alpha range: 0.637 to 0.803. Significant differences were found with One-way ANOVA. Games-Howell Post Hoc Test showed that: Openness to Change: significant differences between Macao and Hong Kong (p<.001), and between Macao and Porto (p<.001); Conservation: significant difference between Macao and Hong Kong (p=.005), but not between Macao and Porto (p=.337); Self-Transcendence: significant differences between Macao and Hong Kong (p=.006), between Macao and Porto (p<.001); Self-Enhancement: significant differences between Macao and Hong Kong (p<.001), and between Macao and Porto (p=.008). Based on Schwartz's circular model of values (Schwartz, 1992), the level of Conservation and Self-Transcendence among the three cities is shown in a two-dimensional scattered plot in two orthogonal bipolar dimensions: with the x-axis opposes the poles of Self-Enhancement and Self-Transcendence, and the y-axis opposes the poles of Conservation and Openness-to-Change. The difference between the two opposing poles were subtracted from each other to form the locations of the three cities (See Figure 1). The three cities are more Open-to-Change, as compared to the negative score of the Conservation axis, and more Self-Transcendent. Macao and Hong Kong were more Conservative and less Self-Transcendent than Porto.

Figure 1. The Result of Portrait Values Questionnaire PVQ-21 of the Three Cities

Data Analysis on Relationship with Gambling Disorder

There were significant relationships between (1) mothers who required to work on shift (p = .022), (2) the perceived severity of gambling problem of participants' parents (p < 0.01), and (3) Family APGAR, with gambling disorder in Macao only (p = .049). The more severe gambling problem of parents perceived by participants, the more dysfunctional the family were, and the more participants who were at risk and with gambling disorder. In general, the more dysfunctional the family of participants, the higher chance they were at risk or suffer from gambling disorder. Besides, 31.8% of families with mothers working directly in gambling related industry were considered dysfunctional, which was comparatively higher than other occupations.

Non-Parametric Kruskal-Wallis test was used to measure the relationship between GBQ, Luck/ Perseverance, and Illusion of Control with Gambling Disorder. Non-parametric Mean Rank showed significant differences between GBQ, and Illusion of Control with gambling disorder in Macao (p=.000), Hong Kong and Porto. Significant differences between Luck/Perseverance and Gambling Disorder were found in Macao (p= .000) and Hong Kong (p=.005). That is, the high score of GBQ, and the Illusion of Control were associated with more gambling disorder in all three cities, but the higher score of Luck/Perseverance was associated with more gambling disorder in Macao and Hong Kong only. No significant differences were found between Openness to Change, and Self-Transcendence with gambling disorder in all three cities. Higher score of Conservation (p =.031) and Self-Enhancement (p=.031) were significantly associated with more gambling disorder in Macao. Specifically, first order values of Tradition (p=.013), Stimulation (p =.041) and Power (p=.017) scored higher for at risk and participants with gambling disorder, while Universal (p=.022) scored lower for at risk and gambling disorder.

Discussion

The hypotheses were validated by comparing Macao with Hong Kong and Porto. HS2.1 and HS2.2 was supported by the following findings. Parents in Macao are more acceptable to gambling: **Higher gambling participation rate:** 61.2% of participants in Porto never gambled, while only 37.3% in Macao and 42.7% in Hong Kong. **Entertainment as motive is higher:** The most common reason to gamble was "to seek entertainment": Macao (44%), Hong Kong (39.8%), Porto (30.4%), but Macao was significantly higher (p =.002). Started earlier: For those who have gambled, most started at age 12-14, but more participants from Macao and Hong Kong started to gamble at an earlier age. **Spent more on gambling:** Participants in Macao had higher spendings on gambling. It is uncommon for adolescents this age to have access to money in Porto, while a considerable amount of pocket money is given in Macao. Lower family function satisfactory level and more shift work of parents seems to result in parents giving out more pocket money as compensation of accompany time. Another reason might be the attitude of Chinese people that their children can "win in the starting line" by providing good quality (in terms of comfort, luxurious) living environment. **More family problems:** There were more "severely dysfunctional" families in Macao. Over 70% participants considered their family as functional in Porto as compared to only 29.7% in Macao. Functional family is a protective factor for adolescents to avoid gambling disorder. One way to improve family function in Macao is to tackle the gambling problem of parents themselves as the more severe the perceived gambling problem of parents, the more dysfunctional family the participants had, and the more the gambling problem. More participants' mothers were required to work on shift was related to more participants with gambling disorder in Macao. Although high percentage of the population working in the gambling related industries (19% father and 37.7% mother), no significant relationship was found with participants' gambling disorder. This is attributed to the attitudes of parents as on how they perceived their work and the type of work-related stories they share with their children. The parents' occupation therefore can both be a protective factor or risk factor to gambling addiction of adolescents, depending on the parental attitudes towards gambling.

The findings of HS2.3 was interesting as the results of Macao's GBQ and the two factor scores were lower than the results of Hong Kong and Porto. The reasons might be: (1) the scale is self-reported. With years of training on the harm of gambling addiction, adolescents should have learned about gambling related topics. They seemed to be equipped with the relevant knowledge at the cognitive level, and they should be more knowledgeable than adolescents in Hong Kong and Porto. But for those who are at risk, the GBQ scale is able to identify them. (2) The questionnaire was filled out right after the training when the information was freshly implanted. Even though the participants were asked to choose the answers which best represented them, their answers might be influenced by the knowledge they have just learnt. As of HS2.4, adolescents from Macao was least Open to Change, less Self-Transcendent than Porto and less Self-Enhanced than Hong Kong (See Figure 1). The

first order value of Tradition, Stimulation, and Power were higher, and Universalism was lower in Macao for at risk and gambling disorder participants. The value of tradition might be related to the Chinese traditional concept on gambling as a form of recreation and social entertainment. It is perceived as part of the Chinese lifestyle, history, and tradition (Shead et al., 2011). The long history of gambling industry in Macao might contribute to and reinforces the environmental influences. Stimulation is excitement, novelty, and challenge in life (Schwartz, 2003). Adolescents with high-risk propensity would tend to involve in high-risk behaviours because risk-taking is perceived to have greater benefits (Dickson et al., 2008). Power is defined as striving for social status and prestige, control or dominance over people and resources (Schwartz, 2003). Power is closely related to sense of control, which aligned with the findings that the Illusion of Control was higher for adolescents with gambling disorder.

Conclusion

An Explanatory Model of Adolescents Gambling Environment in Macao

An explanatory model is developed and is explained in a top-down approach, illustrating the relationship between different layers on the adolescents' gambling environment of Macao (See Figure 2).

Figure 2. An Explanatory Model of Adolescents Gambling Environment in Macao
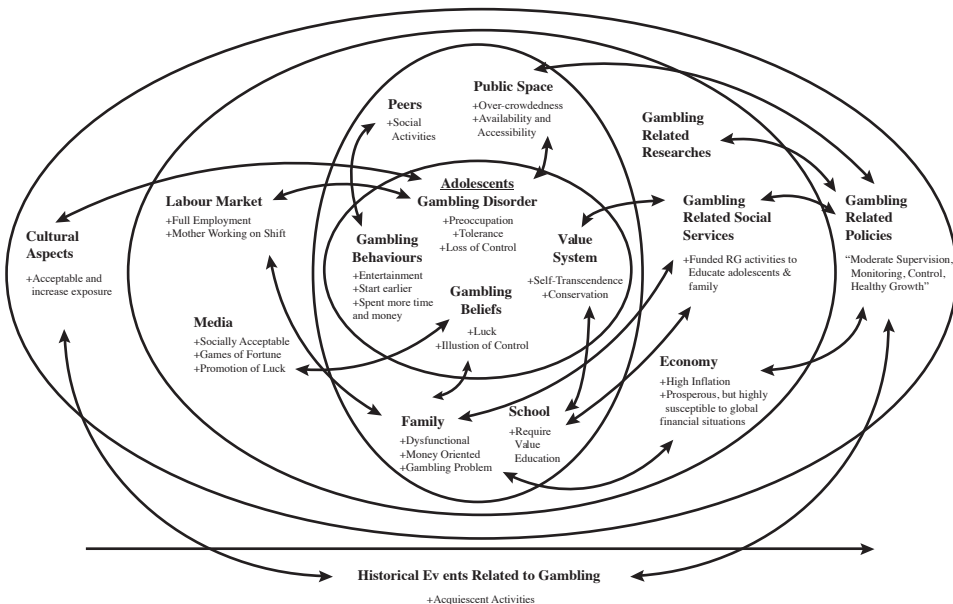
Note. + sign shows 'more' of the elements while – sign shows 'less'.

Arrows indicate the relationships between sub-systems.

Practical implications/recommendations for practice

Building resilience and addressing cognitive distortions is found to be an important protective factor in tackling adolescents' gambling disorder (Derevensky, 2012). Coping skills and assertiveness training targeting at risk individuals can provide tailor-made support. In addition to the concept of 'compensatory' (factors directly reducing problem behaviour) (Dickson et al., 2008), the concept of 'complementary' is added, that is, any form of structured supplements like activities, sports, hobbies etc. that can increase resilience with persistency, fortitude and assertiveness should be encouraged. Another recommendation is to increase adolescents' awareness of the relationship between gambling and themselves through affection. Only when they connect the negative impact of gambling with themselves that they are determined to say "NO" to gambling. Another protective factor is the value of Universalism, which incorporates understanding, appreciation, tolerance, and protection for all people. It helps to shift from personal needs to the needs of others. Programs such as volunteering, serving the society, etc. should be incorporated in schools as a part of civic or moral education. NGOs can provide training to parents and teachers on how to identify and screen at risk adolescents. Mother's working on shift was found to be a risk factor. Mothers, therefore, might need to be more thoughtful about their job choices. To support working mothers, family-friendly work environment with policies such as flexible working hours, part-time positions should be promoted. Another suggestion is to allow families with children under the age of 12 to apply for shift work exemption.

From academic level, it is suggested to implement systemic research at different stages so that adolescents' development can be better evaluated, and data can be provided to policymakers and service-providers. Evidence-based prevention programs should be incorporated into formal school curriculum to achieve continuity, consistency, and effectiveness. The concern of accessibility and availability of gambling venues required the government to take suitable action. From the policymakers level, it is highly recommended that the implementation of gambling regulations to be rigorous rather than loose. The original gambling law (No. 16/2001) was revised by (No. 7/2022) in June 2022, after being in place for over 20 years. The revision of gaming law is believed to be beneficial to the healthy and orderly development of the gaming industry, and to strengthen Macao's position as a world centre of tourism and leisure, promoting diversification and sustainability of livelihood development (Macao SAR Gaming Inspection and Coordination Bureau, 2022). But what is more important is whether the principle of harm reduction can be executed effectively and sustainable. Further evaluation is required for continuously monitoring of the situation. It is suggested to implement mandatory identity checking when entering casinos, and to raise the legal sports betting age to 21. It is also suggested to implement a stricter policy on gambling related advertisement and to move gambling venues away from local residential areas.

Limitations of the study

This cross-sectional design targeted Form 4 students, which makes the sample very specific and narrow. Another limitation is the time this questionnaire was filled out, which was right after the training. Their answers might be influenced by the knowledge they have just learned. Last but not least, the condition of COVID-19 made the data collection very difficult. Insufficient samples from Hong Kong and Porto might limit the findings not generalisable to the population but could only act as a reference on the gambling situation in the two cities.

Suggestions for further studies

It is suggested to (1) start analysing the gambling situation from younger ages as children in Macao starts to gamble earlier; (2) conduct longitudinal studies to allow a better understanding on the evolvement of individuals in different life stages and can better perceive the effects of the intervention programs. They provide valuable resources for policymakers and service-providers, but the implementation requires universities, government and NGO's collaboration to monitor the development of the population in one integrated effort; (3) conduct more qualitative studies to obtain and understand the subjective experience of gambling related phenomenon in Macao context; (4) further explore and test the model developed in this research as it is a preliminary model. The model can also act as a base for the development of other gambling preventive or intervention programs.

Concluding remarks

It is believed that a condition is multifaceted. Different factors, from personal to interpersonal, inter-relational, cultural, political, etc. are maintaining the condition. It is appropriate to take a system approach to investigate, analyse, and intervene with multidisciplinary involvement. By comparing Macao with other cities helped to better understand and to identify Macao's unique gambling conditions from a bioecological perspective. It is necessary to continue monitoring the impact on adolescents as environment is dynamic, ever-changing, especially as we enter the post-COVID-19 era and under the governance of the newly imposed gambling law.

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