Contribution of stressful life events to gambling activity in older age

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Abstract

Older subjects are susceptible to develop gambling problems, and researchers have attempted to assess the mechanisms underlying the gambling profile in later life. The objective of this study was to identify the main stressful life events (SLE) across the lifespan which have discriminative capacity for detecting the presence of gambling disorder (GD) in older adults. Data from two independent samples of individuals aged 50+ were analysed: n=47 patients seeking treatment at a Pathological Gambling Outpatient Unit, and n=361 participants recruited from the general population. Sexual problems (p<.001), exposure to domestic violent behavior (p<.001), severe financial problems (p=.002), alcohol or drug related problems (p=.004) and extramarital sex (p<.001) were related to a higher risk of GD, while getting married (p=.005), moving to a new home (p=.003) and moving to a new city (p=.006) decreased the likelihood of disordered gambling. The accumulated number of SLE was not a predictor of the presence of GD *(p=.732)*, but patients who met clinical criteria for GD reported higher concurrence of SLE in time than control individuals *(p<.001)*. Empirical research highlights the need to include older age groups in evidence-based policies for gambling prevention, because these individuals are at high risk of onset and/or progression of behavioral addiction related problems such as the GD. The results of this study may be useful for developing reliable screening/diagnostic tools and for planning effective early intervention programs aimed to reduce the harm related to the onset and evolution of problem gambling in older adults.

Keywords: Gambling disorder, Older adults, Stressful life events

Introduction

Recreational gambling has become a popular behavior among older adults. Point prevalence rates around 75% have been recorded in seniors participating in gambling activities (Welte, Barnes, Tidwell and Hoffman, 2011). Many older subjects enjoy gambling for pleasure and entertainment and do not suffer any negative consequences, but others are particularly susceptible to develop problem gambling habits or even disordered gambling.

Gambling disorder (GD) is as a behavioral addiction characterized by repeated, uncontrollable and problematic gambling behaviors that cause significant impairment and distress (American Psychiatric Association, 2013). Studies on GD within older age are scarce compared with the large number of works within other groups of age. In fact, no consensus exists regarding what is considered old age in this research area, and while some studies fix old age being 60-65 (the age required for becoming eligible for senior social programs), other works consider the onset of old age as 50+ years (at this age metabolism is down between 10-15%, and a variety of physical changes can cause health to decline with higher likelihood for physical and mental conditions). Aside from the definition of old age, early observational studies published lower rates of GD among older adults than among their younger peers, and though some recent prevalence studies have also reported lower estimates (Abbott, Romild and Volberg, 2018), most current epidemiological research has found that the incidence of individuals meeting criteria for disordered gambling among older adults is at least as high as at other developmental stages: between 0.7% and 1.7% in the study by Welte and colleagues (Welte et al., 2011), and between 0.1% and 11% in studies of lifetime problem gambling (Subramaniam, Wang et al., 2015; Tse, Hong, Wang and Cunningham-Williams, 2012). Differences in the estimated proportion for problem and disordered gambling in the older age have been related to methodological issues (such as sampling origin, clinical versus population-based), use of different measurement instruments, and definition of different age

thresholds (the lower bound for classifying older adults varies substantially across researches, from age 50+ to 70+ years or older). Cultural variations (mostly values and beliefs regarding gambling), historical context and the regulatory/legalization structures for the gambling activity are also powerful reasons to increase variability between the prevalence estimates among older adults, since these variables directly impact on the gambling behaviors and help-seeking attitudes (Subramaniam, Abdin et al., 2015). In any case, epidemiological data show that the frequency of gambling related problems in older adults is similar to those frequencies obtained in younger ages, and even that older adults constitute a sector of the population with special vulnerability. These evidences require new research to address what factors are related with the onset and progression of the GD. This study contributes with the analyses of the relationship pattern between the presence and frequency of life events (strong risk factors identified in adolescence and young adulthood populations) on the gambling profile among older adults.

The prevalence of GD at older ages is of particular concern because these individuals are less likely (often unaware or even in denial) of their problem gambling compared to younger counterparts, and only realize the extent of the problem when its most severe consequences have already occurred [such as financial loss, accumulating debt, involvement with the legal system due the illegal behaviors related to the gambling activity (forgery, fraud, theft or embezzlement to finance gambling)] (Bischof et al., 2014). Because of this situation, the real incidence of the problem in the general population may be under-estimated. Significant increases in the incidence rates are also expected in the coming years, largely as a consequence of the growth in the segment of older age in the demographic pyramid and the more than likely increase in their participation in the digital revolution, which will make gambling increasingly accessible, primarily through Internet platforms (Alberghetti and Collins, 2015; Ioannidis et al., 2018; Tse et al., 2012). And although the impact of these new

environmental conditions on the reward and cognitive control systems in older age is unknown, recent findings in neurocognitive research exploring the neural responses to stimuli that simulate betting on sports suggest that high exposure to gambling may be correlated with higher fronto-striatal activation and higher insular cortex activity and functional connectivity, and that receiving stimuli that increase users' confidence in their ability to win is associated with activation of the brain regions involved in affective decision-making, cognitive inhibitory control, and reward processing (Brevers et al., 2018).

This scenario is further aggravated by the high comorbidity between GD with other psychopathological disorders (Parke, Griffiths, Pattinson and Keatley, 2018), particularly in older age, such as substance use (Pilver, Libby, Hoff and Potenza, 2013; Rash, Weinstock and Van Patten, 2016) and mood and anxiety disorders (Assanangkornchai, McNeil, Tantirangsee, Kittirattanapaiboon and Thai National Mental Health Survey Team, 2016; Nicholson, Mackenzie, Afifi, Keough and Sareen, 2019; Parke et al., 2018). Poor physical health has also been strongly related with the presence of GD (Ariyabuddhiphongs, 2012) among older adults, particularly chronic medical conditions, heart disease and obesity-related problems (Desai, Desai and Potenza, 2007) (many of these multifactorial connections have been related with the sedentary nature of the gambling activity). Further the comorbidity between GD with other health problems among older adults, persistent and uncontrollable gambling activity has been also correlated with clinical significant difficulties. In global terms, GD influences on a lower quality of life, mainly defined as a pervasive sense of loneliness, social isolation, a pessimistic view of the future state of health, levels of guilt and shame, deceptive practices, heightened impulsivity, financial problems, and even illegal acts to finance gambling (Black, Coryell, McCormick, Shaw and Allen, 2017; Botterill, Gill, McLaren and Gomez, 2016; Subramaniam, Wang et al., 2015; Tira, Jackson and Tomnay, 2014). The inability to decide stop gambling has also been associated with increase in the age-related cognitive

impairments, such as unsuccessful perception of risk, increase in the severity of cognitive distortions, and impaired decision making (Bruneau et al., 2016; Levésque, Sevigny, Giroux and Jacques, 2018; Pilver et al., 2013), especially in activities related with cognitive functioning which involves the frontal cortex. Moreover, the practice of gambling is in itself a stress factor, with the consequence of potential neuro-chemical and neuro-physiological affectation (such as the elevated levels of dopamine, neropinephrine and cortisol) (Moccia et al., 2017), which can in turn increase the risk of previous chronic pathologies.

GD has been defined as a complex condition with multiple interacting biological, psychological and social factors. A recent systematic review of its etiology showed that certain variables seem to be almost universal risk factors which can contribute to the onset and progression of the GD within all groups of age (from adolescence to older adults) (N.A. Dowling et al., 2017): a) among socioeconomic features, male sex, younger age, economic disadvantage (low income, limited financial resources and unemployed status), unmarried, membership of an ethnic minority and low education levels; b) certain personality traits, specifically high levels of impulsivity, sensation seeking and under-controlled temperament; and c) poor health. Cognitive and behavioral constructs of the gambling profile have also been associated with emotion dysregulation or deficits in coping (Di Trani, Renzi, Vari, Zavattini and Solano, 2017; Rogier and Velotti, 2018), as well as with neural correlates in the brain's reward system typical of substance use-related disorders (Potenza, 2014; Rash et al., 2016). Cognition research studies have also found that problem gamblers (at younger and older ages) show high gambling-related cognitive biases, the most notable being the gambler's fallacy (i.e., that one is certain to win after a number of losses), selective memory (remembering wins rather than losses), illusions of associations related with gambling outcomes, and over-rating one's own skill for controlling these outcomes (Chrétien, Giroux, Goulet, Jacques and Bouchard, 2017; Lévesque, Sévigny, Giroux and Jacques, 2018). Finally,

twin studies have also obtained an aggregate influence of genetic factors in the risk of GD among both men and women (Davis, Slutske, Martin, Agrawal and Lynskey, 2019). But a major challenge ahead will be to identify the genetic variants that confer this risk, since molecular-genetic research on GD is lagging [to our knowledge only two studies with large samples have been published (Lang et al., 2016; Lind et al., 2013)], and no genome-wide significant single-nucleotide polymorphisms (SNPs) or genes have been detected.

The studies published suggest that all these risk factors, identified mostly at younger ages may also modulate the gambling profile at older age (Guillou Landreat, Cholet, Grall Bronnec, Lalande and Le Reste, 2019). But age-specific risk factors may also make older age a particularly vulnerable developmental stage for the onset and evolution of GD. As a whole, three clusters of risk factors have been identified as characteristic of the older adult problem gambler (Lorenz et al., 2014; Subramaniam, Chong, Satghare, Browning and Thomas, 2017; Tira et al., 2014; Welte et al., 2011): individual variables motivating and preceding the behavior (escaping from boredom, life stress, and negative emotional states), social and environmental problems (e.g., social isolation or loneliness), neurological vulnerabilities in the mechanisms related to behavioral regulation and diminished executive functioning (e.g., due to older age, substance-related impairments, general physical impairment or the effects of medication for illnesses such as Parkinson's). Etiological research has found that GD may be associated with unique clinical phenotypes among older adults and specific consequences. Monetary gain (a frequent motivation for gambling at younger ages) has not been identified a main motivation for the onset or progression of the gambling activity in older age individuals, who has reported as the most likely incentives relaxing, boredom, passing time, getting away for the day, and to achieve excitement or stimulation as a way of overcoming social isolation (e.g., due to the limited relationships with family and friends or the loss of a partner/spouse), to relieve boredom (e.g., generated by retirement) or to cope with physical-mental diseases

(Clarke, 2008; Martin, Lichtenberg and Templin, 2011). But once problematic gambling appears, the motivations of older adults may change, and they may prioritize responses to stress or emotional difficulties (Pattinson and Parke, 2017). Other studies have obtained that specific motivations significantly related with different gambling profiles among older gamblers (Stansbury, Beecher, Schumacher, Martin and Clute, 2015; M. van der Maas et al., 2017): gambling activity as a way of socialization, entertainment and excitement are related to a lower likelihood of gambling problems, while avoidance and monetary motives may be predictors of a higher risk of problematic or disordered gambling.

On the other hand, etiological research has also found that gambling can be a way for some individuals to reduce the effects of stress on their lives, particularly in later life. Routine daily situations characterized by acute stress seem linked to the urge to gamble among problem gamblers (Elman, Tschibelu and Borsook, 2010), and stressful life events (SLE) have been identified as powerful motivators and contributors to the onset of the gambling behavior, gambling severity, and changes in gambling habits over time (Bilevicius et al., 2018; Godinho, Kushnir, Hodgins, Hendershot and Cunningham, 2018; Hing, Russell, Tolchard and Nower, 2016; Luce, Kairouz, Nadeau and Monson, 2016). The consequences of SLE in either precipitating and/or perpetuating GD may appear in either the short or the long term, and some studies have found that even SLE during childhood, adolescence and early adulthood may be connected with the frequency and severity of later gambling behavior (Scherrer et al., 2007; Storr, Lee, Derevensky, Ialongo and Martins, 2012). Various theoretical assumptions have been postulated to explain the underlying links between stress management and gambling, most of them suggesting that emotional vulnerability to SLE may trigger gambling as a way of evading negative emotional issues and increasing their wellbeing (Wood and Griffiths, 2007). It seems that even after controlling for the individual differences (e.g., in impulsivity and coping ability), environmental SLE may affect the likelihood of

engaging in excessive gambling behavior (Welte, Wieczorek, Barnes, Tidwell and Hoffman, 2004). Neuropsychological research has also suggested that alterations in cognitive, executive and emotional feedback processing may be the result of stress-induced changes (Canale, Rubaltelli, Vieno, Pittarello and Billieux, 2017; Lighthall, Gorlick, Schoeke, Frank and Mather, 2013; Schiebener and Brand, 2015; Ungless, Argilli and Bonci, 2010): individuals who experience high levels of stress focus mainly on more immediate gratification and report difficulties in delaying rewards, mainly because the effects of dopamine increases in situations of stress correlate with a reduced interest in avoiding potential losses. Indeed, a recent meta-analysis reported three potential mechanisms that might explain the relationships between experiencing stress and deficits in decision-making in situations of risk and ambiguity (Starcke and Brand, 2016): a) experiencing acute stress increases the reliance on immediate high reward seeking at the cost of considering delayed losses, thus negatively affecting cognitive performance in the decision-making area; b) high stress levels correlate with excessive release of dopamine, noradrenaline and cortisol, which impairs executive control and leads to rushed and unsystematic decision-making; and c) certain personality variables (above all impulsivity) and the social context may moderate the negative influence of stress on decision-making performance (FeldmanHall, Raio, Kubota, Seiler and Phelps, 2015; Wise, Phung, Labuschagne and Stout, 2015).

Later life can be a time of particularly persistent stress, in particular for people who are frail and isolated. Older individuals may experience financial difficulties or insecurity, loss of physical ability (in particular, mobility), and may lose relationships with relatives and friends. These challenges may be aggravated by the occurrence of SLE and/or under the chronic stress experienced as a result of the SLE accumulated across the lifespan, which may make it more difficult for older age people with low ability in stress management techniques to adapt. Gambling may be attractive to these individuals as a means to cope and to escape

their own situations but others are particularly susceptible to develop problem gambling habits or even disordered gambling. Uncontrollable gambling is a stressor itself which may cause (or aggravate) very serious harm at any age (medical conditions, financial, social, and familial loss), but with a potentially great impact in vulnerable populations such as older adults. Unfortunately, studies focused in this section of the population remain rare subjects in literature, and new empirical studies are needed to broaden our understanding of the links between SLE and GD, in order to characterize GD specificities in older adults.

Aims

In summary, there exist a large number of studies to identify the risk factors of GD, on how these variables contribute to the onset and the progression of the disorder. Most of the works have been carried out with samples of young adults, and few studies have included samples composed by only older adults. However, current studies warn of the risk of gambling related problems within this sector of the population. Therefore, further empirical research is necessary in order adults to obtain a comprehensive profile of GD at this age, including its etiology and its motivations, which will help to improve screening/diagnosis and treatment for senior gamblers. On the other hand, SLE have demonstrated a powerful capacity for triggering gambling activity and for increasing GD severity in young adulthood, but it remains unknown whether discrete and/or single SLE are related to the presence of GD in older adults.

The objective of this study was to explore the contribution of a large set of SLE to the presence of GD at older age. Based on earlier empirical studies obtained in adolescence and young adulthood, we hypothesized that the greater the impact of the SLE, the higher the probability of presenting GD and the greater the GD severity also in older adults.

Material and methods

Participants

The data analysed here are from a research project carried out at the Pathological Gambling Outpatient Unit at the University Hospital of Bellvitge which assessed gambling habits in older age. This unit oversees the outpatient treatment of cases with behavioral addictions related problems, mainly GD, and it is certified as a tertiary care center for the treatment of these psychiatric conditions [tertiary care is a level of health care obtained from specialists in large hospitals (after referral from the providers of primary and/or secondary care), characterized by highly specialized equipment and expertise]. The catchment area of the Hospital of Bellvitge includes over two million people in the metropolitan area of Barcelona.

The total number of participants was n=408, in two independent samples: patients recruited from the clinical setting (the "clinical sample"; n=47) and participants recruited from the general population (the "community sample"; n=361). The only inclusion criterion was age 50 years or over. Exclusion criteria were the presence of an organic mental disorder, intellectual disability, neurodegenerative disorder (such as Parkinson's disease) or active psychotic disorder which reduced cognitive capacity and therefore the ability to complete the study's self-report questionnaires. Age 50 was selected as the lower bound for considering older adult based on the substantially variations in literature (usually from age 50+ to 70+ years). In fact, while the most developed countries usually characterize old age starting at 60 years and above (roughly equivalent to retirement ages), this is not a universal cut-off. The definition of old age in clinical research differs depending on multiple factors, such as the medical condition, the culture, the context or even the sex. The cut-off 50 coincides with the World Health Organization proposal, which sets 50 as the beginning of old age.

To ensure that the two samples had the same geographical origin, the participants in the community sample were contacted at the University of Barcelona podiatry and dental clinics, located on the same campus as the Bellvitge University Hospital between November 2016 and February 2018. In this sample, most participants were retired (n=354; 98.1%), were married (n=233; 61.8%) or widowed (n=110; 30.5%) and had a primary level of education or lower (n=309; 85.6%). As regards gender, 135 participants were men (37.4%) and the mean chronological age was 73.8 years (SD=8.4)

The clinical sample was recruited at the same period as the clinical group, and included 37 (78.7%) men, with a mean age of 70.0 years (SD=5.6). All the patients in this sample met DSM-5 criteria for GD. Most were married (n=29; 61.7%) or widowed (n=11; 23.4%), had a primary level of education or lower (n=41; 87.2%) and were retired (n=44; 93.6%).

Materials

Diagnostic Questionnaire for Pathological Gambling (according to DSM criteria) (Stinchfield, 2003). This questionnaire measures the presence of diagnostic criteria for GD through 19 items recoded on a binary scale (yes/no) based on the DSM-IV-TR (American Psychiatric Association, 2010). It provides a binary classification of GD (present/absent) and a dimensional measure of gambling severity (total number of DSM criteria for GD, obtained by summing the single criteria). Given the similarities for the GD criteria between DSM-IV-TR and DSM-5 (APA, 2013), this scale can also be used to measure the presence and severity of GD. The Spanish adaptation of the questionnaire was used (Cronbach's alpha α= 0.81 for the general population and α=0.77 for the clinical sample) (Jiménez-Murcia et al., 2009). Internal consistency for this scale in the study sample was excellent (α=0.92).

Life events. The identification of the personal stressors was based on the assessment of SLE across the lifespan through a questionnaire designed ad *hoc* for the research project, based on a previous scale also used for GD populations (Granero et al., 2020; Jimenez-Murcia et al., 2020). Considering as stressor any situation that potentially produces stress, the questionnaire covers a large set of experiences that may disrupt individuals' lives and cause substantial change and readjustment (such as moving to a new city or to a new country, loss of relative ones, severe illness, violent behaviors, involvements with law, financial problems, sexual problems, divorces, accidents, severe problems with family or friends, unwanted pregnancy, abortion, birth of a child, problems in parenting, job changes/promotions/losses or extramarital sex. Total number of different life event covered by the questionnaire was 31 life events (see Table 1). For each SLE, the initial scoring is binary (1 if the life event has happened and 0 if it has not), and if a positive answer was obtained for the presence of the life event complementary questions are required: the number of times it occurred, their age at first time of the event and the degree of its influence (measured with a scale ranged zero-moderate-some-considerable). The questionnaire does not have a cut-off point: it is scored on the basis that the more life events the older adults has been through, the greater the likelihood of some form of longer impact on the adult. The internal consistency in the study sample was good (α=0.75).

Other variables. The additional data analysed were recorded through a semi-structured interview, which measured socio-demographics [sex, education, marital status, employment status and income, and socio-economic position according to the Hollingshead scale (based on the participants' education and profession; (Hollingshead, 2011)] and other gambling problem-related variables (e.g., bets per gambling/episode or debts accumulated due to gambling).

Procedure

All procedures were carried in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Bellvitge University Hospital (Ref: PR286/14). The semi-structured interview was conducted by psychologists and psychiatrists highly experienced in the assessment and treatment of GD. The clinicians also helped participants to complete the self-report questionnaires so as to guarantee the absence of missing data.

Statistical analysis

Statistical analysis was carried out with Stata16 for windows (Stata-Corp, 2019). To explore which SLE achieved statistically significant discriminative capacity for identifying the presence of GD, two groups were considered in the study: GD-present (n=52, merging all the participants from the clinical sample plus the five individuals from the community sample who met clinical criteria for GD), versus GD-absent (n=356, the subset of the community sample who did not meet criteria for GD). Next, discriminant function analysis (DFA), chi-square tests (χ^2) and the t-test were used to detect any differences between the two groups in terms of the SLE occurrence and impact.

In this study, DFA was used to order the contribution of the SLE measures for differentiating between participants who did and did not meet clinical criteria for GD. In this procedure, standardized discriminant function coefficients are interpreted in an analogous way to standardized regression coefficients in linear regression (partial correlations), indicating the relative relevance of the indicators for predicting the criterion (the higher the absolute value of the coefficient, the greater the discriminative capacity of the indicator). The structure matrix function (also known as canonical loading) represents the correlations between the observed variables and the unobserved discriminant functions (dimensions), considering the

values with absolute loadings equal or higher than 0.24 to be relevant (Huberty and Olejnik, 2006).

In addition, the effect size for the mean and proportion differences was estimated with Cohen's *d* coefficient [low-poor effect size was considered for $|d|>0.20$, moderate-medium for $|d|>0.5$ and large-high for $|d|>0.8$; (Kelley and Preacher, 2012)], and the Finner method (a family wise error rate stepwise procedure) was used to control the increase in type-I error due to multiple statistical tests (Finner, 1993).

Results

Distribution of the SLE in the study

The most frequent SLE in the sample were loss of family members or close friends due to death (80.9%), retirement (78.4%), moving to a new home (76.0%), getting married (68.6%), birth of children (61.0%), severe illness of family or friends (59.8%) and moving to a new city (59.8%) (Figure 1, first panel). The least frequent SLE were unwanted pregnancy (3.9%), domestic violence (3.4%), sexual problems (2.9%) and conflicts with the law (2.2%). The number of different SLE across the lifespan ranged between 0 and 20 in the sample (Figure 1, second panel). Most study participants reported experiencing one or more of the SLE analysed in this study at some point in their lives (n=403, 98.8%), and 54.2% reported experiencing between six and ten. No differences by sex were found for the mean number of different stressors [mean was for men 7.98 (SD=3.69), and for women 7.87 (SD=3.80); p=.762]. Comparison between men and women for the presence of each life event only reported statistical differences for extramarital sex (higher prevalence for men compared to women: 10.5% versus 1.3%, p<.001).

--- Insert Figure 1 ---

The first panel in Figure 2 displays the ordered bar-chart with the mean impact of the SLE (the mean for each stressful event was calculated for participants who reported its occurrence). The highest impact was for loss of family members or close friends due to death (2.34 on a scale 0-3), followed by severe illness of family members or friends (2.34), severe illness of the participant (2.20) and exposure to domestic violence by family members or friends (2.11). The second panel in Figure 2 shows the frequency of SLE experienced with any level of impact. In all, 63.2% of the sample experienced between two and seven SLE with an impact on their lives. No differences by sex were found for the mean impact of the SLE [mean for men was 5.29 (SD=3.54), and for women 5.90 (SD=3.80); p=.009]. Comparison between men and women for the mean impact related to the presence of each life event did not achieved statistical differences p>.05 for all the stressors).

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SLE with discriminative capacity for identifying GD

Table 1 presents the discriminative capacity of the presence of SLE for identifying GD in seniors. The SLE are listed in order according to their relevance and capacity to differentiate between the groups. These results indicate that the presence of GD was related to a higher prevalence of extramarital sex, sexual problems, domestic violence, financial problems and alcohol or other drug-related problems, and to a lower prevalence of moving to a new home, getting married and moving to a new city.

--- Insert Table 1 ---

Table 2 displays the discriminative capacity of the impact related to SLE for identifying GD in seniors, ordered according to their relevance for differentiating between the groups. The presence of GD was significantly associated with higher impact of domestic violence, extramarital sex, sexual problems, alcohol or other drug-related problems, conflicts with the law, retirement and financial problems.

--- Insert Table 2 ---

Contribution of the age of SLE to the presence of GD

Table 3 displays the results for comparing the age of the first occurrence of SLE between patients who met and did not meet clinical criteria for GD. The comparison was obtained for the SLE that obtained discriminative capacity (occurrence or impact) to identify the disordered gambling. Age at the first occurrence of the SLE achieved statistical significance or effect size in the moderate to large range for sexual violence (older age in the GD-absent group), domestic violence (older age in the GD-absent group), financial problems (older age in the GD present group), getting married (older age in the GD-present group) and retirement (older age in the GD-present group). Due to the small sample size of some of the groups, the results in this table must be interpreted with caution.

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Contribution of the accumulated SLE measures to the presence of GD

Table 4 shows the results of comparing the study groups the accumulated SLE measures (total number of SLE across the lifespan, age at first and last SLE occurrence, and time since the first and last SLE). The results indicate that the presence of GD was related to higher age at the time of the first SLE occurrence and lower mean time since the first and last SLE occurrence.

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Figure 3 displays a summary of the main results of the study, showing the SLE with capacity for identifying the presence of the GD, the potential contribution of the impact and age of occurrence.

--- Insert Figure 3 ---

Discussion

The present study aimed to identify the SLE across the lifespan and their impact that are most strongly associated with an increased risk of GD in later life. The results showed that the likelihood of GD was increased for individuals who reported sexual problems, were exposed to domestic violence, had severe financial problems, presented alcohol or drug-related problems and reported extramarital sex. For these sets of SLE, the higher the impact was also related to greater risk of GD. In addition, retirement and conflicts with law were risk factors for GD, independent of their impact. Moving to a new home or to a new city and getting married were protective factors which decreased the likelihood of GD.

Despite the increasing participation in recreational gambling among older adults, few studies have focused on the nature and course of problem and disordered gambling in this population. Most of the empirical evidence available for GD has been obtained from younger populations (mainly from adolescents and young adults) and few studies have been conducted specifically in samples of large numbers of older age people (Guillou Landreat et al., 2019; Subramaniam, Wang et al., 2015; Tse, Hong and Ng, 2013; Tse et al., 2012). This study contributes to this research area, and provides empirical evidence regarding the stressors related with disordered gambling activities in older adults.

Considering the SLE that protect against GD (moving to a new home, moving to a new city, and getting married), getting married is particularly relevant. Older adults are more likely to lose their spouse, and to be a widower has been considered as a particular stressor for the onset/progression of the gambling related problems (Guillou Landreat et al., 2019). Since younger age of marriage was also related to the absence of disordered gambling in this study, we were able to assess the specific contribution of marriage to the development of GD after adjusting for domestic violence and sexual problems, resulting in an odds ratio OR=0.37 (inverse OR=2.70, p=.002). This evidence reinforces the contribution of having a partner to attenuating the risk of gambling, and is consistent with previous research which concluded

444 that unpartnered older adults are more likely to gamble and present more problem gambling
445 probably as a result of social isolation and loneliness (Elton-Marshall et al., 2018; Godinho et
446 al., 2018). These results also corroborate those of previous research which have emphasized
447 the important role of close family members in the initiation and maintenance of gambling
448 activities (Subramaniam et al., 2017).

449 Some stressors which obtained discriminative capacity for the presence of GD in our
450 study were relatively infrequent (specifically, involvement with the legal system, sexual
451 problems, domestic violence, alcohol and other drug-related problems, and extramarital sex).
452 These results are consistent with those of some previous reports, and highlight the relevance
453 of these stressors and their severe long-term consequences, even though they affect only a
454 small segment of the population. The results for domestic violence are particularly important.
455 Some studies have found that early negative experiences related with violence, such as abuse
456 or trauma, are linked to GD in later life and to higher gambling severity (Felsher, Derevensky
457 and Gupta, 2010); intimate partner violence at different stages of adulthood has also been
458 related to increased likelihood of problem gambling and GD (Roberts et al., 2017). However,
459 while evidence of a relationship between family violence and problem gambling is growing,
460 the underlying mechanisms are not clear. In a sample of treatment-seeking problem gamblers,
461 Suomi et al found a high prevalence of some form of violence among the patients (recorded in
462 around 61%), no gender differences in perpetration and victimization, a higher incidence of
463 bidirectional violence (44%) compared to perpetration only (11.3%) or victimization only
464 (6%), and a direct relationship between being a victim of intimate partner violence and the
465 onset of GD or increased gambling severity (Suomi et al., 2019). In any case, these results are
466 particularly relevant, since current reports indicate that domestic violence is under-identified:
467 a high proportion of individuals exposed to violence by a partner or spouse do not recall being

asked about it, independent to the multiple impacts of this severe stressor on the daily functioning (Nicki A Dowling et al., 2018).

Our study also shows that older retired adults and those who have experienced financial difficulties are particularly susceptible to develop problem gambling. Previous research has associated these specific SLE with the onset of the gambling problems or with the evolution of risky gambling habits over time (Luce et al., 2016). Considered simultaneously, it has been postulated that retirement may be the most powerful SLE for gambling activity in older age. In fact, although monetary gain seems to be a frequent motivation for the onset of gambling at younger ages, in older subjects it appears less significant than other incentives such as seeking excitement or relieving the boredom generated by retirement (Clarke, 2008; Martin et al., 2011). Of course, if gambling becomes problematic, the motivations of older individuals may become monetary due to their fear of financial difficulties (Stansbury et al., 2015; M. van der Maas et al., 2017, 2019); this may explain the older age of occurrence of the financial problems stressor in the group who met criteria for GD. Furthermore, we stress that in our study it was not retirement per se that was associated with the presence of GD, but the higher impact and the relatively younger age of its occurrence.

In our study the number of different SLE accumulated across the lifespan was not a significant predictor of the presence of GD. This unexpected result is at odds with the findings of previous research; for example, a recent cross-lagged analysis suggested that the higher the number of SLE, the greater the increase in the severity of problem gambling 12 months later (Luce et al., 2016). Moreover, many of the specific SLE analysed in our study were not related to the presence of disordered gambling. There are a number of possible explanations for our results. First, the potential attenuation effect of specific variables on the links between specific and cumulative SLE over the lifespan with gambling severity should be borne in

493 mind. Roberts and colleagues found that the contribution of specific powerful stressors to
494 pathological gambling was largely attenuated when adjusted for probable alcohol and drug
495 dependence (especially the latter) effects (Roberts et al., 2017), suggesting that the
496 concurrence of various SLE with different impacts on GD may result in spurious relationships
497 when analysed separately, simply due to a statistical bias. Roberts et al.'s study also argues
498 against considering a summative effect of various SLE on gambling activity, and favors an
499 assessment of the specific conditions and the repercussions of each stressor. The study by
500 Storr and colleagues also concluded that the mere acknowledgement of experiencing SLE was
501 not associated with increased odds of presenting gambling behavior, but that gambling
502 severity was significantly increased when modeling the circumstances of each SLE
503 (specifically, SLE directly experienced as threatening or SLE involving deviant/violent
504 behaviors) (Storr et al., 2012). Secondly, it has been suggested that regardless of the initial
505 motivation for starting to gamble, once the behavior becomes problematic the motivations of
506 older individuals may shift to coping with the stress or emotional difficulties directly related
507 to the urge to gamble (Martin et al., 2011; Pattinson and Parke, 2017); this may also attenuate
508 the capacity of SLE occurring at younger ages to identify GD at older age.
509
510 *Limitations*
511 The most important limitation of the study is the retrospective character of the design:
512 a) the measurement of SLE relied on individual recall, which may be inaccurate and subject to
513 bias; and b) the difficulty of assessing temporal relationships restricts the possibility of
514 inferring causes. Other limitation is the low frequency of some SLE in the study and in the
515 clinical sample of patients who met diagnostic criteria for GD prevented us from obtaining a
516 fuller picture of the links between SLE across the lifespan and disordered gambling in older
517 age. And related with the above, although the large set of stressors analyzed in this work, the

questionnaire used could not cover all the potential factors that happened to individuals and were related with the onset and/or the progression of the GD (future research should assess what other specific events could influence gambling activity among older adults).

On the other hand, this study analyzed groups with a different origin: a population-based sample and a clinical GD sample. All the participants were recruited for a research project with older adults, which relatively short duration made a difference in the sample sizes for the groups (361 control participants versus 47 GD patients). However, it should be noted that although the unequal sample size for the groups, this aspect should not be considered as a limitation since the sizes of the groups are large enough to guarantee the statistical power. In fact, based on methodological considerations, we decided to use the maximum number of subjects from each subsample to contribute to the improvement of the external validity of the research (selecting subjects in order to have equivalent samples in size could include an unnecessary selection bias in this research) (Hocking, 2013; C. J. M. Maas and Hox, 2005).

Conclusions

Compared to younger age individuals, older adults are highly vulnerable to gambling-related problems due to specific age-related risk factors, among them the occurrence of SLE and the impact of these events on their lives. Older adults constitute a heterogeneous group with life experiences, values and attitudes shared across generations (Alberghetti and Collins, 2015), which make this group of special relevance for the study of the gambling profiles. Our findings can broaden our understanding of the etiological mechanisms underlying gambling severity in seniors, by identifying specific SLE over the lifespan with discriminative capacity for detecting the presence of disordered gambling. The results indicate the need to reduce the impact of the stressful events most strongly related to the onset and evolution of gambling severity as a target of preventive and clinical interventions.

However, this study is pioneer, and the sample size for the GD group is relatively low. Future research is needed to obtain a more complete picture of the specific links between SLE over the lifespan, psychological and physical co-morbidities, and other individual and social factors related with the gambling phenotype in older ages. Path-analyses defining and estimating the mediational mechanisms underlying gambling severity in this segment of the population may lead to significant improvements in the areas of prevention and early intervention and treatment. As we had hypothesized based on the literature for adolescence and young adulthood ages SLE impact on the gambling profile among older adults. But our study adds new valuable information: specific stressors experienced at different ages could have different effects on the GD, some of them even decreasing the likelihood of presenting this behavioral addiction. The design of assessment tools, preventive programs and intervention therapies specific for older adults should consider these concrete events, since as more information is available on the gambling behavior of these individuals as more efficient the programs used to tailor their specific needs.

Finally, the signs of problematic and disordered gambling may be subtle among older adults, and in some cases other family members or close friends do not realize the scope of the problem until they help them pay bills or balance a checkbook. Primary care physicians and geriatricians, the professionals closest to older people and responsible to monitor their health and medication, should have reliable and effective tools to explore the presence of gambling related problems during their routine visits, since early identification of these impairments could contribute to reduce greater damage. On the other hand, some older adults live alone, have few relationships with other family members, have limited income and are more likely not to access treatment compared to other age groups. This subgroup may feel particularly embarrassed about potential consequences of problematic gambling (such as cumulate debs or financial losses) contributing to higher reluctance to seek help. Educational

568 programs and preventive services addressed to increase public awareness of the potential
569 problematic behaviors related to gambling activities could contribute to responsible gambling
570 to reduce harm within older age. Evidence-based programs including the specificities of older
571 adults are also required to effectively treat the GD.
572

Statement of Ethical Approval

All procedures were carried in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Bellvitge University Hospital (Ref: PR286/14).

Declaration of Contribution of Authors

Conceptualization and design: RG, SJM. Data Analysis and Interpretation of Data: RG, SJM. Formal Analysis: RG. Funding Acquisition: SJM, FFA. Investigation: TMM, GMB, MGP, LM, NA, EC, CVA, MLM, CM, ZA, JSG, GSL, IS, HLG, IB, BM. Methodology: RG, SJM. Project Administration: SJM, FFA, JMM. Resources: AdPG. Supervision: SJM. Validation: AdPG. Visualization: SJM, IG, MGB, AS. Writing - Original Draft Preparation: RG, SJM. Writing- Review & Edition: SJM, RG.

Statement of Conflict of Interest

No potential conflict of interest was reported by the authors.

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Table 1 Discriminative capacity of the presence of SLE for identifying GD

	GD absent (*n*=356)		GD present (*n*=52)					
	n	%	*n*	%	*p*	|*d*|	|SMF|	|SCDFC|
Extramarital sex	9	2.5%	12	23.1%	**<.001***	**0.65†**	.611	.533
Sexual problems	5	1.4%	7	13.5%	**<.001***	**0.51†**	.459	.332
Violent behavior	8	2.2%	6	11.5%	**.001***	0.37	.324	.313
Severe financial problems	60	16.9%	18	34.6%	**.002***	0.41	.286	.349
Moving into new home	279	78.4%	31	59.6%	**.003***	0.41	.277	.272
Alcohol/drugs related problems	11	3.1%	6	11.5%	**.004***	0.33	.267	.252
Getting married	253	71.1%	27	51.9%	**.005***	0.40	.260	.245
Moving to a new city	222	62.4%	22	42.3%	**.006***	0.41	.258	.141
Conflicts with the law	6	1.7%	3	5.8%	.061	0.22	.175	.034
Severe illness (family-friends)	218	61.2%	26	50.0%	.123	0.23	.144	.147
New people living at home	73	20.5%	6	11.5%	.126	0.25	.142	.157
Jobs changes	132	37.1%	14	26.9%	.154	0.22	.133	.124
Birth of a child	221	62.1%	28	53.8%	.256	0.17	.106	.057
Victim of violent behaviors	66	18.5%	13	25.0%	.271	0.16	.102	.138
Retirement	282	79.2%	38	73.1%	.315	0.14	.093	.098
Domestic violence (family/friend)	18	5.1%	1	1.9%	.317	0.17	.093	.148
Severe illness	120	33.7%	21	40.4%	.344	0.14	.088	.007
Problems with family or friends	28	7.9%	6	11.5%	.371	0.12	.083	.051
Moving to other country	34	9.6%	3	5.8%	.375	0.14	.082	.124
Family or friend victim violence	41	11.5%	4	7.7%	.411	0.13	.076	.033
Problems at work	32	9.0%	3	5.8%	.439	0.12	.072	.110
Victim of accidents	54	15.2%	10	19.2%	.452	0.11	.070	.009
Loss of family/friends (deaths)	286	80.3%	44	84.6%	.464	0.11	.068	.206
Loss of family/friends (fights)	75	21.1%	9	17.3%	.531	0.10	.058	.117
Problems in parenting	23	6.5%	4	7.7%	.739	0.05	.031	.051
Divorce	39	11.0%	5	9.6%	.771	0.04	.027	.112
Abortion (individual or partner)	31	8.7%	4	7.7%	.807	0.04	.023	.072
Loss of job	43	12.1%	6	11.5%	.911	0.02	.010	.024
Unwanted pregnancy	14	3.9%	2	3.8%	.976	0.00	.003	.029
Job promotion	48	13.5%	7	13.5%	.997	0.00	.000	.069
Seeing an accident	48	13.5%	7	13.5%	.997	0.00	.000	.029

Note. GD: gambling disorder. SLE: stressful life event.

SMF: structure matrix function. SCDFC: standardized canonical discriminant function coefficients.

*Bold: significant comparison. †Bold: moderate-mild (|*d*|>0.50) .802to large-high (|*d*|>0.80) effect size.

Table 2 Discriminative capacity of the impact of SLE for identifying GD

	GD absent (*n*=356)				GD present (*n*=52)						
	Not	*Little*	*Some*	*A lot*	*Not*	*Little*	*Some*	*A lot*	*p*	|SMF|	|SCDFC|
Violent behavior	98.3%	0%	1.4%	0.3%	90.4%	0%	1.9%	7.7%	**<.001***	.402	.514
Extramarital sex	98.0%	0.6%	1.4%	0%	86.5%	5.8%	7.7%	0%	**<.001***	.400	.404
Sexual problems	99.2%	0%	0.3%	0.6%	92.3%	0%	1.9%	5.8%	**.002***	.370	.194
Alcohol/drugs related problems	97.5%	1.4%	0.8%	0.3%	90.4%	1.9%	1.9%	5.8%	**.002***	.360	.079
Conflicts with the law	99.2%	0.6%	0.3%	0%	94.2%	1.9%	1.9%	1.9%	**.014***	.330	.310
Retirement	54.8%	24.2%	13.8%	7.3%	46.2%	15.4%	15.4%	23.1%	**.002***	.290	.447
Severe financial problems	83.7%	3.1%	7.0%	6.2%	69.2%	7.7%	17.3%	5.8%	**.023***	.189	.109
Birth of a child	61.2%	9.3%	11.0%	18.5%	73.1%	9.6%	5.8%	11.5%	.325	.181	.176
Moving to a new city	67.1%	14.9%	11.2%	6.7%	76.9%	15.4%	3.8%	3.8%	.302	.174	.265
Violent behavior (family/friend)	94.9%	0.8%	2.2%	2.0%	100%	0%	0%	0%	.432	.162	.176
Severe illness (family-friends)	41.6%	5.3%	18.8%	34.3%	55.8%	3.8%	9.6%	30.8%	.200	.157	.297
Moving to other country	94.4%	2.8%	1.7%	1.1%	92.3%	0%	3.8%	3.8%	.183	.141	.269
Moving to a new home	57.6%	21.9%	15.2%	5.3%	71.2%	13.5%	9.6%	5.8%	.267	.138	.082
Getting married	65.7%	8.4%	14.9%	11.0%	75.0%	7.7%	7.7%	9.6%	.499	.124	.234
Abortion (individual or partner)	92.4%	0.6%	2.8%	4.2%	94.2%	3.8%	1.9%	0%	.062	.119	.143
Divorce	91.6%	2.2%	2.8%	3.4%	90.4%	0%	1.9%	7.7%	.325	.093	.150
Direct victim of violent behaviors	83.4%	4.2%	5.9%	6.5%	76.9%	7.7%	7.7%	7.7%	.625	.086	.195
Loss of family/friend (fights)	79.8%	5.9%	9.8%	4.5%	86.5%	3.8%	3.8%	5.8%	.467	.084	.221
Job changes	78.4%	12.6%	6.5%	2.5%	84.6%	7.7%	5.8%	1.9%	.741	.080	.014
Severe illness	68.5%	4.5%	10.4%	16.6%	61.5%	7.7%	11.5%	19.2%	.677	.078	.097
New people living at home	85.4%	8.4%	3.7%	2.5%	88.5%	1.9%	1.9%	7.7%	.080	.057	.052
Loss of family/friend (deaths)	89.6%	4.5%	3.7%	2.2%	88.5%	1.9%	7.7%	1.9%	.471	.051	.133
Job promotion	90.7%	2.8%	4.5%	2.0%	90.4%	7.7%	0%	1.9%	.139	.050	.026
Problems at work	91.3%	3.4%	4.2%	1.1%	94.2%	1.9%	1.9%	1.9%	.757	.047	.072
Loss of job	89.6%	2.0%	4.2%	4.2%	90.4%	1.9%	5.8%	1.9%	.835	.037	.061
Seeing an accident	22.2%	4.5%	25.0%	48.3%	19.2%	11.5%	17.3%	51.9%	.133	.014	.234
Victim of accidents	86.0%	2.8%	6.2%	5.1%	86.5%	3.8%	3.8%	5.8%	.889	.013	.099
Problems with family or friends	92.4%	2.2%	2.0%	3.4%	88.5%	7.7%	1.9%	1.9%	.175	.012	.037
Unwanted pregnancy	96.6%	0.3%	1.4%	1.7%	96.2%	1.9%	0%	1.9%	.356	.007	.031
Family/friend victim of violence	91.3%	2.8%	2.8%	3.1%	92.3%	1.9%	1.9%	3.8%	.950	.004	.055
Problems in parenting	93.3%	1.4%	3.9%	1.4%	92.3%	3.8%	1.9%	1.9%	.539	.000	.046

Note. SLE: stressful life event. GD: gambling disorder. *Bold: significant comparison.

SMF: structure matrix function. SCDFC: standardized canonical discriminant function coefficients.

Table 3 Discriminative capacity of the age at the time the SLE occurred for identifying the presence of GD

		GD absent (*n*=356)		GD present (*n*=52)			
	n	*Mean*	*SD*	*Mean*	*SD*	*p*	|*d*|
Extramarital sex	21	37.67	15.06	34.11	15.93	.633	0.23
Sexual problems	12	52.75	20.71	36.00	11.53	.268	**1.00†**
Domestic violence	14	33.25	5.38	26.40	10.06	.263	**0.85†**
Severe financial problems	78	30.26	12.98	42.63	16.63	**.022***	**0.83†**
Moving to new home	310	26.56	14.72	31.44	20.26	.116	0.28
Alcohol/drug-related problems	17	31.86	11.81	35.75	23.36	.717	0.21
Marital status: married	280	24.35	5.26	27.20	7.07	**.014***	0.46
Moving to a new city	244	25.15	16.49	22.35	14.43	.465	0.18
Conflicts with the law	9	36.40	22.69	50.00	28.28	.527	**0.53†**
Retirement	320	62.78	4.11	61.03	4.78	**.027***	0.39

Note. SLE: stressful life event. GD: gambling disorder. SD: standard deviation.

*Bold: significant comparison. †Bold: moderate-mild (|*d*|>0.50) .802 to large-high (|*d*|>0.80) effect size.

Table 4 Comparison between groups for the measures of accumulated SLE

	GD absent (*n*=356)		GD present (*n*=52)			
	Mean	*SD*	*Mean*	*SD*	*p*	|*d*|
Total number of different SLE	7.94	3.65	7.75	4.39	.732	0.05
Age at first SLE (years-old)	22.72	17.24	29.92	22.98	**.008***	0.35
Age at last SLE (years-old)	62.80	14.07	62.50	11.56	.883	0.02
Time since first SLE (years)	51.34	19.25	40.34	22.22	**<.001***	**0.53†**
Time since last SLE (years)	11.31	13.30	7.81	9.75	**.048***	0.30

Note. SLE: stressful life event. GD: gambling disorder. SD: standard deviation.

SMF: structure matrix function. SCDFC: standardized canonical discriminant function coefficients.

*Bold: significant comparison. †Bold: moderate-mild (|*d*|>0.50) .802 to large-high (|*d*|>0.80) effect size.

Figure 1 Distribution of SLE occurrence in the study (*n*=408)

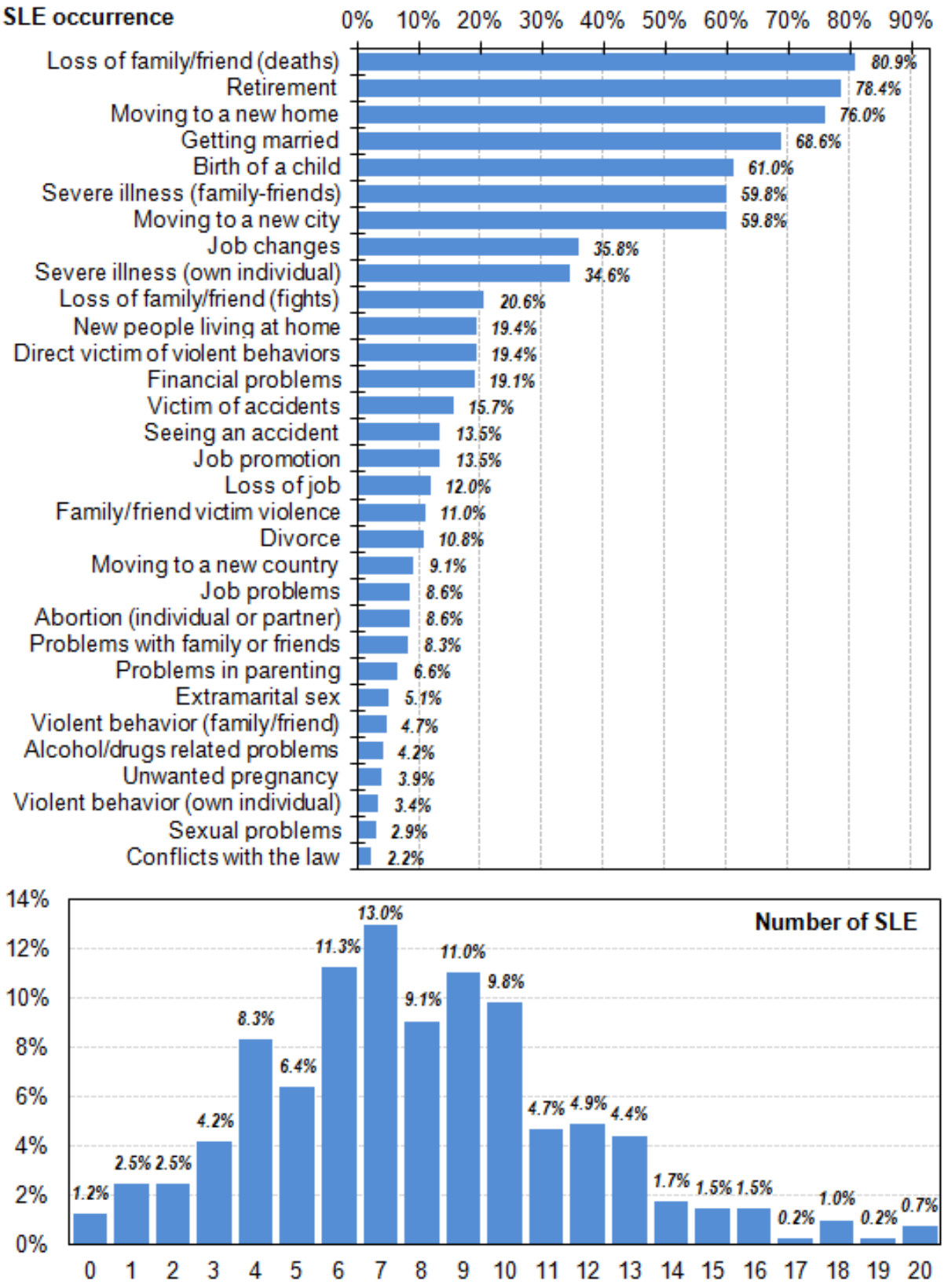

Figure 2 Distribution of the impact of SLE in the study (*n*=408)

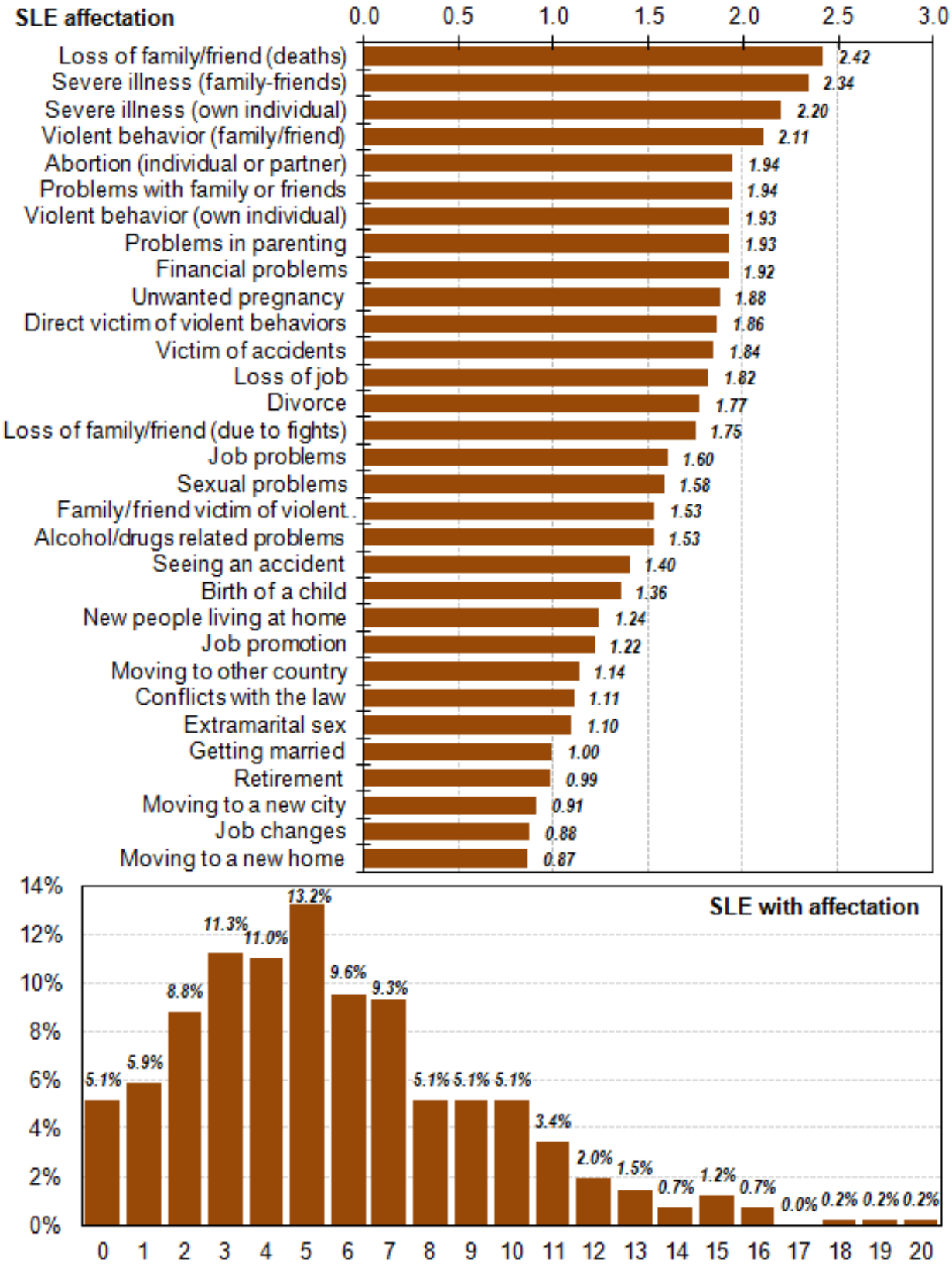

Figure 3 Summary of results: SLE with discriminative capacity as risk factors or protective factors for identifying the presence of GD

Note. SLE: stressful life event. GD: gambling disorder.