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The cumulative effect of multiple dimensions of lifestyle on risky drinking during the Covid-19 pandemic

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ABSTRACT

Lifestyle impacts morbidity and mortality worldwide. Herein, we evaluated the association of a multidimensional lifestyle measure and its domains (diet/nutrition, substance use, physical activity, social, stress management, sleep, environmental exposure) with risky drinking. Also, we analyzed the cumulative effect of unhealthy domains in the likelihood of presenting risky drinking. To reach these objectives, data from a web survey conducted in Brazil and Spain was analyzed. The main outcome was risky drinking assessed by the AUDIT-C. Lifestyle was measured using the Short Multidimensional Inventory Lifestyle Evaluation (SMILE). Fixed logistic models were used to evaluate associations between lifestyle and risky drinking. Between April and May 2020, 22,785 individuals answered the survey. The prevalence of risky drinking was 45.6% in Brazil and 30.8% in Spain. The SMILE score was lower (unhealthier lifestyle) among at-risk drinkers. Worse scores on Diet, Substance use, Stress management and Environment were associated with an increased likelihood of risky drinking. The higher the number of unhealthy domains, the higher the likelihood of presenting risky drinking: adjusted odds ratio (aOR) for risky drinking was 1.15 (IC95% 0.98–1.35) and 23.42 (IC95% 3.08–178.02) for those presenting worse lifestyle in 1 and 5 domains, respectively. Finally, interactions suggest that improvement in lifestyle domains would have a larger effect in Spain than in Brazil. Our results suggest that future interventions aiming at reducing Risky drinking may benefit from strategies targeting multiple domains of lifestyle.

1. Introduction

Increased alcohol consumption during the COVID-19 has been a topic of debate (Rehm et al., 2020). Studies indicate that the majority of individuals kept their drinking at the same levels then before the pandemic (Garnett et al., 2021; Pollard et al., 2020; Gritsenko et al., 2020; Sidor and Rzymski, 2020; Rolland et al., 2020; López-Bueno et al., 2020; Anne et al., 2020; Sun et al., 2020), although increased harmful drinking has also been documented (Ammar et al., 2020). Decreasing the harmful use of alcohol is a specific objective of the Sustainable Development Goals (SDGs) since it is a leading risk factor for burden of disease worldwide (WHO, 2018; Organization WH, 2017; Griswold et al., 2018). Accordingly, alcohol use is estimated to be the 5th/6th more relevant risk factor for death and disability in Brazil and Spain, respectively (IHME I for HM and E. Burden of Disease, 2017; IHME, 2017).

Avoiding risky substance use, including alcohol, is also one of the Lifestyle Medicine pillars- the other being diet/nutrition, physical activity, social support, restorative sleep, and stress management. Lifestyle factors (LF) have been associated with several non-communicable diseases (NCDs) (Lippi et al., 2020; Chen et al., 2020; Nyberg et al., 2020), mental health disorders (Firth et al., 2020), decreased survival time without disability, and mortality (Wu et al., 2020a; Lee et al., 2020; Ruiz-Estigarribia et al., 2020; Wu et al., 2020b). In addition, LF tend to

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cluster and present an additive effect on decreased survival time without disability and mortality (Nyberg et al., 2020; Lee et al., 2020; Wu et al., 2020b; Loef and Walach, 2012). Up to 2020, epidemiological studies did not include all of the lifestyle domains when evaluating mortality. Most of them included smoking, alcohol use, body mass index and physical activity (Nyberg et al., 2020; Lee et al., 2020; Wu et al., 2020b; Loef and Walach, 2012). Ruiz-Estegarria et al. expanded the number of LF in their analysis - including sleep, time spent with friends and time spent watching TV - to also show the additive effect of those LF on mortality (Ruiz-Estigarribia et al., 2020).

During the COVID-19 pandemic, the combination of unhealthy LF was estimated to account for more than 50% of the population attributable fraction of severe COVID-19 in the UK (Hamer et al., 2020). Increase on unhealthy nutrition and screen time, decreased physical activity and worst sleep patterns have been reported (Ammar et al., 2020; Stanton et al., 2020; Gomes et al., 2020; Pišot et al., 2020; Romero-Blanco et al., 2020). Evidence regarding alcohol use in those studies has been mixed, but individuals who increased alcohol consumption were more likely to present depression and anxiety, loneliness, anger and psychological distress (Gritsenko et al., 2020; Lechner et al., 2020). Considering the cluster of LF, and its possible syndemic effect, there is an emerging need to investigate the interplay of different LF. For instance, during the current pandemic, changes on sleep and increased stress were associated with increased drinking (Neill et al., 2020), while better social support and wellness were associated with decreased alcohol use (Rolland et al., 2020; Lechner et al., 2020). Increased food intake, interestingly, was associated with both augmented and decreased alcohol use (Neill et al., 2020; Huber et al., 2020).

Evaluating harmful alcohol use/ alcohol abuse/light-moderate alcohol use disorders (according to WHO, DSM-IV or DSM-5 classifications, respectively (APA, 2002; APA, 2013)) through the lenses of Lifestyle Medicine/Psychiatry may bring new approach to understand and intervene on risky drinking – in addition to the well consolidated psychosocial and public health approaches. Thus, the objectives of the present manuscript are twofold: to evaluate the association of each lifestyle domain with risky drinking, and to evaluate the cumulative effect of unhealthy lifestyle domains in the likelihood of presenting risky drinking. These objectives were evaluated in the context of two countries, Brazil and Spain, that present different economic profiles, different stages of the COVID-19 pandemic and different alcohol-related policies.

2. Methods

An anonymous web survey, programmed in SurveyGizmo®, was conducted from April 20–May 20, 2020 (Brazil) and April 15–May 15, 2020 (Spain), as described elsewhere (Balanzá-Martínez et al., 2020; De Boni et al., 2020a). A convenience sample of adults from both sexes was recruited via social networks using a snowball technique and sponsored social network advertisements. Due to the lack of parameters to estimate the sample size for the original study, a 30 day-period of data collection was pre-specified.

2.1. Outcome

Screening for risky drinking was performed using the Alcohol Use Disorder Identification Test (AUDIT-C). A cut-off ≥3 presents 95% sensitivity and 60% specificity for detecting heavy alcohol and alcohol abuse or dependence (Bush et al., 1998). Thus, herein we considered a cut-off ≥3 as 'risky drinking'.

2.2. Variables and measurements

Lifestyle was measured using the Short Multidimensional Inventory Lifestyle Evaluation (SMILE) (Balanzá-Martínez et al., 2020), developed to allow a multidimensional measure of lifestyle. It comprises 27 items evaluating 7 domains (Diet and Nutrition, Substance use, Physical activity, Stress management, Restorative sleep, Social support, and Environmental exposure (i.e., screen time before bed)). Answers are measured through a 4-point Likert scale, and scores are calculated by summing the responses (some questions have inverted score). The higher the SMILE score, the healthier the lifestyle pattern.

Demographic information included sex, age, educational level, number of people living in the house, working status (if working on the front line), and time of social distancing/self-isolation. The COVID-19 questions were: 'Have you been diagnosed with COVID-19?', 'Have you been admitted to a hospital/hospital stay due to COVID-19?', and 'Have you lost a significant one?'. Self-rated health (SRH) was measured using the question 'How would you rate your health in general?' (Jylhä, 2009). Current depression was screened using Patient Health Questionnaire-2 (PHQ-2 (Kroenke et al., 2003), with cut-off ≥ 3), and current anxiety was screened using the Generalized Anxiety Disorder 7-item (GAD-7 (Sousa et al., 2015), cut-off ≥ 10). Previously diagnosed conditions were investigated using the question 'In the last 12 months, have you been diagnosed by a medical doctor or health professional, or received treatment for any of the following conditions? (IBGE, 2014), and conditions were aggregated as chronic diseases, mental health disorders, and infectious diseases.

2.3. Statistical analysis

For continuous numerical variables, we presented frequencies using medians and interquartile intervals. Mann-Whitney tests were performed to compare central tendencies. For nominal/categorical variables, we presented absolute and relative frequencies, and tested independence using chi-square and Fisher's exact tests.

All the SMILE items/questions were evaluated for their frequency and association with risky drinking, stratified by country (Supplementary Material 1). The original score of each domain is calculated by summing the responses of each domain's item. However, domains present different numbers of items (for instance, there are five questions to evaluate Diet/Nutrition while only one evaluates Physical Activity). To make them comparable, all the scores from the SMILE domains were scaled to 0 to 1 range by $z_i = (d_i - \min(d))/(\max(d)-\min(d))$, where $d = (d_1, \ldots, d_n)$ is each independent SMILE domain and z_i is then the ith domain's scaled data. Therefore, all the scores from the SMILE scaled domains range from 0 to 1. The comparison of the distribution of the original and scaled score domains may be seen in the Supplementary Material 2. The SMILE scaled domains by country, risky drinking, sex, and age were presented using radar plots.

To test the association of each independent variable with risky drinking we performed fixed-effects generalized linear parametric model with a logistic link function (Binomial family). Every model was adjusted by country, sex, age, education, household members, depression, and anxiety. *P*-values of adjusted Odds Ratios were corrected by the number of comparisons using the Bonferroni correction.

Of those, three sets of models (i.e., 15 models) were performed to evaluate the association of SMILE domains with risky drinking: In the first set, each SMILE domain was considered as the continuous 0-1score (multiplied by 100 to facilitate the interpretation of odds ratios (OR) as percent-increments). In these models, for each domain, we also included high-order interaction-terms among country and age. To estimate marginal mean aOR values and its 95% confidence intervals for high-order interactions, we kept all other variables (i.e., the domain evaluated, country, sex, age, education, household members, depression and anxiety) either in their mean values or proportions-Supplementary Material 3.

In the second set of models, the score of each SMILE scaled domain was categorized as binary "Worse" or "Better". The optimal cut-off points for dichotomizing the scores were selected as the ones that minimize the *p*-value for the Chi-squared test evaluating the association between the dichotomic score and risky drinking.

Finally, to evaluate the effect of multiple unhealthy lifestyle domains, we created a new ordinal variable by summing up the aforementioned "Worse" domains that were positively associated with risky drinking. Thus, response options for this new variable ranged from 0 to 5.

All the statistical analyses were performed in the software R v.3.6.3 and the library 'emmeans' and its dependencies.

2.4. Ethical aspects

The study was approved by the *Comissão Nacional de Ética em Pesquisa* (CONEP, Brazil - 3.968.686) and the Ethics Committee at the Hospital Universitari i Politècnic La Fe, in Valencia, Spain (2020-149-1). The survey was anonymous (no identification - name, zip code or IP address was collected) and participants read the consent form and confirmed their interest in participating in the first screen of the online questionnaire. As a direct benefit, participants found information on lifestyle and reliable websites and telephone numbers to find information regarding COVID-19.

3. Results

Overall, 22,785 individuals completed the survey (19,256 in Brazil and 3529 in Spain). Most were female (68.2%), median age was 37 years (IQR 28–51), and 74.3% presented higher education or more. Most of the sample (58.4%) was employed and 16.4% considered themselves as essential workers. The overall prevalence of risky drinking was 43.3% (45.6% in Brazil and 30.8% in Spain). The characteristics of the sample stratified by risky drinking may be found in Table 1. The same characteristics stratified also by country may be found in the Supplementary material 3.

Table 1 also shows that demographic factors associated with an increased likelihood of risky drinking were to live in Brazil, age between 18 and 40 years old, to be employed or to have lost the job during the COVID-19 pandemic (compared to be not unemployed), to present a higher education level and to live alone. None of the COVID-19 questions was associated with risky drinking. Regarding the comorbidities, presenting a 12-month diagnosis or treatment for chronic diseases decreased the likelihood of risky drinking while presenting a current positive anxiety screening increased it.

Lifestyle was worse among risky drinkers (SMILE score 77.0 (s.d. ± 9.0)) as compared to non-risk drinkers (SMILE score 79.2, s.d. ± 9.1). In addition, lifestyle was worse in Brazil (SMILE score 77.8, s.d ± 9.2) compared to Spain (SMILE score 80.3, s.d. ± 8.2).

Regarding the SMILE domains, Fig. 1 shows that risky drinkers presented worse scores for substance use irrespectively of country, sex or age. Younger individuals from Brazil, regardless of risky-drinking and sex, presented the worst scores in all the domains- except for social support.

Models results either adjusted (aOR) or not (OR) by country, sex, age, education, household members, depression, and anxiety, and risk drinking are presented in Table 2. The first set of models evaluates SMILE scaled scores, the higher the score, the better the lifestyle. Higher scores (taken here as a percent-increase) in the SMILE domains of Diet/Nutrition, Substance use, Stress management and Environmental exposure were associated with a decreased likelihood of risky drinking. Conversely, higher scores on Physical Activity and Social Support were associated with increased likelihood of risky drinking. Statistically significant incremental association likelihoods for risk drinking between

Table 1
Characteristics of the sample by risky drinking, and binomial models evaluating the association of Demographics, Covid-19 factors, and comorbidities with risky drinking, $n = 22{,}785$. Brazil and Spain, 2020.

Feature	Level	Risky drinking		OR (CI95%)	aOR (CI95%)	Bonferroni
		No	Yes			Adj.p-value
Demographics						
Country	Spain	2440 (18.9%)	1089 (11.03%)	Ref.	Ref.	Ref.
	Brazil	10,469 (81.1%)	8787 (88.97%)	1.88 (1.74–2.03)	1.69 (1.56–1.83)	< 0.001
Sex	Female	8899 (68.94%)	6632 (67.15%)	Ref.	Ref.	Ref.
	Male	4010 (31.06%)	3244 (32.85%)	1.09 (1.03–1.15)	1.07 (1.01–1.13)	0.864
Age	(41–100]	5714 (44.26%)	3311 (33.53%)	Ref.	Ref.	Ref.
	(0–41]	7195 (55.74%)	6565 (66.47%)	1.57 (1.49–1.66)	1.49 (1.4–1.58)	< 0.001
Employed	Yes	7137 (55.29%)	6088 (61.64%)	1.35 (1.27–1.42)	1.26 (1.19–1.34)	< 0.001
	Unemployed due COVID-19	397 (3.08%)	383 (3.88%)	1.52 (1.31–1.76)	1.44 (1.24–1.67)	< 0.001
Essential worker	Yes	2196 (17.01%)	1549 (15.68%)	0.91 (0.85–0.97)	0.98 (0.91–1.06)	1
Frontline worker	Yes	766 (5.93%)	513 (5.19%)	0.87 (0.77–0.97)	0.99 (0.88–1.12)	1
Studying	Yes	2043 (15.83%)	1481 (15%)	0.94 (0.87–1.01)	0.88 (0.82–0.96)	0.078
Education	Primary/secondary	3505 (27.15%)	2343 (23.72%)	Ref.	Ref.	Ref.
	University degree	6493 (50.3%)	5066 (51.3%)	1.17 (1.09–1.24)	1.17 (1.09–1.25)	< 0.001
	Masters/PhD	2910 (22.54%)	2467 (24.98%)	1.27 (1.18–1.37)	1.36 (1.25–1.47)	< 0.001
Household members	1	1519 (11.77%)	1369 (13.86%)	Ref.	Ref.	Ref.
	2–3	7356 (56.98%)	5756 (58.28%)	0.87 (0.80–0.94)	0.83 (0.76–0.9)	0.001
	4–9	4010 (31.06%)	2739 (27.73%)	0.76 (0.69–0.83)	0.73 (0.67–0.8)	< 0.001
COVID-19 related						
Self- isolated	Yes	3101 (24.02%)	1968 (19.93%)	0.79 (0.74–0.84)	0.95 (0.89–1.02)	1
Time isolated	None	2384 (18.47%)	1339 (13.56%)	Ref.	Ref.	Ref.
	1–4 weeks	1185 (9.18%)	1014 (10.27%)	1.52 (1.37–1.7)	1.21 (1.08–1.36)	0.09
	5+ weeks	8620 (66.78%)	7092 (71.81%)	1.46 (1.36–1.58)	1.15 (1.06–1.24)	0.09
Covid-19 diagnosis	Yes	131 (1.01%)	87 (0.88%)	0.87 (0.66–1.14)	0.96 (0.72–1.26)	1
Lost someone	Yes	1046 (8.1%)	694 (7.03%)	0.86 (0.77–0.95)	0.9 (0.82–1.00)	1
Comorbidities						
Chronic disease 12-month	Yes	4237 (32.82%)	2812 (28.47%)	0.81 (0.77–0.86)	0.87 (0.82–0.93)	0.001
Mental disorder 12-month	Yes	3907 (30.27%)	3216 (32.56%)	1.12 (1.06–1.19)	0.99 (0.93–1.05)	1
Infectious disease 12 -month	Yes	427 (3.31%)	347 (3.51%)	1.06 (0.92–1.23)	0.99 (0.85–1.14)	1
Current Depression	Yes	5559 (43.06%)	5045 (51.08%)	1.38 (1.31–1.46)	1.11 (1.04–1.19)	0.066
Current anxiety	Yes	5429 (42.06%)	4888 (49.49%)	1.35 (1.28–1.42)	1.12 (1.05–1.20)	0.036
Self-rated health	Regular/bad/very bad	3596 (27.86%)	2694 (27.28%)	0.97 (0.91–1.03)	0.93 (0.87–0.99)	0.926

For each feature it was performed a Generalized linear model adjusted by country, sex, age, education, household members, depression, and anxiety. The Reference category for dichotomous yes/no features is "No".

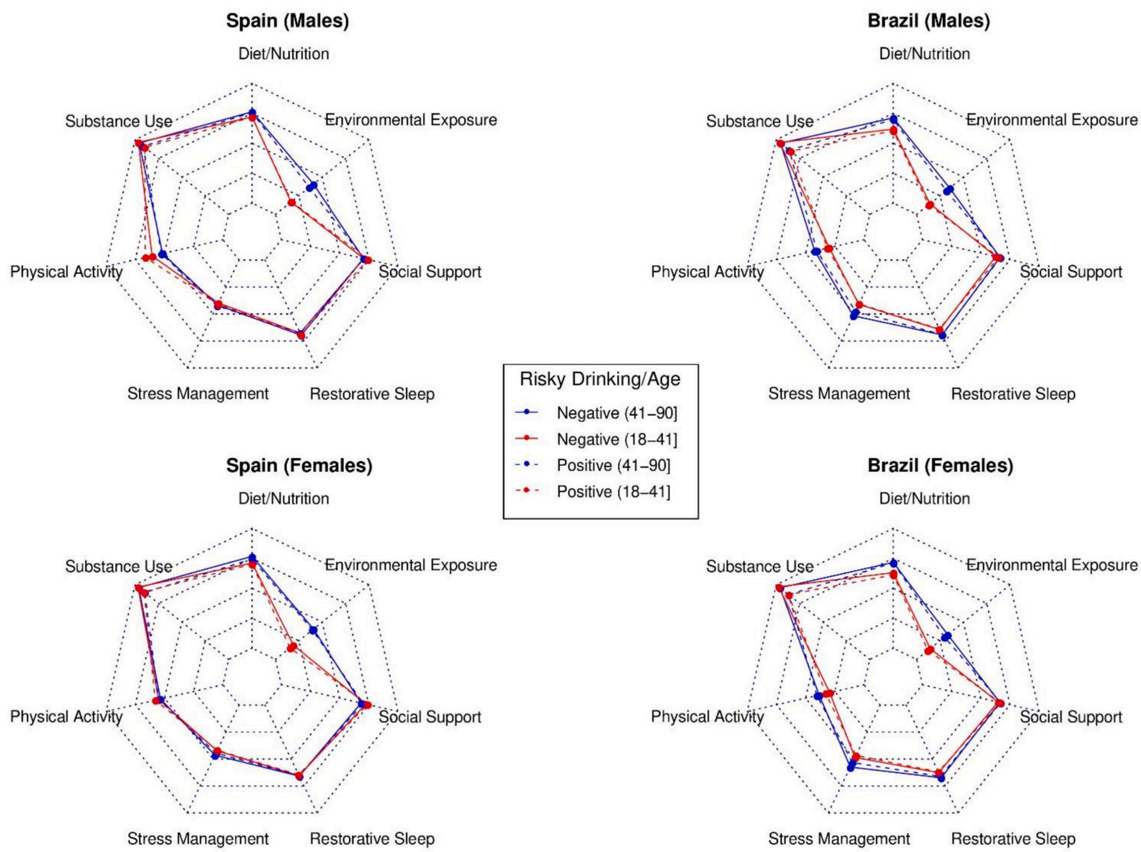

Fig. 1. SMILE scaled domains by country, risky drinking, sex, and age. Spain (n = 3529) and Brazil (n = 19,256), 2020.

Brazil and Spain by age groups in each SMILE domain were found (Supplementary Material 4). For each percentage improvement in the SMILE domains (better lifestyle), the decrease in risky drinking aOR was lower in Brazil compared to Spain. This means that improvement in lifestyle domains have a larger effect in Spain than in Brazil. In addition, this effect is even more important among those aged between 18 and 40 years compared to those older than 41 years.

The second set of models shows each SMILE domain dichotomized following an optimal cut-off, thus individuals categorized as 'better', present higher SMILE scores and those categorized as 'worse' present a lower score. For instance, among those presenting a worse diet, 50.69% were risky drinkers and for those presenting worse substance use, 89.53% were risky drinkers. In the binomial models, the associations have the same direction as presented when SMILE domains were evaluated as continuous variables: individuals categorized as presenting a worse lifestyle into Diet, Substance use, Stress management, and Environmental Exposure were more likely to present risky drinking. Those categorized with worse Physical Activity and Social Support were less likely to be risky drinkers. Finally, in the last model, we summed the number of worse domains for each individual and observed that the higher the number of compromised lifestyle domains, the higher the likelihood of presenting risky drinking. For instance, participants categorized as presenting a worse lifestyle in one domain presented an aOR 1.15 (0.98–1.35) for risky drinking while those presenting a worse lifestyle in 5 domains had an aOR 23.42 (3.08–178.02).

4. Discussion

The present study shows the association between risky drinking and the multidimensional evaluation of lifestyle and its specific domains. An overall unhealthy lifestyle was associated with an increased chance of risky drinking. Specifically, presenting unhealthy scores into diet/nutrition, substance use, stress management and environmental exposure were associated with increased likelihood risky drinking. Of note, healthy scores on social support and physical activity were also associated with increased risky drinking too. Moreover, we found the higher the number of unhealthy lifestyle domains, the higher the likelihood of presenting risky drinking. In addition, we showed that improvements in lifestyle would have a larger effect in Spain than in Brazil, and this effect would be even larger among younger participants.

Our data shows that lifestyle behaviors are interconnected, may influence each other, and, possibly, other health outcomes. Such findings support the concept of lifestyle as a multidimensional construct (Balanzá-Martínez et al., 2020), challenging our way to think, develop and evaluate interventions designed to reduce harmful drinking. Up to now, during the COVID-19 pandemic, the most common explanation for a possible increase on alcohol drinking has been the self-medication hypothesis (McPhee et al., 2020) - probably due to the associations of increased drinking with depression and anxiety (Garnett et al., 2021; Schmits and Glowacz, 2021; Capasso et al., 2021). However, lifestyle factors were the strongest predictors of poor mental health in our previous analysis including essential workers (De Boni et al., 2020b), and their importance on the incidence and severity of mental health problems has been already described (Firth et al., 2020). It is likely that individuals presenting a previous unhealthy lifestyle would have a narrow repertoire of strategies to deal with the prolonged stress derived from the pandemic and were already at-risk drinkers. In addition, an interesting Belgian study, showed that motivation for drinking during the pandemic was mostly the same as the pre-pandemic period among college students (social and coping motives) (Bollen et al., 2021). This finding may be helpful in explaining the association of at-risk drinking with good social support, as individuals could use more alcohol when socializing. The association of at-risk drinking with good scores on physical activity is intriguing and deserves evaluation in future studies.

Table 2
Binomial models evaluating the associations of SMILE scale domains, dichotomous SMILE domains and the accumulation of 'worse' SMILE domains with risky drinking, $n = 22{,}785$. Brazil and Spain, 2020.

	Level	Risky drinking		aOR (CI95%)	Bonferroni
		No	Yes		Adj.p-value
A. SMILE scaled domains*					
Diet/nutrition	Median (IQR)	66.67 (20)	66.67 (66.67)	0.996 (0.994–0.998)	<0.001
Substance use	Median (IQR)	100 (0)	91.67 (16.67)	0.907 (0.903–0.91)	<0.001
Physical activity	Median (IQR)	33.33 (66.67)	33.33 (66.67)	1.002 (1.001–1.003)	<0.001
Stress management	Median (IQR)	50 (27.78)	44.44 (22.22)	0.993 (0.991–0.995)	<0.001
Restorative sleep	Median (IQR)	66.67 (33.33)	66.67 (25)	0.999 (0.997–1)	1
Social support	Median (IQR)	66.67 (27.78)	66.67 (27.78)	1.007 (1.005–1.009)	<0.001
Environmental exposure	Median (IQR)	0 (33.33)	0 (33.33)	0.996 (0.995–0.997)	<0.001
B. SMILE dichotomized domains**					
Diet/nutrition	Better	11,830 (57.44%)	8767 (42.56%)	Ref	Ref
	Worse	1079 (49.31%)	1109 (50.69%)	1.13 (1.03–1.24)	0.067
Substance use	Better	12,900 (56.83%)	9799 (43.17%)	Ref	Ref
	Worse	9 (10.47%)	77 (89.53%)	9.69 (4.84–19.41)	<0.001
Physical activity	Better	1817 (57.63%)	1336 (42.37%)	Ref	Ref
	Worse	11,092 (56.5%)	8540 (43.5%)	0.9 (0.83–0.97)	0.052
Stress management	Better	8219 (58.84%)	5750 (41.16%)	Ref	Ref
	Worse	4690 (53.2%)	4126 (46.8%)	1.19 (1.13–1.27)	<0.001
Restorative sleep	Better	993 (63.29%)	576 (36.71%)	Ref	Ref
	Worse	11,916 (56.17%)	9300 (43.83%)	1.18 (1.06–1.32)	0.017
Social support	Better	10,632 (55.9%)	8387 (44.1%)	Ref	Ref
	Worse	2277 (60.46%)	1489 (39.54%)	0.72 (0.66–0.77)	<0.001
Environmental exposure	Better	6264 (60.7%)	4056 (39.3%)	Ref	Ref
	Worse	6645 (53.31%)	5820 (46.69%)	1.16 (1.10–1.23)	<0.001
C. Accumulation of worse SMILE domains***					
Number of domains	0	510 (66.49%)	257 (33.51%)	Ref	Ref
	1	4216 (62.27%)	2554 (37.73%)	1.15 (0.98–1.35)	0.472
	2	4960 (55.76%)	3935 (44.24%)	1.39 (1.19–1.64)	0.001
	3	2690 (51.55%)	2528 (48.45%)	1.56 (1.32–1.84)	<0.001
	4	532 (47.58%)	586 (52.42%)	1.68 (1.38–2.06)	<0.001
	5	1 (5.88%)	16 (94.12%)	23.42 (3.08–178.02)	0.023

SMILE =Short Multidimensional Inventory for Lifestyle Evaluation.

* Scores for each SMILE domain were re-scaled to 0–1 range.

** Each domain was dichotomized following the optimal cut-offs (diet = 0.47, substance use = 0.42,Physical activity = 1, stress management = 0.44, sleep = 1,Social support = 0.5, environmental = 0.33.

*** Domains presenting aOR <1 (physical activity and social support) were not included in the sum. All the regressions are adjusted by country, sex, age, education, household members, depression, and anxiety.

Naugthon et al., (Naughton et al., 2021) described an increase in strength physical activity and a small increase on the AUDIT-C scores during the lockdown in UK, but how these behavior will evolve remains unknown.

The increased effect of multiple unhealthy lifestyle domains in the prediction of risky drinking supports lifestyle evaluation as a multidimensional construct. This means that no matter which domain is unhealthy, the larger the number of unhealthy domains, the most likely will be unhealthy alcohol use. The lowerSMILE score among at-risk drinkers provides similar information reinforcing the SMILE as a valid way to perform lifestyle multidimensional evaluation. We believe such multidimensional evaluation represents a shift on lifestyle research. Overall, previous studies mostly evaluate one or a maximum of three combined lifestyle behaviors simultaneously (Firth et al., 2020) although healthy lifestyle indexes and scores are becoming more frequent (Nyberg et al., 2020; Wu et al., 2020b). These kinds of evaluation make it hard to differentiate why Lifestyle Medicine/Psychiatry would distinguish from the consolidated study of behavioral risk factors or Behavioral medicine. Nowadays, technology, big data analytics and artificial intelligence may give us a unique opportunity to understand and intervene on lifestyle using a holistic and integrated approach. Moreover, behavioral and mental health sciences may provide important contributions to further evolve the concept of lifestyle as a multidimensional construct (Balanzá-Martínez et al., 2020).

The prevalence of risky drinking was higher in Brazil than in Spain, and country of living remained as a risk factor after controlling for all other variables. In addition, we found significant associations with risky drinking by country and age, on all the lifestyle domains. We already described higher prevalences of depression and anxiety in Brazil compared to Spain during the COVID-19 pandemic (De Boni et al., 2020b). We hypothesized that those differences, as well as the one found here, may be related to the syndemic effect of social determinants of health among individuals living in Brazil. The present findings are somewhat discouraging because even if lifestyle scores improve, the decrease in risk drinking would be less significant in Brazil than in Spain. Such findings emphasize the importance of enforcing public health measures, such as tax increases and decreased availability, to decrease the harmful use of alcohol - as widely known in the field (Babor et al., 2003).

None of the COVID-19 questions was associated with risky drinking. Considering data was collected in the very beginning of the pandemic, this may indicate that changes in drinking behavior, and other behaviors, may take longer to occur and repercuss into daily routine. Regarding the comorbidities, presenting a 12-month diagnosis or treatment for chronic diseases decreased the likelihood of risky drinking, whereas presenting a current positive anxiety screening increased it. These findings may reflect results from other studies indicating that most individuals did not change their alcohol use pattern as a direct response to COVID-19 pandemic (Garnett et al., 2021; Pollard et al., 2020; Gritsenko et al., 2020; Sidor and Rzymski, 2020; Rolland et al., 2020; López-Bueno et al., 2020; Anne et al., 2020; Sun et al., 2020) but rather as a mediating effect of anxiety and depression (Naughton et al., 2021).

Limitations of the study include the non-probabilistic nature of the sample, as other websurveys (de Boni, 2020). Women, who usually drink less than men (WHO, 2018), were overrepresented in both countries, but we were not able to find any difference on risky drinking between gender after adjusting for multiple comparisons. Social desirability bias regarding alcohol use may not be excluded but considering the frequency and normalization of alcohol drinking behavior in both countries (WHO, 2018), it is unlikely that individuals who usually drink would feel embarrassed by answering the AUDIT-C questions. In addition, the cross-sectional design precludes inference on causality. This means that it is not possible to know if unhealthy lifestyle causes risky drinking or risky drinking deteriorates other health behaviors. It is also not possible to evaluate if all unhealthy behaviors have another underlying cause (Sharma et al., 2018; Brutman et al., 2020; Boers et al., 2020). Additional longitudinal studies are necessary to disentangle such questions. Furthermore, the effect of lifestyle on neurobiology, reward system and impulse control- which are all affected by alcohol drinking- remains to be evaluated. However, either from public health or lifestyle medicine perspective, improving all these behaviors (which includes limiting alcohol use) may decrease morbidity and mortality in the long run (Nyberg et al., 2020; Lee et al., 2020).

Finally, our findings support risky drinking to be evaluated in the context of a multidimensional approach of lifestyle. Future interventions should consider multiple lifestyle domains simultaneously, and the particular syndemic effect of social determinants of health among individuals living in low-middle income countries. Such interventions may be personalized and feasible profiting from major advances in artificial intelligence and technology.

Authors' contributions

RBDB conceived the study and wrote the first draft of the manuscript. MRA and JCM analyzed the data. MG assisted on literature review. All authors revised the manuscript and provided significant intellectual contribution. All the authors approved the submitted version.

Conflicts of interest

VBM has been a consultant, advisor, or Continuing Medical Education speaker over the last 3 years for the following companies: Angelini, Ferrer, Lundbeck, Nutrición Médica, and Otsuka. The remaining authors have no conflicts to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2021.106718.

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