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AIMS Public Health

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Predicting emerging and re-emerging disease outbreaks through internet search trends: An analysis from India

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Keywords: outbreaks; infectious disease; surveillance

Early detection is the key for the prevention and control of any communicable diseases. In India the Integrated Disease Surveillance Programme (IDSP) was launched in November 2004 for surveillance purpose. In this portal, most of the Indian districts report data for 22 epidemic prone notifiable diseases.

This one stop portal can also respond to the outbreaks through skilled and well equipped Quick Response Teams (QRTs) [1]. Presently under IDSP, the information is collected on three specified reporting formats, namely “S” (suspected cases/syndromic), “P” (presumptive cases) and “L” (laboratory confirmed cases). “S” form is filled by the health workers to report data on suspected cases/syndromes. “P” form is filled up by Medical Officers to report data on probable/clinically suspected cases. “L” form is designed to collect data on lab confirmed cases.

The obtained data flows from bottom to top via S, P, and L forms. i.e., community to national level. An outbreak is detected by this surveillance mechanism takes about 7 to 10 days, which is dangerous for rapidly spreading diseases like swine flu, bird flu, nipah virus etc. Therefore, supplementary system to this IDSP will play a great role in collecting timely data on epidemic prone communicable diseases which may minimize the influence of unprecedented outbreaks. An innovative surveillance mechanism for predicting disease outbreaks embedded with internet search behaviour of the population has currently emerged as a promising technique [2]. Now a days, internet use via cell phone in India is rapidly increasing [3,4]. Recently, a large proportion of medical or health-related information are flowing to the cell phones via internet [5]. Recent data indicates that primary sources of information flows through the Internet in most of the communities [6–9].

Presently, big multinational companies are using search data (after data mining) for monitoring purposes as well as for marketing purpose. Among all, e-news, social network data, and blog data are used as the main source [2]. This whole procedure is commonly known as “nowcasting” [10]. This “nowcasting” process can help us to estimate the magnitude of outbreaks by near real-time in early stages of an outbreak. Additionally, this process can be embedded with the existing healthcare setup. Hence, this

approach is quite useful in resource-poor countries where their health systems are already overburdened. It is established from various studies that “Google Trends” may be a useful instrument for disease surveillance [11,12]. This instrument can act as an add on measure to the existing IDSP system for timely disease surveillance. A study conducted by Verma M et al. in India with an objective to evaluate the temporal correlation between Google Trends and conventional IDSP data in Haryana and Chandigarh (U.T.) [13].

Google search was conducted for febrile illness like malaria, dengue fever, chikungunya, and enteric fever for the abovementioned area in 2016. Those extracted data were compared with the IDSP data (only P form). Google search trends and IDSP reporting showed temporal correlation. A lag of -2 to -3 weeks was observed between google search trends and IDSP data.

That study had some limitations. 1) The study used only the ‘P’ form data of febrile cases as it is difficult to differentiate the fever cases reported in “S” form. 2) Also, “L” form data also was excluded due to delay in lab reporting. 3) External validity was also emerged as an important concern. 4) Due to cultural diversity in India there are language differences. As Indians, we also do use social media/transfer of e-data in our vernacular language. In that study only, English language was used for data retrieval, which underestimates the actual value/burden and thus error was occurred in the calculation of correlation. 5) As Google Trends does not provide data at intra-province level, the established correlation may not help to identify the hotspot of an outbreak or epidemic. 6) Varied strength of positive correlation was observed with all febrile illnesses which may not have much significance. 7) Besides Google search, people may communicate/retrieve data via various search engines like, SIRI, Bing, E- Explorer or they may use social media like Facebook, Instagram or Twitter etc. 8) Lastly, seasonal variation could not be identified as the data was collected for short period of time (1 year only).

Despite of limitations, this google based surveillance system can reinforce the existing IDSP system. This kind of outbreak predicting intelligence system may be experimented at the ground level covering the larger communities in resources constraint areas like India. Mathematical modelling techniques can be incorporated in the future studies for accurate forecasting of epidemics and outbreaks for better adjustment of confounders. Not only “Google search”, other portal sites like “E-explorer”, “SIRI”, “Bing” and other search engines can be used for data mining and disease surveillance in the future.

In spite of the massive potential of this application, this technique should be used as an add-on to the existing surveillance systems. As we are now used to work manually (filling IDSP forms), training and retraining (for filling digital forms) of the peripheral health workers are the key for successful

implementation of this intelligence system. However, the results of this study hold promise in Indian scenario for forecasting of emerging and re-emerging diseases outbreaks in near future.

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Marijuana use among adolescents is associated with deleterious alterations in mature BDNF

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ABSTRACT

Background: With increases in marijuana use and legalization efforts, it is imperative to establish its impact on the developing brain. Therefore, we investigated whether exposure to marijuana alters brain derived neurotrophic-factor (BDNF), given its critical role in brain development and plasticity. We then examined whether onset age of cannabis use was associated with more severe changes. A single site, cohort study following 500 urban healthy American adolescents. Changes in plasma m-BDNF levels were longitudinally assessed, and a multi-method approach was implemented to ascertain marijuana use. Multivariate and general linear model (GLM) regression modeling were utilized to test the main hypothesis, controlling for confounders. **Results:** Group-based trajectory modeling identified four distinct groups, characterized by naive (60% control), starters (14%), chronic users (20%), and experimenting/quitters (6%). Compared to controls, those initiating marijuana use had similar pre-existent m-BDNF (1939.2 ± 221 vs. 2640.7 ± 1309 ng/ml, $p=0.4$). After adjusting for confounding factors, GLM analyses revealed that, compared to controls, younger adolescents increased BDNF levels when experimenting and during moderate marijuana use. Older adolescents had a steeper increase in endogenous BDNF levels, particularly when escalating use. Multivariate analyses confirmed marijuana use as a predictor of m-BDNF ($p = 0.001$). **Conclusions:** This is the first study demonstrating BDNF alterations were not a precondition. Rather, BDNF alteration was secondary to marijuana use, serving as cautionary evidence of marijuana's deleterious effects. Findings suggest that when marijuana use escalates, the BDNF pathway becomes more deregulated. Analyses confirm that age of marijuana use onset influences the magnitude of these changes.

Keywords: Marijuana; adolescent; Brain Derived Neurotrophic Factor (BDNF); brain development; smoking

1. Introduction

With approximately 147 million users, marijuana the cannabis sativa plant, is by far the most common drug used worldwide [1–2]. Noteworthy, global analyses revealed an overall rise in the prevalence of lifetime cannabis use by adolescents [3]. The dangers of marijuana products are disquieting when

considering the increased potency of today's cannabis, and its rapid passage to a brain still under development [4]. Yet, the controversy over marijuana's dangers versus "safety" is ignited with contradictory findings. In addition, current knowledge is largely inferred from studies in animals, adults, and subjects with pathological conditions (i.e., schizophrenia) [5–8]. It is remarkable that very few studies focused on adolescents, even though the onset of marijuana use typically occurs during this developmental period. The ability to draw definitive conclusions from studies pertaining to the adolescent population is often limited by cross-sectional designs, the concurrent use of multiple substances, and the lack of information regarding pre-existing biological integrity [3,9].

Adolescent exposure to cannabis normally occurs by smoking cannabis joints, which contain over 421 different chemicals, including over 60 cannabinoids, yet most in-vitro studies only use Δ^9 tetrahydrocannabinol (Δ^9 -THC) at a fixed dose [10]. Active ingredients vary in concentration by strain (e.g., Sativa vs. Indicas), and their effects are not limited to the endocannabinoid system [11]. Moreover, they are the result of direct and indirect cellular and network effects. As a result of this faulty, simplistic approach, knowledge regarding marijuana's biological mechanisms of action is also limited.

Given that cannabinoids can transactivate BDNF receptors, and considering BDNF's critical role controlling brain development, cognitive processes, and neuroplasticity, it is surprising that very little research on BDNF in this context has been done [12–15]. Though BDNF has been widely studied for its ability to support neuronal development and plasticity, other less beneficial effects have been discovered. Data from animal models indicated, albeit with some exceptions, that BDNF also contributes to the enduring synaptic plasticity that underlies drug addiction [16]. The few studies examining the relationship between BDNF and marijuana in healthy humans has been inconclusive. They were mostly cross-sectional and performed on adults, and translating conclusions from them would be flawed, as marijuana leads to differential neurochemical effects in adolescence than during adulthood [6,13,17]. In addition, they used serum to measure BDNF, which is not considered a proxy of central nervous system levels, rather a proxy of platelets [9,13]. Given all these methodological limitations, it is impossible to draw conclusions about the long-term effects of cannabis use on these at risk population [18–19]. Building on prior studies, our study aim was to determine if the BDNF pathway becomes deregulated with the use of marijuana. We followed the trajectories of adolescents before and after the onset of marijuana use. Our design considered prior methodological approaches and knowledge gaps. For example, unlike many previous studies, we used poor platelet plasma (PPP), as studies have consistently demonstrated that PPP is both significantly correlated with, and can be used as a proxy for, CNS levels [20]. We also carefully selected a healthy population with little to no use of other drugs to avoid their confounding effects.

2. Methods

“ROBIM” (the Role of Brain Derived Neurotrophic Factor in Decision Making Participants) is a 5-year, longitudinal study based in Miami, Florida. Adolescents were recruited through direct outreach to community and health care centers. Hispanic adolescents were eligible if they did not have a history of a clinical disease (i.e., cancer, renal or heart disease), major neurological, or psychiatric disorder (i.e., autism, severe developmental problems, schizophrenia) that prevented their participation in the study. Adolescents receiving any neuro-pharmacological intervention, or taking bodybuilding substances (i.e. steroids, growth hormones) were ineligible.

2.1. Data collection

Visits were conducted by trained interviewers and consisted of a detailed medical history, physical/neurological examinations, structured survey questionnaires, and a urine test to corroborate self-reported drug use. The protocol was approved by the IRB’s at Florida International University and the University of Miami.

2.2. Cannabis measures

Using the NIDA Quick Screen, participants were queried regarding the use of marijuana at any point in their lives, as well as any other legal (alcohol or tobacco) or illegal drugs [20]. If the adolescent reported marijuana use, we asked after the intensity of use and age at first use. Intensity of use/the frequency of use was defined as once, once in the last 30 days, once a week, 3 times a week, 4 times a week, once daily, several times per day, and quit. The age of debut was included based on evidence suggesting that the greatest risk effects of cannabis occur during early adolescence, but are moderate to negligible when first used above the age of 18 [17]. On the basis of their answers over the length of the study, the participants were divided into categories/trajectories: no substance use, “once or twice” substance use [(likely no substance use disorder (SUD)], monthly use (likely mild-to-moderate SUD), weekly/daily (likely severe SUD) and those that quit. Each of these classifications corresponds to an “actionable category” as distinguished by AAP, which recommends a distinct type of brief intervention for each one [21].

2.3. Brain derived neurotrophic factor

BDNF is initially synthesized as a precursor (proBDNF), which is proteolytically processed into mature BDNF (mBDNF)[22]. Since BDNF cross the blood brain barrier, it can be measured in the periphery [23]. Blood was drawn between 8 and 11 a.m. to minimize the effects of circadian rhythm. Platelet-poor

plasma (PPP) was obtained following standardized procedures and were assayed under blinded conditions. BDNF concentrations were quantitatively determined using the MILLIPLEX MAP Human Pituitary Magnetic Bead Panel from Millipore (EMD Millipore Corporation, Billerica, MA, USA). The assessments were done following the manufacturer's instructions.

2.4. Covariates

Information was collected on potentially confounding variables, including adolescent/parent sociodemographics (age, education, employment, gender, and country of birth) and medical history. We gathered information on variables known to affect BDNF, such as other abused drugs (e.g., amphetamines, barbiturates, tranquilizers, cocaine, heroin, opiates, PCP, psychedelics, inhalants, and steroids), exercise (Stanford 7-day survey), and body mass index [24].

2.5. Statistical analyses

Descriptive statistics (e.g., minimum, maximum, median, mean with SD for each variable, and the frequency and percentage for each categorical variable) were used to summarize the data. The dependent variable of interest was m-BDNF level. A between-group analysis was adopted to compare the levels of BDNF between naïve, current, and past users of marijuana. For continuous demographic variables, a two-sample t test was used for comparing marijuana user and non-users groups. For categorical variables, a chisquare test was applied for this comparison. Longitudinal linear mixed regression model was applied to examine the trend differences of BDNF between the two groups, separated by age younger than or older than 15 years old. Finally, multivariate regression analyses were also used to determine whether marijuana, contributed to the prediction of BDNF alterations, after sociodemographics, physical activity, nutrition, and other drugs were taken into account.

3. Results

3.1. Marijuana use

The proportion of adolescents reporting ever using marijuana at baseline was 26%, representing the most widely used substance in this population. An additional 5% reported trying marijuana in the past, but not using it anymore. By the 12-month evaluation, an additional 18 percent of the adolescents enrolled in the study began using marijuana. Use of other drugs (crack, cocaine, stimulants, prescription opiates, or club drugs) was only 5%.

The demographic characteristics of the adolescents by marijuana use groups (yes/no) are depicted in Table 1. The groups mostly differed in age; on average cannabis users were slightly older than non-users. Marijuana use was most prevalent among high school students (26%). Only 7% of middle school students reported current use of marijuana. As expected, at the beginning most cannabis use was intermittent, and low in amount, while older adolescents mostly reported weekly to daily use.

3.2. Mature BDNF in those beginning marijuana use

To resolve the quintessential dilemma of whether differences noted in BDNF levels can be attributed to predisposing characteristics, or whether they are a consequence of marijuana use, we evaluated BDNF levels in individuals that began using marijuana after baseline. By the 24-month visit, an additional 18% of the sample started using marijuana. Those initiating marijuana use have similar pre-existent m-BDNF levels compared to non-marijuana users (1939.2 ± 221 vs. 2640.7 ± 1309 , $p = 0.4$). At baseline, m-BDNF levels were slightly lower in those progressing to higher consumption (1297.3 ± 278.7), than those who continued consuming at the same levels (1860.9 ± 176.2 pg/ml, $p = 0.6$). However, at the 12-month evaluation, m-BDNF values doubled for those with a pattern of escalating use (4284.5 ± 1942.3 vs. 2093.4 ± 292.1 pg/ml; $p = 0.05$ See Figure 1).

Table 1. Demographic characteristics of the adolescent population (n = 490).

Demographic Variable	Non Marijuana User	Marijuana User	P Values
Gender			
Male	48%	45%	0.4
Female	52%	55%	
Age In Years	14.5 ± 2.2	16.5 ± 1.4	< 0.001
Education	8.2 ± 2.3	10.0 ± 1.6	< 0.001
Income Low/Poverty	41%	47%	0.4
Middle	26%	25%	
High Class	33%	28%	
Immigrant	23%	24%	0.9
Born in the USA	77%	76%	
Body Mass Index	23.3 ± 5.1	24.0 ± 6	0.5

Note: Differences in baseline sociodemographic measures between participants with and without marijuana use. Values are means $\pm$ SD or percentages. No significant differences in sociodemographic characteristics were reported between groups except for age and years of education.

3.3. Longitudinal analyses

As most features of addiction develop progressively as a consequence of repeated exposure to the

specific drug, we analyzed the effect of marijuana use over the following 12 months. In contrast to baseline, high BDNF levels were evident among marijuana users compared to non-users (3731.1 ± 903.4 vs. 2046.2 ± 262.5 , $p = 0.02$). In an effort to determine their trajectories, we compared changes longitudinally between younger adolescents <15 and those older.

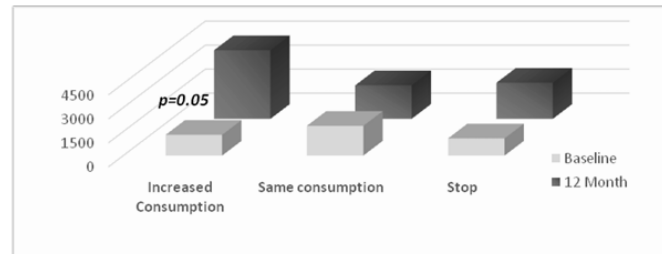


Figure 1. Impact of progressive marijuana use on BDNF levels. Pair wise comparisons of time points revealed that BDNF levels increased particularly in heavy users. BDNF remain high even after quitting suggesting that changes are long-lasting. Bars indicated the mean of the group at baseline (front line) and at the end of the study (back).

Figures 2A and 2B illustrate the importance of considering developmental stage when analyzing BDNF levels. Figure 2A depicts the mean BDNF over time separated by marijuana user and non-users for those who started their marijuana at age ≤ 15 . These models were based on longitudinal regression analysis, although marijuana use ($p = 0.50$), time ($p = 0.24$), and their interaction ($p = 0.41$) not significant. Figure 2B depicts the mean BDNF over time separated by marijuana users and non-users for those who started their marijuana at age > 15 . These models were based on similar longitudinal regression analyses: marijuana use ($p = 0.015$), time ($p < 0.0001$), and their interaction ($p = 0.012$) were significant.

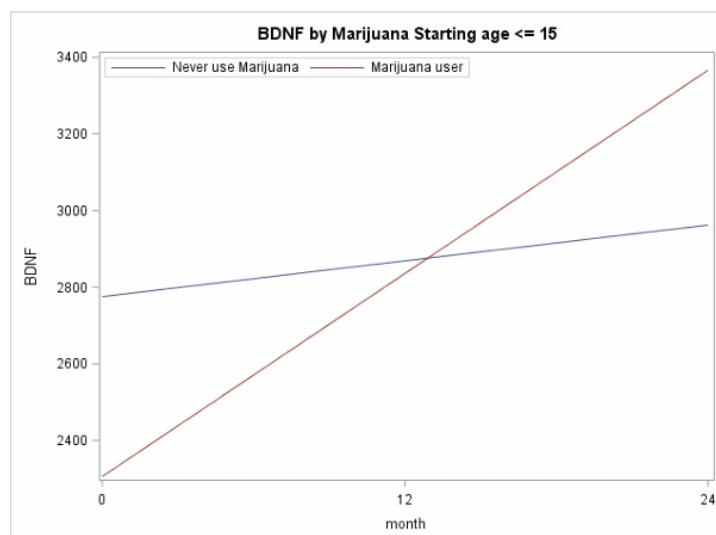


Figure 2A. BDNF by Marijuana Starting Age ≤ 15 . Illustrates the mean BDNF over time separated by marijuana user and non-users for those who started their marijuana use younger than 15.

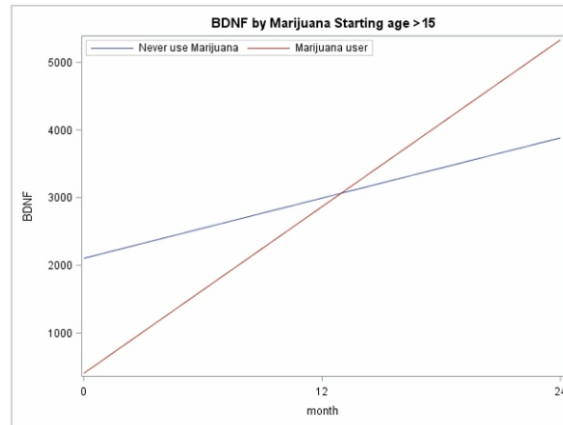


Figure 2B. BDNF by Marijuana Starting Age > 15. Representation of m-BDNF levels at different time points and the trend of changes during the study period.

3.4. Final analyze

To assess whether marijuana use predicts BDNF levels, we performed a multivariate analysis using m-BDNF at the last visit as the dependent variable, and marijuana as the independent variable (see Table 2). To assure the absence of any other group differences, gender, age, body mass index, diet, exercise, stressors, and migration were included in the model as covariates. Significant effects for marijuana were found ($p=0.014$), meaning that marijuana use at baseline was associated with changes in BDNF levels.

Table 2. Regression analyses of BDNF at the last visit coefficients^a.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	3026.408	1752.859		1.727	0.091
Marijuana use	274.89	136.97	0.120	2.007	0.04
Age	-151.394	111.915	-0.083	-1.912	0.062
Migration/stress	440.621	581.792	0.046	3.082	0.449
Body Mass Index	-2.976	46.966	-0.04	-0.063	0.950
Gender	-558.545	478.830	-0.069	-1.166	0.244

Note: P value using Logistic Regression likelihood ratio adjusted for sociodemographic, migration/stressors, family (income, attachment, type of family) and healthy behavior variables (nutrition, exercise, other drugs). Age and marijuana use were the only predictors of BDNF level at the last visit.

4. Discussion

The Healthy People 2020 initiative has set the goal to reduce the rate of adolescent marijuana use to six percent [25]. However, it only takes one look at the data from our sample (25% are regular users) to recognize that we are far from that goal. This widespread use should be alarming, since adolescence is a peak time for neurodevelopment, and subsequently a period of increased susceptibility to alterations in brain structure and function [2,6–8,26–29]. The present study specifically provides evidence that both initiation and regular use of marijuana predict changes in mature BDNF.

Although it is inherently difficult to establish causality in human studies, our methodological and design approaches provide a stronger basis for causal inference [30]. First, this study was longitudinal, which allowed for uniformity. Secondly, by including a sizable proportion of drug naïve subjects, and by performing drug screening tests, we were able to establish that drug use preceded the outcome. Our study took measures to exclude alternative explanations for our findings. Participants passed a rigorous health screening, including medical history, physical exam, and blood testing to assure the inclusion of adolescents without comorbid developmental or neurologic conditions. We also collected information on several covariates that potentially impact BDNF, such as diet, exercise, sociodemographics, and other drug use. Finally, animal models have long provided support that the observed relationship between marijuana and BDNF is more than a simple association [4–5,12–13,15,28–29]. They have also provided the mechanisms of action by which these variables interact: a) activation of the extracellular signal-regulated kinase or b) through endocannabinoid transactivation of BDNF-TrkB receptors [16,31].

While the increased levels of m-BDNF associated with cannabinoids have been previously reported, the functional relevance of these changes should be carefully interpreted [6,13]. Though in the past they were viewed as beneficial, this is an erroneous deduction [6,13]. This conclusion is derived from acute models where increases in m-BDNF protect the brain in the short-term [32]. Subsequent research has established that chronic exposure will lead to allostatic overload, maladaptive responses, and illness [33]. Additionally, a rise in BDNF, which is highly distributed in the hippocampus, increases the odds of hyperexcitability and/or excitotoxic damage by increasing long term potentiation [34]. Further confirming our postulates are human neuroimaging studies showing that marijuana use is associated with a volumetric reduction of the hippocampus [31].

By modifying BDNF, marijuana use could also induce alterations in “plasticity”, which reference neuronal changes associated with the acquisition of new skills or the ability to adapt [35–37]. Emerging data have demonstrated that synaptic plasticity may also be involved in the “learning” of addictive

behaviors [16,38–40]. In vertebrate model systems, exogenous BDNF promotes cocaine-taking behavior over a range of experimental conditions, and led to increased risk of relapse [41]. Moreover, BDNF infusions induced a switch in the γ -aminobutyric acid type A receptors from inhibitory to excitatory signaling, potentiating cue-induced drug seeking [39]. These findings from different fields let us conclude that sustained increases of m-BDNF are not beneficial. Translational studies are needed to confirm whether this interaction reflects a drug-induced, synaptic plasticity phenomenon similar to the one observed in animals [16,39–41].

In addition, our data demonstrated that there are variations in BDNF responses between younger and older individuals. Since marijuana use among the younger teens in our study was generally “light”, it is possible to conclude that a dose-response should exist. The steep increases in BDNF associated with escalating marijuana use also suggested this trend. This phenomenon may result from BDNF-induced neuroplasticity changes that promote drug seeking [38]. Such activity-dependent remodeling has been proposed as part of the transition from casual drug use to drug addiction in other drug fields [39–40]. Supporting these posits are also data demonstrating that injection of a TrkB antagonist in the peripheral system significantly reduces drug-dependency behaviors in animals [40–42].

In summary, marijuana the most frequent drug used by these adolescents alter the production of BDNF. Alterations were both age and dose dependent and while past users improved their levels they did not return to basal levels. Analyses confirmed that they were not a pre-condition that leads to increase substance use. Our next goal is to analyze the consequences in neuropsychological performance to better understand the neurodevelopmental trajectories of users versus non-users.

These relevant findings come with some caveats. Our sample was limited to Hispanic adolescents in South Florida. Nevertheless, our study was longitudinal and had a good sample size for a single site study. BDNF levels were measured in plasma and not in the CNS. However, both in humans and in animals, peripheral levels highly correlated with changes observed in the brain [20,43–44]. Though it is inherently difficult to establish causality in human studies, we ensured that conclusions were determined with a high level of confidence by using the correct design and laboratory methods. Animal models also provide strong support that the observed relationship between marijuana and BDNF is more than a simple association [5–6,10–11,16,29–30]. They also provide support that such alterations could be deleterious during critical developmental periods, and could contribute to, and exacerbate, addictive behavior. Although, marijuana users exhibited lower BDNF levels raising a question about their potential predicting value, additional studies should be performed in order to confirm our findings. Finally, results indicated the importance of analyzing marijuana across the different phases of

adolescence, as it can be more informative when determining long-term impact. Now policy initiatives need to ensure that legalization of marijuana to protect the rights of ailing individuals does not harm the youth who will be the future of every country. It is clear from the data amassed herein that the adolescent body registers marijuana use as a stressor. Effects of chronic use remain pervasive via heightened m-BDNF, leading to alterations in brain function and structure [6,26–29]. Such results caution against movements to broadly legalize marijuana.

Conflict of interest

The authors declare no conflict of interest.

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Clusters of alcohol abstainers and drinkers incorporating motives against drinking: a random survey of 18 to 34 year olds in four cities in four different continents

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ABSTRACT

Objective: The aim of this analysis was to identify alcohol consumption clusters for adolescents and early adults according to attitudes to drinking, motivations against drinking and perceptions associated with alcohol. **Method:** Interviews were undertaken with people aged 18–34 years old living in four cities in different regions of the world. Multistage random sampling was consistent across the four cities (Ilorin (Nigeria), Wuhan (China), Montevideo (Uruguay) and Moscow (Russia)). The questionnaire was forward and back translated into relevant languages and face-to-face interviewing undertaken. The data were weighted to the population of each city. In total 6235 structured interviews were undertaken (1391 in Ilorin, 1600 in Montevideo, 1604 in Moscow and 1640 in Wuhan). Questions regarding motivation against alcohol consumption (14 items), assessing perceptions (3 items) and attitudes to drinking in certain situations (8 items) were asked of all respondents including abstainers. Factor analysis was initially undertaken to identify highly related correlated variables. **Results:** Cluster analysis provided a variety of clusters (Ilorin (3 clusters), Montevideo (5), Moscow (4) and Wuhan (4)). At least one cluster in each city was dominated by abstainers and another by heavy episodic drinkers. Variations by city and alcohol consumption patterns existed in regards to variables included. **Conclusion:** This analysis detailed the city specific motivations against drinking alcohol, and the attitudes towards alcohol consumption. Differences highlight the influence of country/city specific culture, customs, laws, societal norms and traditions.

Keywords: alcohol; adolescent; perceptions; motivations; survey; Moscow; Montevideo; Wuhan; Ilorin

1. Introduction

In understanding lifelong patterns of alcohol consumption, the early formative period of late adolescent and early adulthood, commonly acknowledged as “transition to adulthood” is seen as a crucial period of life development [1–4]. The behaviours and patterns associated with alcohol consumption initiated during these years are important indicators for later stages of the lifespan [2,3]. Negative social and health outcomes associated with excess alcohol consumption in these formative years include increased road accidents, violence, injuries and ramifications associated with unplanned sex. There are also the possibility of long-term alcohol problems and dependency [3]. Many transformations, encompassing most components of life including academic, accommodation, relationships, and work/career options, occur during the transition to adulthood [3,5].

Multi-factorial and complex beliefs, attitudes and motivations towards alcohol are also being developed. Identifying the motivating factors that influence people to drink, limit or abstain helps to understand alcohol consumption patterns during these formative years [6–9]. Although simplistic explanations have been highlighted, the motivations for drinking and not drinking alcohol are multifaceted. Complex interactional and situational factors have been presented in the research literature [10,11]. Motivating factors for alcohol consumption primarily focus on aspects such as social influences, coping with stress, enhancement and conformity [6,8,12]. Motives for not consuming or limiting alcohol focus on harm avoidance, religion, upbringing, personal beliefs, fear of loss of control, and fear of adverse consequences [9–11,13,14]. Research highlights the important role social motives play in all facets of alcohol consumption from abstaining to heavy episodic drinking (HED), especially in the transition to adulthood age bracket of 18 to 34 years [6,8,12,15–17].

Although negative outcomes associated with alcohol consumption are researched extensively, research into reasons and motives for abstaining or limiting alcohol consumption are less common. Attitudes and beliefs have been shown to be important predictors of alcohol consumption especially in this age group [18] and are seen as important areas for promotion and public health campaigns. In most instances positive attitudes and beliefs towards alcohol are reflected in higher alcohol consumption. Alcohol outcome expectations are acknowledged as important predictors of alcohol consumption, especially in this age group, with more positive attitudes also related to higher alcohol consumption [12,19,20].

Together with motives and attitudes, socio-demographic and socio-economic variables are important indicators associated with drinking and alcohol consumption patterns [2,21–26]. Age (alcohol consumption declining with age), gender (males drinking more alcohol than females), education (with

differences by education level), work status (differences by employment status), and relationship status (with marriage/partnership and parenthood often reducing alcohol consumption rates), have been shown to be associated with patterns of alcohol consumption for those transitioning into adulthood.

The aim of this study was to use a methodologically-sound database of face-to-face interviews with randomly selected people aged 18 to 34 years in four cities in four different continents to determine similarities and differences in factors associated with alcohol consumption;. In addition, the study aimed to highlight variables amenable to policy, preventive and control initiatives by defining distinct subgroups of people in terms of alcohol consumption patterns and to assess and identify similarities and differences across these international cities that will assist future public health endeavors internationally and locally. Many studies of attitudes towards, and motives for and against, alcohol consumption rely on information from current drinkers only [15,27,28]. This study incorporates these groups but also includes non-drinker—those who have never drunk alcohol or who have quit/ceased drinking. Furthermore, many studies of adolescents and emerging adults in this regard are limited to university or college populations and are often based on USA populations [27,29,30]. This study uses unique, international, community, population-wide samples, representative of adolescents and young adults aged 18 to 34 years, in the four international cities. To undertake this comparison, and to determine in greater depth the alcohol consumption patterns in the four cities, cluster and factor analysis were undertaken segmenting the population into groups that are homogeneous as possible. Factor and cluster analysis in alcohol consumption provides additional in-depth reflections on pathways to effective public health prevention and control activities.

2. Methods

2.1. Study participants and sampling strategy

Four cities were chosen pragmatically based on diversity to be involved in the study. The city of Wuhan, capital of Hubei Province in China; Moscow, the capital and the largest city of Russia; Ilorin which is the administrative capital of Kwara State, Nigeria; and Montevideo, the capital of Uruguay. For each city, multistage random sampling was undertaken and was kept consistent across the four cities. In each randomly selected household, the person with the most recent birthday, aged between 18 and 34 years, and who had lived in the city for at least six months, was eligible and was invited to participate in the study.

2.2. Ethics

In Wuhan, ethical approval was obtained from the Hubei Provincial CDC (Hubei Provincial Society for Health Promotion and Cigarette-smoking Control, HBPHPandCCS-2014-01), in Moscow from the Ethics Committee on the NRC on Addictions, in Ilorin from the Ethics Research Committee of the University of Ilorin (UERC/ASN/2014/007) and in Montevideo from the Pro Humanities Ethics Committee.

2.3. Questionnaire development

The questionnaire was forward-translated into the relevant languages (e.g. English to Chinese) and back-translated (e.g. Chinese to English) to ensure the questions were conceptually and culturally equivalent between the cities. Prior to the main survey, a pilot study of 25 to 50 interviews was conducted in each city. Data collection was interviewer-administered. The average length of interviews was 15 minutes. Response rates ranged from 48.4% in Moscow to 95.0% in Ilorin. The detailed methodology and demographic profile of respondents has previously been published [31].

2.4. Survey questions

Each respondent was asked: 1) if they had ever consumed alcohol (excluding sips), 2) how often during the past 12 months they had drunk beer, wine, spirits (e.g., vodka, gin, whisky, brandy), and any other alcohol beverage, even in small amounts, and 3) during the past 12 months, how many alcoholic drinks they had on a typical day when they drank alcohol.

Overall quantity (i.e. usual frequency of drinking by usual number of drinks consumed per drinking occasion) was calculated by multiplying the responses to the above two questions (how much and how many) with 25 or more drinks (coded as 25), 19–24 drinks (coded as 21.5), 16–18 drinks (coded as 17), 12–15 drinks (coded as 13.5), 9–11 drinks (coded as 10), 7–8 drinks (coded as 7.5), 5–6 drinks (coded as 5.5), 3–4 drinks (coded as 3.5), 2 drinks (coded as 2), 1 drink (coded as 1) and less than 1 full drink (coded as 0.5). The annual number of drinks was calculated by multiplying the responses to the question on how many days did they drink alcohol with the response from how many drinks did they have. The variables were recoded into four drinking status groups: 0 drinks = Abstainers; > 0 but less than 365 drinks/year = Light Drinkers; 365–729 drinks/year = Moderate Drinkers; 730 or more drinks/year = Heavier drinkers.

Motivation against drinking alcohol included a question on how important the following reasons were: 1) pregnancy or trying to become pregnant (females only), 2) of taste, 3) don't like the effect it has, 4) have seen bad examples of what alcohol can do, 5) previously hurt by somebody's else drinking, 6) drinking could affect work or school performance, 7) drinking is too expensive or a waste of money, 8) religious reasons, 9) brought up not to drink, 10) had an alcohol problem or afraid of becoming an alcohol, 11) too young, 12) friends and/or family members disapprove, 13) health reasons, and 14) just not interested. Possible responses were very important, important, not very important, and not at all important. The questionnaire asked these attitude questions of current drinkers, and non-drinkers (both past drinkers and lifetime abstainers) as separate questions. The two questions were combined to make one data item for each alternative. Option 1 was asked only of females and was excluded.

General attitude to alcohol use included whether respondents agreed that 1) having a drink is one of the pleasures of life, 2) having a drink with someone is a way of being friendly, 3) there is nothing good to be said about drinking. Response categories were strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Respondents were also asked how many drinks people in certain situations should feel free to drink 1) as a mother, spending time with small children, 2) as a father, spending time with small children, 3) for a man out at a bar with friends, 4) for a woman out at a bar with friends, 5) for a woman out with co-workers, 6) for a man out with co-workers, 7) for a man having dinner at home with spouse or partner, and 8) for a woman having dinner at home with spouse or partner. Responses options were: no drinks, some drinking but not enough to feel the effects (1 or 2 drinks), enough to feel the effects but not become drunk, getting drunk is sometimes alright, and getting drunk is always alright.

Demographic questions included age, sex, marital status (recoded into married/not married), highest education obtained (secondary school or less/vocational, professional, non-university/university), employment status (employed/not employed), have any children (yes/no), and currently a student (yes/no).

2.5. Analysis

To eliminate/reduce potential biases and to ensure that the results accurately reflected the population of interest, the data were weighted by age, sex and probability of selection. Specific demographic/census databases were used for each city. Details on specific weighting methodology are contained in a previous publication [31]. Data were analysed using Statistical Package for the Social Sciences (SPSS) version 20 for Windows (Chicago, IL).

As data on many individual motivational and attitudinal variables were collected, factor analysis was initially used to identify sets of variables for each city that were highly correlated and to simplify the analysis. Cluster analysis was then used to identify clusters and heterogeneity of groups of individuals. Since this analysis is purely exploratory, there was no need to randomly divide the sample into two halves in order to confirm the factor structure derived from one half of the dataset on the other half. For each city, an exploratory factor analysis (EFA) was conducted. All of the above data items were entered into the analysis. Details on specific analysis for each city are detailed below. The factor scores from the analysis for each city were saved, and used as an input into a cluster analysis, along with a derived variable regarding the drinking status of the respondent. Also included in the cluster analysis were the demographic data detailed previously. Hierarchical agglomerative clustering was employed using the squared Euclidean distance measure and Ward's method to form the clusters.

3. Results

In total, n=6235 interviews were undertaken (1391 in Ilorin, 1600 in Montevideo, 1604 in Moscow and 1640 in Wuhan). Missing and “don't know” responses were excluded from all analyses, with the final numbers included being 1144 for Ilorin, 981 for Montevideo, 1526 for Moscow, and 1150 for Wuhan. A demographic profile of respondents for each city is presented in Supplementary The proportion having ever consumed alcohol was 33.3% (95% CI 30.9–35.9) of respondents from Ilorin, 53.4% (95% CI 51.0–55.8) for Wuhan, 86.1% (95% CI 84.3–87.7) for Moscow, and 96.4% (95% CI 95.3–97.2) for Montevideo (Table 1).

3.1. Factor analysis by city

Ilorin, Nigeria

Various extraction and rotation options were tried, with the best solution being produced by principal components extraction with an oblique rotation. When all of the items were entered into an EFA, the questions regarding general attitudes and situations formed their own factors and did not add anything to the understanding of the data. When these were removed, and the EFA considered only motivations against drinking, two factors emerged. The first factor was a motivation because of intrinsic factors (e.g. dislike for the effects of alcohol). The second factor related to motivation because of extrinsic pressures (e.g. social pressure against drinking) (Supplementary Table 2).

The approach to this analysis was the same as the analysis previously described for Ilorin. The final EFA considered only motivations against drinking where two factors emerged. The first factor was motivation by intrinsic personal pressures (e.g. about social pressure against drinking). The second factor was motivated by fear of effects (e.g. a dislike for the effects of alcohol) (Supplementary Table 3).

Moscow, Russia

When all items were entered into an EFA using maximum likelihood extraction and oblimin rotation (oblique rotation allowing for correlated factors), the questions regarding general attitudes, perceptions of situations, and motivations against drinking formed their own individual factors. Although this seems like an obvious result, it did not occur in the two previous factor analyses. The first factor was perceptions of drinking limits in different situations (e.g. for a woman out at a bar with friends), the second factor was motivation by fear (e.g. have been hurt by someone else's drinking), and the third factor was positive justification/perception of drinking (e.g. drinking is one of the pleasures of life) (Supplementary Table 4).

Wuhan, China

When all items were entered into an EFA, principal axis factoring produced the best extraction results, which combined with oblimin rotation produced a two factor solution where the questions regarding motivations against drinking and general attitudes/perceptions of situations formed factors. The first factor was motivation by both intrinsic and extrinsic pressures against drinking (e.g. I have had alcohol problems/am afraid of being an alcohol; my friends and/or family disapprove of me drinking). The second factor was perceptions of drinking limits in different situations (e.g. for a woman having dinner at home with her spouse or partner) and a positive justification/attitude towards drinking (e.g. having a drink with someone is a way of being friendly) (Supplementary Table 5).

3.2. Cluster analysis by city

Ilorin, Nigeria

When cluster analysis was undertaken, the dendrogram and the agglomeration schedule both supported a three cluster solution encompassing 26.6%, 33.3% and 40.0% of the sample. Those clusters are detailed

in Table 1. Members of Cluster 1 were more likely to be abstainers, former drinkers, older, university educated, married, employed females with children. Members of Cluster 2 were more likely to be younger than Cluster 1 and older than Cluster 3 members, unmarried with no children, who were current drinkers or HEDs. Members of Cluster 3 were all students, more likely to be young, who do not drink, are unmarried and do not have children. They were students, and they were therefore also less likely to be working. Differences by intrinsic and extrinsic pressures were apparent across the Clusters.

Montevideo, Uruguay

The dendrogram and the agglomeration schedule both supported a five cluster solution encompassing 15.5%, 14.3%, 36.3%, 22.7% and 11.2% of the sample. These clusters are detailed in Table 2. Cluster 1 were more likely to be current alcohol drinkers or HED, younger than the other Clusters, unmarried, not employed with no children. Cluster 2 were more likely to be current drinkers, university educated, employed, females without children, and also more likely to be students. Cluster 3 were more likely to be older than the other Clusters, married, employed with children and are current drinkers or HEDs, with a lower level of education than average. They were also less likely to be students. Cluster 4 are more likely to be employed, males with no children who are HEDs. Cluster 5 were more likely to be abstainers or past drinkers with 94.7% of this cluster not drinking, and those that did were light drinkers. They were more likely to have a low level of education. Differences by intrinsic and extrinsic pressures and fears of the effects of alcohol were apparent across the Clusters.

Moscow, Russia

A four cluster solution was indicated by the dendrogram and agglomeration schedule encompassing 23.0%, 25.2%, 36.1% and 15.6% of the sample in this case. The clusters are detailed in Table 3. Cluster 1 were more likely to be older, current drinkers or HEDs, married with children, employed, and well educated. Cluster 2 members were younger than other Clusters, unmarried, less likely to have children, less likely to be employed, or have a degree qualification. They were more likely to be lifetime abstainers although all drinker types were represented in this group. Cluster 3 were more likely to be employed, well educated, unmarried with no children who were current drinkers or HEDs. Cluster 4 are more likely to be females and less likely to be students. They were abstainers or former drinkers. Differences in perception of acceptable drinking limits, justification for drinking and motivation against drinking were apparent across the Clusters.

Wuhan, China

Hierarchical agglomerative clustering was employed using the squared Euclidean distance measure and Ward's method to form the clusters. This analysis did not result in clusters that discriminated drinking behaviour or attitudes. A number of different alternative extraction methods and factor solutions were tried, including reducing the factor analysis to just motivations against drinking as in Ilorin and Montevideo, but all suffered from the same problem. Eventually marital status, education status and number of children were omitted and a four cluster solution of acceptable quality was produced. The four cluster solution encompassed 36.3%, 33.2%, 21.6% and 8.8% of the sample. The clusters are detailed in Table 4. Cluster 1 were current drinkers who were employed, highly educated, and not likely to be a student. Cluster 2 were mostly non-drinkers (lifetime abstainers and former drinkers), more likely to be employed, not likely to be a student with high levels of education. Cluster 3 reflected a variety of levels of alcohol consumption patterns with the majority being current drinkers or lifetime abstainers. They were also more likely not to be married, not employed (100% students) and less likely to have children. Cluster 4 were a mixture of current drinkers and lifetime abstainers who were more likely to be not employed, non-university educated and not students. Differences in motivation against drinking and acceptable levels of drinking were apparent especially in Cluster 2.

4. Discussion

The results of this analysis from a random-population survey of 18 to 34 year olds in four distinct cities of the world highlighted the complexity associated with determining patterns of alcohol consumption in this important age group. Although results varied considerably across all four cities, some similarities between the cities in terms of alcohol consumption were apparent. Two of the three clusters for Ilorin were dominated by alcohol abstainers. This reflects the relatively low overall prevalence rates of alcohol consumption in Nigeria [32–35], although among those who do drink alcohol, large amounts are regularly consumed [34–37]. The abstainer cluster, predominately students, consisted of younger people whose extrinsic motivations against drinking was dominated by religious reasons or because they were brought up not to drink alcohol. Internationally, religion and the influence of upbringing have been shown to have important considerations for abstainers and low alcohol drinkers [11,14,23,30]. In Nigeria, the practice of Muslim religion is widespread [14,32,36] and our previous research indicated that the Muslim respondents were significantly less likely to be current drinkers [31]. In all four cities at least one of the final clusters was predominately abstainers and ex-drinkers, but religion as a motive for not consuming alcohol was only prominent in Ilorin. Internationally religious convictions have been shown to be stronger in females [12] although in our analyses the Ilorin cluster that rated religion high was not dominated by females.

Table 1. Results of cluster analysis for Ilorin-Nigeria.

Ilorin, Nigeria	n	%	AR	n	%	AR	n	%	AR	N	%	X2	Df	P value
Drinking status														
Lifetime abstainer	155	59.4	1.5	153	46.8	-3.8	235	59.9	2.3	543	55.4	24.336	6	<0.001
Former drinker	41	15.7	-0.7	70	21.4	2.6	56	14.3	-1.9	167	17.0			
Current drinker	53	20.3	-1.4	82	25.1	0.9	94	24.0	0.4	229	23.4			
Heavy episodic drinker	12	4.6	0.4	22	6.7	2.8	7	1.8	-3.1	41	4.2			
Age (mean years)	30.05			24.74			22.29							
Gender														
Male	68	26.1	-8.3	195	59.6	5.1	209	53.3	2.6	472	48.2	72.503	2	<0.001
Marital Status														
Married	259	99.2	30.3	10	3.1	-12.1	1	0.3	-15.6	270	27.5	917.453	2	<0.001
Employment Status														
Employed	199	76.0	12.7	166	50.8	3.6	55	14.0	-14.9	420	42.8	258.616	2	<0.001
Highest level of education														
Secondary school or less	152	58.2	-0.1	215	65.7	3.2	207	52.8	-3	574	58.6	162.965	4	<0.001
Vocational/professional/Non-university tertiary education	37	14.2	-5.4	50	15.3	-5.8	177	45.2	10.5	264	26.9			
University degree or higher	72	27.6	7	62	19.0	2.8	8	2.0	-9	142	14.5			
Children?														
Yes	248	95.0	25.9	40	12.2	-9.1	20	5.1	-14.5	308	31.4	672.53	2	<0.001
Student?														
Yes	3	1.1	-15.3	6	1.8	-17.6	392	100.0	30.7	401	40.9	943.37	2	<0.001
Factor 1 – Intrinsic pressures (mean) *	0.34↓			0.06			0.02							
Factor 2 – Extrinsic pressures (mean)	0.26			0.34			-0.09↑							

Note: The weighting of the data can lead to rounding discrepancies and totals not adding. (a) Uses Harmonic Mean Sample Size= 318.013; the group sizes are unequal. The harmonic mean of the group sizes is used; Type I error levels are not guaranteed. ↓ Less important ↑ More important.

Table 2. Results of cluster analysis for Montevideo-Uruguay.

	Cluster 1 (n=237, 15.5%) (Young drinkers)			Cluster 2 (n=217, 14.3%) (Student drinkers)			Cluster 3 (n= 554, 36.3%) (Older married HED)			Cluster 4 (n=347, 22.7%) (Male HED)			Cluster 5 (n=170, 11.2%) (Abstainers)			Total (n = 1525)		X2	Df	P value
	n	%	AR	n	%	AR	n	%	AR	n	%	AR	n	%	AR	n	%			
Drinking status																				
Lifetime abstainer	0	0.0	-2.8	0	0.0	-2.7	2	0.4	-4.3	0	0.0	-3.6	40	23.5	17.6	42	2.8	1400.6	16	<0.001#
Former drinker	0	0.0	-5.1	4	1.8	-3.8	3	0.5	-8.4	1	0.3	-6.2	121	71.2	31.2	129	8.5			
Very light drinker	7	3.0	0	5	2.3	-0.6	17	3.1	0.2	7	2.0	-1.2	9	5.3	1.9	45	3.0			
Current drinker	165	69.6	1.2	187	86.2	6.7	422	76.2	6.3	234	67.4	0.6	0	0.0	-19	1008	66.1			
Heavy episodic drinker	65	27.4	3.2	21	9.7	-4	110	19.9	0.1	105	30.3	5.6	0	0.0	-6.9	301	19.7			
Age (mean years)	21.64			25.60			28.12			25.41			25.55							
Gender																				
Male	110	46.2	-1.1	3	1.4	-15.3	243	43.9	-3.3	330	95.1	19.3	69	40.6	-2.5	755	49.5	503.12	4	<0.001
Marital Status																				
Married	7	3.0	-15.0	104	47.7	0	420	75.8	16.6	103	29.7	-7.6	93	54.7	2.0	727	47.6	414.26	4	
Employment																				
Employed	0	0.0	-24.7	196	90.3	7.5	404	72.9	2.8	341	98.6	13.7	102	60.0	-2.5	1043	68.4	718.08	4	
Highest level of education																				
Secondary school or less	122	51.5	-2.1	56	25.7	-10.3	398	71.8	8.5	184	53.2	-1.9	118	69.0	3.2	878	57.5	243.48	8	<0.001
Vocational/prof/Non-uni	102	43.0	3.4	94	43.1	3.2	130	23.5	-6.3	138	39.9	2.8	48	28.1	-1.6	512	33.6			
University degree	13	5.5	-2	68	31.2	12.5	26	4.7	-4.4	24	6.9	-1.5	5	2.9	-2.9	136	8.9			
Children?																				
Yes	21	8.9	-11.5	36	16.5	-8.5	487	87.9	26.8	0	0.0	-18.4	111	65.3	6.3	655	42.9	927.55	4	<0.001
Student?																				
Yes	158	66.7	11.1	171	78.4	14.5	27	4.9	-18.7	136	39.2	1.8	43	25.3	-2.8	535	35.1	515.63	4	<0.001
Factor 1-Intrinsic pressure (mean) *	-0.03			0.13			0.18			-0.02			-0.37↑							
Factor 2-Fear of effects (mean)	0.11			-0.24↑			0.07			0.14			-0.29↑							

Note: The weighting of the data can lead to rounding discrepancies and totals not adding. (a) Uses Harmonic Mean Sample Size =257.986; the group sizes are unequal. The harmonic mean of the group sizes is used; Type I error levels are not guaranteed. # 1 cell < 5. ↓ Less important ↑ More important.

Table 3. Results of cluster analysis for Moscow-Russia.

	Cluster 1 (n=245, 23.0%) (Older drinkers)			Cluster 2 (n=269, 25.2%) (Students)			Cluster 3 (n=385, 36.1%) (Current drinkers)			Cluster 4 (n=167, 15.6%) (Abstainers, females)			Total (n= 1066)					
	n	%	AR	n	%	AR	n	%	AR	N	%	AR	n	%	X2	Df	P value	
Drinking status																		
Lifetime abstainer	0	0.0	-6.2	64	23.8	7.9	0	0.0	-8.6	52	31.3	9.2	116	10.9	528.728	12	<0.001	Cells < 5.
Former drinker	1	0.4	-5.4	21	7.8	-0.9	5	1.3	-6.7	71	42.8	16.3	98	9.2				
Very light drinker	0	0.0	-0.5	1	0.4	1.7	0	0.0	-0.8	0	0.0	-0.4	1	0.1				
Current drinker	2128	86.5	6.0	173	64.3	-2.9	334	86.8	8.4	40	24.1	-14.6	759	71.3				
Heavy episodic drinker	32	13.1	2.9	10	3.7	-3.3	46	11.9	3.0	3	1.8	-3.4	91	8.5				
Age (mean years)	30.94			20.61			26.54			28.65								
Gender																		
Male	132	53.9	1.3	131	48.7	0.3	205	53.2	3.3	43	25.7	-6.2	511	47.9	40.820	3	<0.001	
Marital Status																		
Married	207	84.5	16.4	11	4.1	-13.7	85	22.1	-8.7	118	70.7	9.0	421	39.5	465.430	3	<0.001	
Employment																		
Employed	244	99.6	11.0	57	21.2	-21.4	370	96.1	13.2	95	57.2	-4.6	766	71.9	564.995	3	<0.001	
Highest level of education																		
Secondary school or less	11	4.5	-5.4	103	38.4	12.1	27	7.0	-5.7	23	13.9	-0.6	164	15.4	269.003	6	<0.001	
Vocational/prof/Non-uni	105	42.9	-0.3	155	57.8	5.4	143	37.1	-1.8	62	37.3	-1.8	435	40.9				
University degree or higher	129	52.7	4.3	10	3.7	-14.3	215	55.8	7.5	81	48.8	2.3	435	40.9				
Children?																		
Yes	245	99.6	25.3	7	2.6	-12.3	3	0.8	-16.8	97	58.4	7.6	352	33.0	834.912	3	<0.001	
Student?																		
Yes	1	0.4	-10.5	269	100.0	31.7	0	0.0	-14.7	11	6.6	-6.3	281	26.4	1007.935	3	<0.001	
Factor 1 – Situations (mean) ^a	0.28↑			-0.07			0.33↑			-0.58↓								
Factor 2 – Motivation by fear (mean)	0.17↓			-0.19↑			0.20↓			-0.31↑								
Factor 3 – Positive justification (mean)	-0.37↑			0.18			-0.45			0.63↓								

Table 4. Cluster analysis for Wuhan-China.

	Cluster 1 (n=412, 36.3%) (Drinkers)			Cluster 2 (n=376, 33.2%) (Abstainers)			Cluster 3 (n=245, 21.6%) (Abstainers/former)			Cluster 4 (n=100, 8.8%) (Unemployed)			Total (n = 1133)					
	n	%	AR	n	%	AR	n	%	AR	n	%	AR	n	%	X2	Df	P value	
Drinking status																		
Lifetime abstainer	36	8.8	-17.6	324	85.9	20.6	84	34.1	-3.2	45	44.6	0.3	489	43.1	667.791	12	<0.001	
Former drinker	5	1.2	-5.9	48	12.7	5.1	25	10.2	2.0	4	4.0	-1.3	82	7.2				
Very light drinker	10	2.4	-0.7	4	1.1	-2.6	18	7.3	4.7	1	1.0	-1.2	33	2.9				
Current drinker	321	78.1	18.2	1	0.3	-20.3	113	45.9	1.2	48	47.5	1.1	483	42.6				
Heavy episodic drinker	39	9.5	6.6	0	0.0	-5.0	6	2.4	-1.6	3	3.0	-0.7	48	4.2				
Age (mean years)	26.13			26.30			20.41			26.67								
Gender																		
Male	247	60.0	4.5	185	49.2	-0.9	121	49.4	-0.6	27	27.0	-5.1	580	51.2	36.990	3	<0.001	
Marital Status																		
Married	199	48.7	2.7	212	56.4	6.3	8	3.3	-14.3	70	70.0	5.6	489	43.3	220.003	3	0.008	
Employment																		
Employed	412	100.0	16.3	376	100.0	15.2	15	6.1	-25.2	0	0	-16.3	803	70.9	1064.784	3	0.014	
Highest level of education																		
Secondary school or less	37	9.0	1.2	34	9.0	1.1	0	0.0	-5.1	17	16.8	3.6	88	7.8	76.331	6	0.015	
Vocational/professional/Non-university	238	58.2	3.0	196	52.1	-0.0	99	40.4	-4.2	59	58.4	1.3	592	52.3				
University degree or higher	134	32.8	-3.7	146	38.8	-0.5	146	59.6	7.1	25	25.8	-3.3	451	39.9				
Children?																		
Yes	147	36.2	0.8	163	44.1	4.6	11	4.7	-10.9	65	65.0	6.7	386	34.8	147.998	3	0.006	
Student?																		
Yes	0	0.0	-13.4	0	0.0	-12.5	245	100.0	33.7	0	0.0	-5.5	245	21.6	1133.000	3	0.005	
Factor 1 – Intrinsic/Extrinsic (mean) (a)	0.25			-0.29†			0.14			0.05								
Factor 2 – Situations (mean)	-0.45†			0.36‡			0.12			0.13								

Note: The weighting of the data can lead to rounding discrepancies and totals not adding. (a) Uses Harmonic Mean Sample Size= 208.716; the group sizes are unequal. The harmonic mean of the group sizes is used; Type I error levels are not guaranteed. ↓ Less important ↑ More important.

The other abstainers and former drinker cluster found in the Ilorin sample was dominated by married females. Less important for this cluster was motivation by intrinsic and extrinsic pressures such as disliking the effect of alcohol. This again reflects the dominant culture in Nigeria where females not consuming alcohol is the societal norm [32,35,37,38], although this presumption is being challenged in

recent times [38]. The third cluster for Ilorin was dominated by married men who were heavy drinkers again reflecting the dominant alcohol culture found in Nigeria [32,35,37–39].

In the Montevideo analyses, five clusters were apparent. As a reflection of the higher alcohol consumption prevalence rates found in Montevideo [17,25], only one cluster featured abstainers or former drinkers and only represented 11.2% of the total Montevideo sample. Although the mean age of this cluster (26 years) was not the lowest, this cluster's main motivation against drinking was because they were too young, because friends and family disapprove of their drinking and because they were brought up not to drink. The minimum legal age to purchase alcohol in Uruguay is 18 years, although there is no law related to age of consumption of alcohol, so the young age reflection must be self-perceived. Also included in this cluster, and which may explain the inclusion of the first factor, was the motivation against alcohol because of fear which included having seen bad examples of what alcohol can do, and having been hurt by somebody else's drinking. It should be noted that the majority in this cluster were ex-drinkers rather than abstainers per se, perhaps indicating previous bad experiences. Other research has shown the prominence of 'being brought up not to drink' as an important factor for abstainers [14]. Of note, the family/friends influence was more highly rated in the Montevideo factors than in other cities. Family and/or friend disapproval, in particular, is a common reason for limiting alcohol consumption, especially among younger people [11,13,17].

The cluster patterns for Moscow consisted of one cluster where abstainers and former drinkers represented over 70% of the cluster group. Again, based on the high overall alcohol consumption rates [25,40,41], this cluster was smaller in number of respondents and was dominated by females. Higher rates of alcohol consumption for males is frequently acknowledged in Russia [39,42]. Also important in this cluster was the motivation against alcohol consumption because of fear such as they had been hurt by somebody else's drinking, because of health reasons and because they had seen bad examples. This high rating of health reasons (whether current, perceived or possibly into the future) is unusual in this age group as the limiting of alcohol consumption because of health reasons are usually associated with older persons [13]. This could be the result of intensive alcohol reduction programs implemented in recent years by public health agencies that has resulted in changes in alcohol use [43,44]. It has been suggested that alcohol campaigns aimed at limiting consumption should concentrate on broader issues than health outcomes, instead incorporating social and community issues such as crime rates, driving accidents, and economics [6]. Not surprising for Moscow was the domination of HEDs in each of the remaining two clusters. In both of these clusters the positive justification represented by a belief that having a drink is one of the pleasures of life was more common in line with previous studies [19,45]. This factor was less likely to be present in the abstainer cluster which again has previously been reported [19,45].

It has been argued that alcohol consumption patterns in China do not always follow patterns of Western countries [28,46]. Our results indicate this to be true with both initially the factor analysis, and then the cluster analysis, producing different patterns and results in Wuhan compared to the other three cities. While China has a long history of alcohol consumption [46], overall prevalence rates have been relatively low until recent times, especially for females. China's frequency of drinking alcohol and amount consumed at a population level is now approaching other countries levels [25,46–48]. The transition is more notable in the age group of focus in this study [46]. Unsurprisingly, based on the lower overall alcohol prevalence rate, three of the four final clusters had higher rates of abstainers and former drinkers. The clusters consisted of two distinct groups with opposite levels of importance for the factors included. All the clusters had high levels of education. For the largest abstaining group (Cluster 2), the intrinsic/extrinsic factor associated with the motivation against alcohol 'because they had alcohol problems' or 'were afraid they would become an alcoholic', was stronger for this cluster.

Although it would be expected that gender would play an important part in these results, separate clusters dominated by males and females were only found in two of the Montevideo clusters, one cluster for Wuhan and none for the other cities. In this instance the Montevideo male dominant cluster tended to be unmarried, employed males who were heavy drinkers and in the separate cluster females were more likely to be educated, employed and current drinkers. In the final Wuhan cluster, females represented 73% of the sample. Other important descriptive variables included, not being employed and not being students, indicating perhaps a stay-at-home mother (with over 65% having children). While different patterns of alcohol consumption have been historically important, as female's alcohol consumption rates increasingly head towards convergence with males, especially in this age group, it is expected that different patterns would become less prominent [24], although this merging of the female and male alcohol overall consumption rate is contested in the literature [21]. Of note, Loose and Acier [6] report lack of differences in motives for each sex in their French study of students as did Mezquita et al. [16] in their study of Spanish students.

Weaknesses associated with this study include the fact that these analyses are limited to cross sectional studies with no cause or effect or long-term trends implied. We also did not take into account the economic and development status of each city/country, nor investigate relationships with other risk factors (such as smokers and drug intake) which are factors that are an important consideration for the age group we studied [2]. In addition, limiting our alcohol consumption measures to one measure (frequency/quantity) rather than multiple dimensions could be seen as a weakness. Furthermore, the lack of details on personality traits, an important consideration when assessing alcohol consumption patterns, is acknowledged [16,29]. It is also acknowledged that alcohol consumption patterns within a community

are a reflection of that location's political structure, laws and regulations, societal norms and traditions, dominance of anti-alcohol religious convictions, average income levels and economic standings, as well as motives, behaviors and beliefs. Many of these aspects were not addressed in this study. Additionally, it is generally accepted, in theory, that attitudes determine behaviours. Theory also has it that in some circumstances behaviours determine attitudes, (e.g. this is partly what smoking bans hope to achieve). Either way, the theory of factorial causation dictates that attitudes and behaviours should not be analysed in the same exploratory factor analysis (EFA), which we did undertake.

This study, in its rigorous attention to pre-survey detail and cultural differences, has endeavored to overcome any major shortcomings. The strengths of this study include the diversity of the cities studied, the focus on the limited age range, the relatively large sample size, high response rates and the use of probability-based sampling methodology (stratified, clustered, systematic) in each city. In addition, often alcohol consumption is not recorded in many official statistics and this self-report methodology has been able to incorporate all levels of consumption. An additional strength of the study is the inclusion of both abstainers and ex-drinkers, a group often omitted from these types of analyses. Weighting of the data allowed for the estimates to be representative of the general population. A further strength was the use, as far as possible, of comparable measures of alcohol consumption and demographic variables and similar methodological aspects such as sample selection, protocols, and administration. This included city specific interviewing. The involvement of local communities and language specific interviewing with translation and back translation of all questionnaires are also strengths of the study. The use of pre-designed epidemiological-sound methodology, rather than post-data collection manipulation of already collected data, is seen as an additional strength.

This research, addressing the need for more geographical based, methodologically-comparable studies especially in low and middle income countries [3,48], has gone some way in satisfying Bloomfield et al's [49] call for descriptive epidemiological alcohol-related research across multiple regions of the world and calls for more studies on motivation associated with alcohol consumption and abstaining [10,13]. Future research could address the effects of specific alcohol related policies, guidelines, legislation and economic development in each of these cities. In addition, the role and pattern of social interactions has been highlighted as an important component associated with alcohol consumption in this age group and further research into this aspect of life would be beneficial.

In conclusion, specific groupings and characteristics regarding attitudes to, and motives against, alcohol consumption are likely to exist. This study identified up to five groups for each city examined, which provides greater understanding of the patterns of alcohol consumption in these communities and

increased understanding of these key motivations for drinking alcohol. Knowledge and awareness of these patterns highlights opportunities to provide more targeted preventative education and communicative strategies. This research highlights how motivations and behaviours associated with alcohol consumption are closely connected to specific countries and cultures and the importance of socio-demographic indicators.

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Conflict of interest

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The other authors declare that they have no competing interest other than those mentioned in the acknowledgment section.

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Population insight of the relationship between lifestyle and cancer: A population-based survey

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ABSTRACT

Background: There is a substantial rise in the incidence of cancer in Saudi Arabia. Life style models and lack of awareness are the prime suspect in this substantial increase. Therefore, the objective of the present study was to assess the relationship between lifestyle and cancer in a population-based Survey in Northern Saudi Arabia. Methodology: This cross-sectional study was conducted in North Saudi Arabia (Hail Region). Data was collected as a part of a community based cancer's awareness movement that covered an area inhabited with approximately 500,000 individuals. Results: In this study, about 2558/3227 (79.3%) and 641/794 (80.7%) believed that tobacco smoking and smokeless are not a risk of cancer development. In this study large section (87.2%) of the study population believe that exposure to diverse occupational or non-occupational chemicals has no role in cancer development. Furthermore, around 59% of the study subjects in the current study believed that repeated exposure to insecticidal chemicals doesn't influence the risk of cancer. Conclusion: The present study point to the urgent need for awareness educational programs and preventive measures towards may lifestyle factors that can increase or decrease the overall risk of cancer among Saudi population.

Keywords: cancer awareness; lifestyle; Saudi Arabia; cancer; risk factors

1. Introduction

The global burden of cancer continues to increase largely both in developed and developing countries [1]. The incidence of cancer continues to rise every years due to accumulation of several risk factors including; increasing tobacco use, physical inactivity, overweight, aging and shifting reproductive patterns accompanying urbanization and economic growth. In 2012, there were 14.1 million new cancer cases and 8.2 million deaths worldwide. In recent years it was observed that the burden of cancer has shifted toward developing world, which represented about 57% of new cases and 65% of cancer deaths worldwide [2]. The incidence of the new cancer cases in developing countries is expected to increase from about 56% to more than 60% of the world's total in 2030, which is attributed to the increasing

However, implementing systematic, equitable and evidence-based strategies for prevention, early detection, diagnosis, treatment and palliation using available resources is a program known as national cancer control program (NCCP) designed by World Health Organization (WHO) to reduce the morbidity and mortality of cancer and improve quality of life of cancer patients. Regardless of resource limitations a country experiencing, when well-perceived and well-managed, a NCCP supports decrease the cancer burden and improve facilities for cancer patients and their families [4]. Increased weight or obesity elevates the risk of several cancers in many organs including; esophagus, colorectum, breast endometrium and kidney. It is necessary to maintain the body mass index within the normal range (18.5–25 kg/m²). Regular physical activity, decreases the risk of colorectal cancer and breast cancer. Alcoholic beverage consumption was found to increase the risk of some cancers including; liver, esophagus, pharynx, oral cavity and breast cancer. Foods frequently contaminated with Aflatoxin increases the risk of hepatocellular carcinoma. Salt preserved foods and high salt consumption perhaps upsurge the risk of carcinoma of the stomach. Certain salted fish was found to increase the risk of nasopharyngeal carcinoma. Preserved food particularly red meat possibly increase the risk for colorectal cancer.

Regular intake of Fruits and vegetables most likely decrease the risk of several cancers including; the cancers of oral cavity, esophagus, stomach and colorectum [5]. There is a substantial rise in the incidence of some cancers in Saudi Arabia in recent years due to several etiological risk factors, which differ for different geographical regions in the country [6]. Life style models and lack of awareness are the most common factors expected to contribute to substantial increase in the incidence of cancer in Saudi Arabia [7–11]. Increase of age in general population as well as, obesity are the most challenging factors contributing to the etiology of cancer in Saudi Arabia [12]. Cancer awareness is an increasingly important issue in light of increasing incidence and associated healthcare costs, as well as the presence of risk management strategies [13]. However, the great majority of cancers arise as a consequence of modifiable life style risk factors; therefore community education program targeting cancer risk factors is crucial to reduce the overall incidence of cancer [14]. Therefore, the objective of the present study was to assess the relationship between lifestyle and cancer: A population-based Survey in Saudi Arabia.

2. Materials and methods

This cross-sectional study was conducted in North Saudi Arabia (Hail Region). Data was collected as a part of a community based cancer's awareness movement that covered an area inhabited with approximately 500,000 individuals. The sample size was calculated using online sample size calculator available at: <https://www.calculator.net/sample-size-calculator.html>.

Applying confidence interval of 60 ± 1.66 and confidence level of 95%, the sample size was 3326.

Participants were targeted in different public settings including University of Hail. Each participant was asked to fill a questionnaire about tobacco and alcohol habits and other information regarding their attitudes towards these factors in relation to cancer etiology. Beside the demographical characteristics, the questionnaire also included; Living with smoker, Smokeless tobacco; Chemical usage, Insecticidal exposure, Vegetable and fruit wash before eating, Radiation exposure, Soft or refined food can increase the risk of cancer, Preserved food can increase the risk of cancer, Some food can increase the risk of cancer, Some food can decrease the risk of cancer, Natural food can decrease the risk of cancer, Vegetable and fruit intake decrease cancer risk, Green Tea and other antioxidant decrease cancer risk, Physical activity decrease cancer risk, Increased body weight increases cancer risk, Obesity can increase the risk of cancer.

2.1. Statistical analysis

Statistical analysis was performed by proportion. The Microsoft Excel Office 2007 and the SPSS software (version 16) were used for statistical analysis. The software was used for calculation and production of frequencies and percentages.

2.2. Ethical consent

Written informed consent was obtained from each respondent, ensuring strict anonymity. The Ethical Committee of the Department of Pathology, College of Medicine at the University of Hail has approved the study.

3. Results

This study included 3326 participants, their ages ranging from 15 to 77 years old with a mean age of 25 years. Out of 3253 respondents for gender classification, 1701 (52.3%) were males and 1552 (47.7%) were females.

The knowledge about the relationship between cancer risk and factors such as tobacco usage and alcoholic beverages consumption was summarized in Table 1. Out of 3227 respondents, 669/3227 (20.7%) participants were found to believe that tobacco smoking is a major risk factors for cancer and the remaining 2558/3227 (79.3%) had indicated that tobacco smoking is not risk factors. Out of the 669 answered "yes", 647/1684 (38.4%) were males compared to 22/1543 (1.4%) females. Out of 2558

participants answered “No”, 1037/1684 (61.6%) were males and 1521/1543 (98.6%) were females, as indicated in Table 1, Figure 1.

With regard to exposure to passive smoking (living with smoker), 1430/3103 (46%) participants were found to believe that exposure to passive smoke is a risk for cancer and the remaining 1673/3103 (54%), were not. Out of 1430 respondents “Yes”, 761/1597 (47.7%) were males and 669/1506 (44.4%) were females. Out of 1673 respondent “No”, 836/1597 (52.3%) were males and 837/1506 (55.6%) were females, as shown in Table 1, Figure 1.

With regard to smokeless tobacco, 1139/1322 (86.2%) participants has pointed out that, smokeless tobacco is a major risk for cancer and only 183/1322 (13.8%) have answered “No”. Out of the 1139 “Yes” respondents, 641/794 (80.7%) were males and 498/528 (94.3%) were females. Out of 183 answered “No”, 153/794 (19.3%) were males and 30/528 (5.7%) were females, as shown in Table 1, Figure 1.

For alcoholic beverages consumption, only 57/3207 (1.8%) have agreed that alcohol consumption may be a risk factor for cancer and the remaining 3150/3207 (98.2%) believed that alcohol beverage consumption is not considered as a cancer risk factor, as indicated in Table 1, Figure 1.

Table 1. The relationship between cancer, tobacco exposure, and alcohol consumption.

Variable	Category	Males	Females	Total
<i>Tobacco smoking</i>				
	Yes	647	22	669
	No	1037	1521	2558
	Total	1684	1543	3227
<i>Living with smoker</i>				
	Yes	761	669	1430
	No	836	837	1673
	Total	1597	1506	3103
<i>Smokeless tobacco</i>				
	Yes	641	498	1139
	No	153	30	183
	Total	794	528	1322
<i>Alcohol consumption</i>				
	Yes	55	2	57
	No	1607	1543	3150
	Total	1662	1545	3207

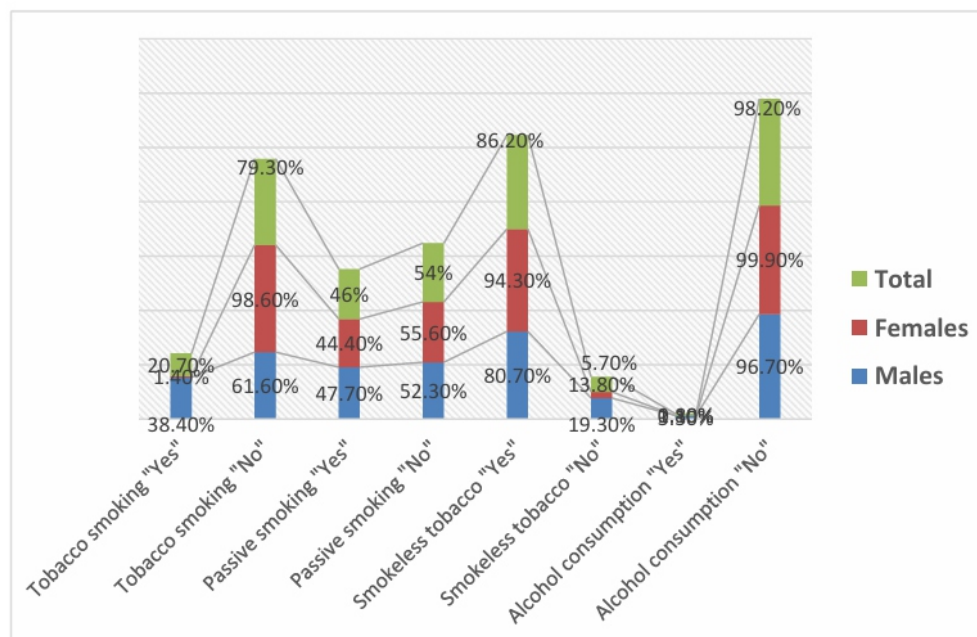


Figure 1. The proportions of the relationship between cancer, tobacco exposure, and alcohol consumption.

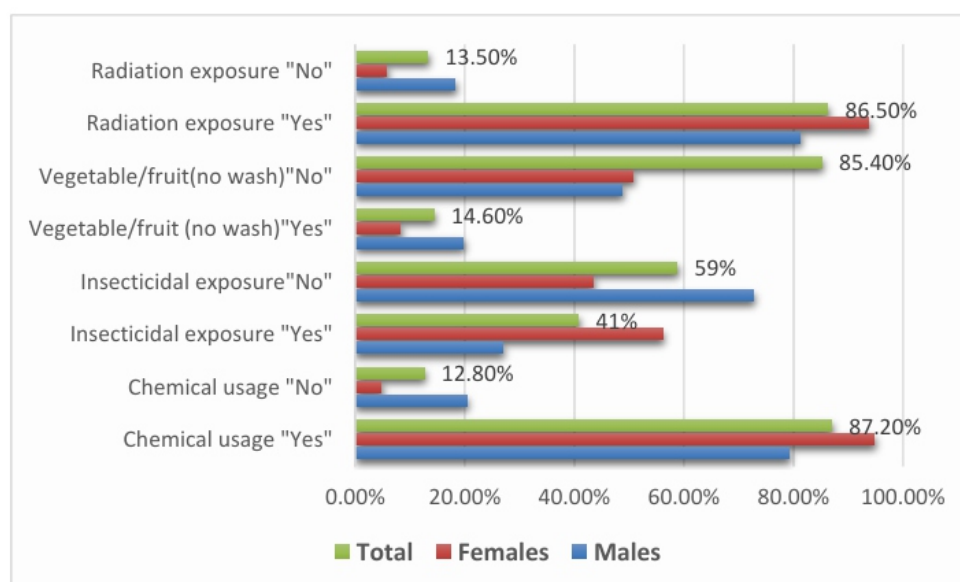
The knowledge on the relationship between cancer, chemical usage, insecticidal, and radiation exposure was summarized in Table 2, Figure 2. Out of the 1884 respondents, about 1640/1880 (87.2%) participants believed that comprehensive repeated chemical substances usage is a major cancer risk factor and the remaining 240/1880 (12.8%) have reverse believe. Out of the 240 participants answered “No”, 194/944 (20.6%) were males and the remaining 46/936 (5%) were females.

Out of the 3153 respondents, about 1292/3153 (41%) participants believed that comprehensive repeated exposure to insecticidal chemicals is a major cancer risk factor and the remaining 1861/3153 (59%) have reverse believe. Out of the 1861 participants answered “No”, 1210/1663 (72.9%) were males and the remaining 651/1490 (43.7%) were females. Out of the 3207 respondents, about 469/3207 (14.6%) participants believed that comprehensive repeated eating of vegetables and fruits without wash is a major cancer risk factor and the remaining 2738/3207 (85.4%) have reverse believe. Out of the 2738 participants answered “No”, 1341/2738 (49%) were males and the remaining 1397/2738 (51%) were females.

Out of the 1750 respondents, about 1514/1750 (86.5%) participants believed that exposure to radiation is a major cancer risk factor and the remaining 236/1750 (13.5%) have reverse believe. Out of the 236 participants answered “No”, 195/1055 (18.5%) were males and the remaining 41/695 (6%) were females, as indicated in Table 2, Figure 2.

Table 2. The relationship between cancer, chemical usage, insecticidal, and radiation exposure.

Variable	Category	Males	Females	Total
<i>Chemical usage</i>				
	Yes	750	890	1640
	No	194	46	240
	Total	944	936	1880
<i>Insecticidal exposure</i>				
	Yes	453	839	1292
	No	1210	651	1861
	Total	1663	1490	3153
<i>Vegetable and fruit wash before eating</i>				
	Yes	339	130	469
	No	1341	1397	2738
	Total	1680	1527	3207
<i>Radiation exposure</i>				
	Yes	860	654	1514
	No	195	41	236
	Total	1055	695	1750

**Figure 2.** The relationship between cancer, chemical usage, insecticidal, and radiation exposure.

The relationship between cancer, and food habits was summarized in Table 3, Figure 3. When asking the participants whether soft or refined food can increase the risk of cancer, around 1230 participants have responded. Out 1230 respondents, 920 (74.8%) (388 were males and 532 were females) answered “Yes” and 310 (25.2%) (265 were males and 45 were females) answered “No”.

When asking the participants whether preserved food can increase the risk of cancer, about 1372 participants have responded. Out 1372 respondents, 1082 (79%) (462 were males and 620 were females) answered “Yes” and 290 (21%) (240 were males and 50 were females) answered “No”.

When asking the participants whether some food can increase the risk of cancer, about 465 participants have responded. Out 465 respondents, 89 (19%) (56 were males and 33 were females) answered “Yes” and 376 (81%) (301 were males and 75 were females) answered “No”. When asking the participants whether some food can decrease the risk of cancer, about 2858 participants have responded. Out 2858 respondents, 1767 (19%) (708 were males and 1059 were females) answered “Yes” and 1091 (81%) (653 were males and 438 were females) answered “No”. When asking the participants whether natural food can decrease the risk of cancer, about 2581 participants have responded. Out 2581 respondents, 2072 (80%) (873 were males and 1199 were females) answered “Yes” and 509 (20%) (328 were males and 181 were females) answered “No”. When asking the participants whether vegetable/fruit intake can decrease the risk of cancer, about 2039 participants have responded. Out 2039 respondents, 1738 (80%) (654 were males and 1084 were females) answered “Yes” and 301 (20%) (177 were males and 124 were females) answered “No”. When asking the participants whether anti-oxidants such as green tea intake can decrease the risk of cancer, about 1834 participants have responded. Out 1834 respondents, 1169 (64%) (393 were males and 776 were females) answered “Yes” and 301 (36%) (345 were males and 320 were females) answered “No”, as shown in Table 3, Figure 3.

Table 3. The relationship between cancer, and food habits.

Variable	Category	Males	Females	Total
<i>Soft or refined food can increase the risk of cancer</i>				
	Yes	388	532	920
	No	265	45	310
	Total	653	577	1230
<i>Preserved food can increase the risk of cancer</i>				
	Yes	462	620	1082
	No	240	50	290
	Total	702	670	1372
<i>Some food can increase the risk of cancer</i>				
	Yes	56	33	89
	No	301	75	376
	Total	357	108	465
<i>Some food can decrease the risk of cancer</i>				
	Yes	708	1059	1767
	No	653	438	1091
	Total	1361	1497	2858
<i>Natural food can decrease the risk of cancer</i>				
	Yes	873	1199	2072
	No	328	181	509
	Total	1201	1380	2581
<i>Vegetable and fruit intake decrease cancer risk</i>				
	Yes	654	1084	1738
	No	177	124	301
	Total	831	1208	2039

Continued on next page

Variable	Category	Males	Females	Total
<i>Green Tea and other antioxidant decrease cancer risk</i>				
	Yes	393	776	1169
	No	345	320	665
	Total	738	1096	1834

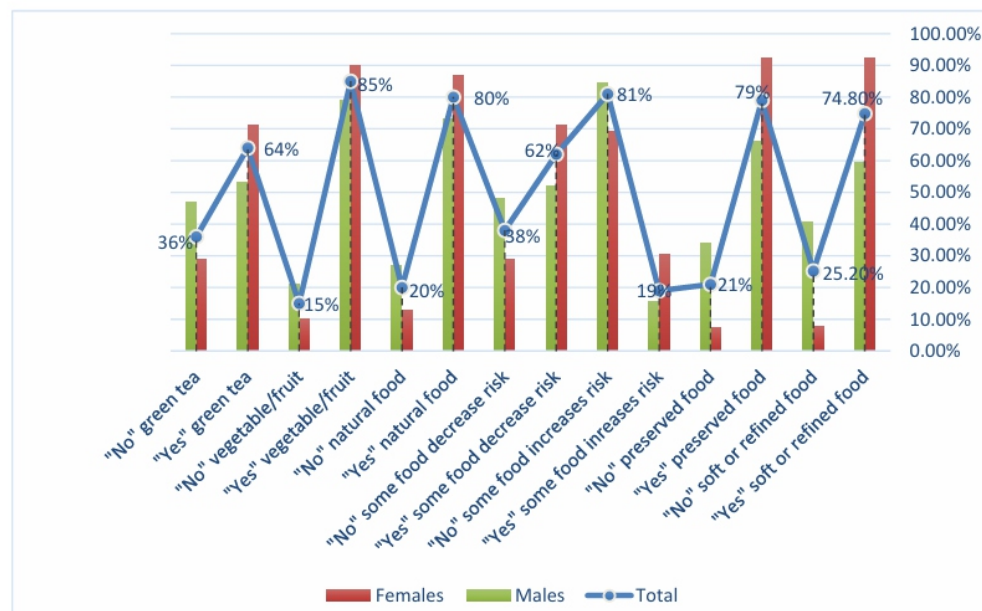


Figure 3. The relationship between cancer, and food habits.

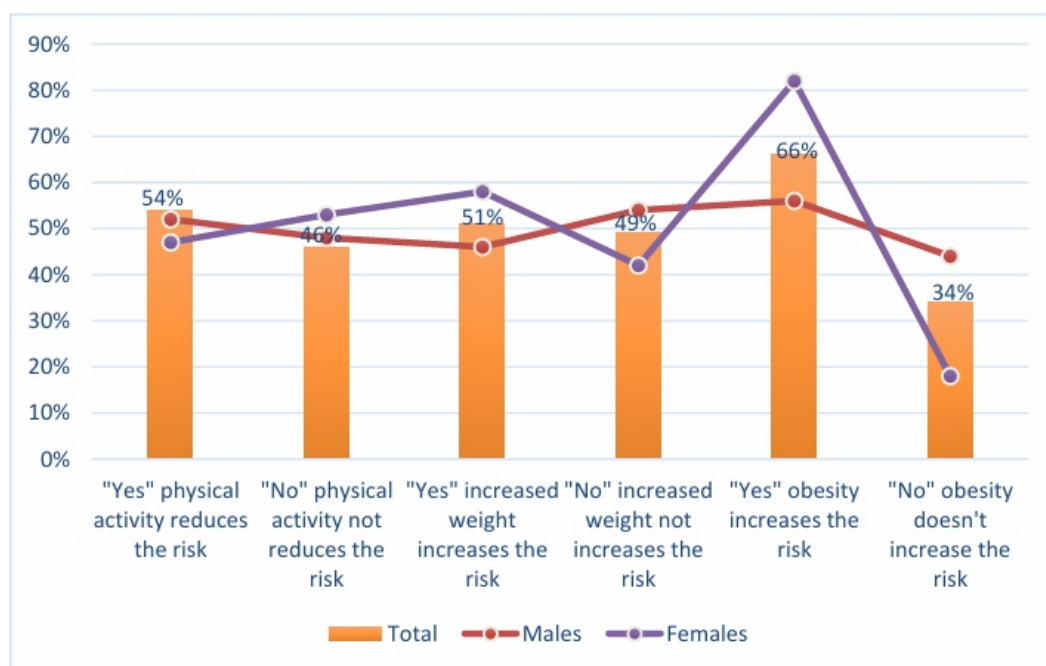
The relationship between cancer, and body weight and physical activity was summarized in Table 4, Figure 4. With regard to the physical activity as a factor that can decrease the risk of cancer, out of 3193 respondents, 1711 (54%) participants agreed “Yes” (874 were males and 837 were females) that physical activity can reduce the risk of cancer, hence, about 1482 (46%) participants (793 were males and 689 were females) disagreed “No”.

With regard to increased body weight as a factor that can increase the risk of cancer, out of 3172 respondents, 1631 (51%) participants agreed “Yes” (759 were males and 872 were females) that increased body weight can increase the risk of cancer, hence, about 1541 (49%) participants (898 were males and 643 were females) disagreed “No”.

With regard to obesity as a factor that can increase the risk of cancer, out of 1124 respondents, 745 (66%) participants agreed “Yes” (379 were males and 366 were females) that obesity can increase the risk of cancer, hence, about 379 (34%) participants (299 were males and 80 were females) disagreed “No”.

Table 4. The relationship between cancer, and body weight and physical activity.

Variable	Category	Males	Females	Total
<i>Physical activity decrease cancer risk</i>				
	Yes	874	837	1711
	No	793	689	1482
	Total	1667	1526	3193
<i>Increased body weight increases cancer risk</i>				
	Yes	759	872	1631
	No	898	643	1541
	Total	1657	1515	3172
<i>Obesity can increase the risk of cancer</i>				
	Yes	379	366	745
	No	299	80	379
	Total	678	446	1124

**Figure 4.** The relationship between cancer, and body weight and physical activity.

4. Discussion

Cancer represent a major health problem worldwide. Although the prevalence of cancer is high in developed countries, but there is a tremendous increase of cancer in developing countries. In light of increasing of new cancer cases, there is an uprising need for implementing cancer awareness programs.

In the present study we tried to highlight some important cancer issues in order to find out the gaps in this context to make available more information to take effective cancer prevention strategies.

In the current study we screened a large population in a cross sectional survey in Hail region (Northern Saudi Arabia) in order to evaluate the level community awareness and knowledge toward some cancer related life style habits. Hail is a province of Saudi Arabia, located in the north of the country. It has an area of 103,887 km² and a population of 547226 (2010 census) [15]. Hail's people are social able and they have the custom of regular gathering in what is known locally as “Diwania”, therefore, is always opportunities to spread the awareness through these public gathers.

In this study, about 79.3% and 80.7% believed that tobacco smoking and smokeless are not a risk of cancer development. These findings have great discrepancies from other studies that reported much lower percentages. In study to evaluate the awareness of oral cancer and perception of tobacco use cessation counseling 97.6% Indian, 96.5% Saudi, 96.5% Yemeni and 98.4% United Arab Emirates respondents recognized the association between oral cancer and cigarette smoking [16]. Another study indicated that tobacco chewing (84%), tobacco chewing with areca nut (68%), chewing areca nut alone (51%) and exposure to actinic radiation (71%) as risk factors [17]. Another study from Yemen indicted that about 71.5% of the participants had heard about oral cancer. Smoking and smokeless tobacco usage were identified as the major risk factors by 71.5% and 73.7% of the participants, respectively [18]. In a study to assess the level of awareness regarding association between tobacco use and cancer, the risk awareness of the smoking lung cancer link was 83.6%, while the risk awareness of the smoking heart disease link was 46.5% [19]. In a study from Saudi Arabia to assess the level of awareness and knowledge about signs and risk factors of oral cancer in the general population in Saudi Arabia. Only 53.6% of the participants had heard of oral cancer. Smoking and alcohol consumption were identified as the major risk factors by 81.7% and 56.3% of the participants, respectively [20]. However, the acute differences in these studies compared to our findings might be attributed to study population. The majority of these previous studies devoted to students and more educated population settings, hence, our study was restricted to deep community base setting in northern Saudi Arabia. The level of education and less exposure to civilization in addition to the lack of awareness might strongly contribute the findings of the present study.

In the present study about 98.2% of the participants disagreed that alcohol consumption is a risk factor for cancer development. Although it was well established that alcohol beverages consumption is a risk for the development of several precancerous and cancerous lesions [21–23], but there is a lack of data in this regard from Saudi Arabia. However, studies from Saudi Arabia have showed low epidemiological values in this regard [24,25]. In Saudi Arabia, alcohol beverage consumption is illegal and also considered as social stigma, thus it is difficult to find the exact epidemiological measures.

In this study large section (87.2%) of the study population believe that exposure to diverse occupational or non-occupational chemicals has no role in cancer development. The exposure to diverse types of chemical substances has been linked to a number of cancers. Early-life arsenic exposure, has been linked to lung and bladder cancer [26], workplace chemical exposures (soldering materials) has been linked to breast cancer [27]. Occupational exposure to diverse chemical in industrialized areas has been linked to several cancers [28]. However the only study in this context from Saudi Arabia linked the occupational benzene exposure in petroleum stations to development of bladder precancerous changes [29].

Furthermore, around 59% of the study subject in the current study believed that repeated exposure to insecticidal chemicals doesn't influence the risk of cancer. Exposure to insecticidal chemicals such as Organochlorine insecticides has been linked to some cancers, particularly leukemia [30,31].

In the present study about 85.4% of the participants believed that comprehensive repeated eating of vegetables and fruits without wash doesn't increase the risk of cancer. The majority of these vegetables and fruits are contaminated with various chemicals including pesticides insecticides, and herbicides, the risk of which is well established [30,32,33]. With regard to the exposure to radiation, approximately 86.5% of the participants believed that exposure to radiation is a major cancer risk factor. This is high percentage of awareness toward radiation hazard. When asked the participants whether soft or refined food can increase the risk of cancer, around 74.8% answered yes. Many studies have suggested the relationship between intake of refined and fast food and the risk of cancer [34–36], which requires, the undertaking of certain educational and preventive measures.

When asked the participants whether preserved food can increase the risk of cancer, about 79% of the participants agreed. However, the intake of preserved foods was positively associated with the incidence of epithelial ovarian cancer [37], as well as, esophageal carcinoma [38]. On we asked the participants whether some food can increase the risk of cancer, only 19% have answered yes. It was suggested that vegetable fiber and total fiber play very important roles in protecting against colorectal cancer [39]. Increased intake of omega-3 fatty acids associated with decreased omega-6—resulting in higher omega-3 to omega-6 ratio compared with Western-type diet—is inversely associated with breast cancer risk [40]. Moreover, similar results were found on asked the participants whether some food can decrease the risk of cancer. There are several dietary types can reduces the risk of some cancers. It was found that soy intake possibly decreases the risk of breast cancer [41].

On asking the participants whether natural food can decrease the risk of cancer, 80% answered yes. Because of their role as antioxidants, the intake of carotenoids has been found to reduce the risk of head

and neck cancer (HNC) [42]. The consumption of fruits is well known to reduce the risk of human cancers. Since oxidative stress and chronic inflammation play important roles in cancer development, dried fruits with antioxidative and anti-inflammatory properties hold promise for cancer chemoprevention. The antioxidant, anti-inflammatory and chemopreventive activities of dried fruits are largely attributed to their polyphenols and vitamins. Dried fruits contain adequate amounts of bioactive principles, such as anthocyanins, acetogenins, catechins, coumarins, phenolic acids, terpenes, xanthones, and others [43].

On asking the participants whether vegetable/fruit intake can decrease the risk of cancer, about 80% agreed. A higher consumption of vegetable and fruit was found to be associated with a decreased risk of several cancers, such as breast cancer, hepatocellular carcinoma, gastric carcinoma etc [44–46]. When asking the participants whether anti-oxidants such as green tea intake can decrease the risk of cancer, about 64% agreed. An inverse association between green tea intake and lung cancer risk has been observed among never smokers but not among smokers [47]. There are insufficient evidences to support green tea consumption reduces the risk of esophageal cancer, gastric cancer, and pancreatic cancer [48–50].

With regard to the physical activity as a factor that can decrease the risk of cancer, about 46% of the study population disagreed. Physical activity is consistently associated with a reduced risk of colorectal cancer in epidemiologic studies. Overall, a stronger relative risk of physical activity on colorectal cancer risk was observed in the higher body mass index group, although the difference was not statistically significant, suggesting an added benefit of physical activity as a cancer prevention strategy in population groups with strong risk factors for colorectal cancer [51]. Exercise promotes significant improvements in clinical, functional, and in some populations, survival outcomes and can be recommended regardless of the type of cancer. Although generally safe, patients should be screened and appropriate precautions taken. Efforts to strengthen uniformity in clinical trial reporting, develop clinical practice guidelines, and integrate exercise and rehabilitation services into the cancer delivery system are needed [52].

With regard to increased body weight as a factor that can increase the risk of cancer, about 49% of the study population in the present study disagreed. The joint association between energy balance and cancer risk are hypothesized to share the same underlying mechanisms, the amplification of chemical mediators that modulate cancer risk depending on the responsiveness to those hormones to the target tissue of interest. Disentangling the connection between obesity, the insulin-IGF axis, endogenous hormones, inflammatory markers, and their molecular interaction is vital [53]. The association between obesity and several cancers is well-established [54,55].

Alcohol consumption, salt consumption, red meat consumption and Aflatoxin contamination are considered as cancer risks [56]. The limitations in the current study include its cross-sectional design. Longitudinal studies in the future might give up insight into developments in the outcomes of existing and future lifestyle related cancer control measures. Another limitation of the present study is that data were obtained via self-report.

5. Conclusions

The present study point to the urgent need for awareness educational programs and preventive measures towards may lifestyle factors that can increase or decrease the overall risk of cancer among Saudi population. There is a necessity for in depth cancer prevention related studies and further specific measurements to prove that life style risk factors have influence on cancer burden in Saudi Arabia and in Northern Saudi Arabia in particular.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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Psychometric properties of the workplace psychologically violent behaviors-WPVB instrument. Translation and validation in Greek Health Professionals

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ABSTRACT

Background: Mobbing exerts severe psychological and occupational effects on the victim. This study aims to validate the Yildirim & Yildirim's Workplace Psychologically Violent Behaviors (WPVB) instrument (2008) in the Greek language in Greece, as cultural variations may result in significantly different perceptions of mobbing. Methodology: A translation process of the WPVB questionnaire scale was followed from the English to the Greek version and a review by a team of experts for its content validity took place, as well. Principal component analysis took place and the Cronbach's index was 0.95. The cross sectional, quantitative study was performed in 1536 health professionals (Hps), working in 11 public hospitals for at least one year with response rate of 76.8%. Results: Factor analysis revealed two factors, and 31-item construct, compared to the four factors and the 33-item construct of the original version of the tool. All items were found to have a statistically significant correlation ($p < 0.001$). Median score was 0.48. Whereas 25% of answers score was above 1.00, thus suggesting significant mobbing in around 25% of HPs. Association of WPVBs subscales with sex and occupation are had lower values in women as compared to men. Lower scores on "Attack on personality" and "Total mobbing" score were recorded in nurses as compared to doctors. Doctors had lower scores on "Individual's isolation from work" as compared to administrative personnel, while had greater scores on "Individual's isolation from work" as compared to technicians. Nurses had significantly lower scores on "Attack on professional status", "Individual's isolation from work", "Direct attack" and "Total mobbing" score as compared to administrative personnel. Conclusions: The study highlights that the phenomenon of mobbing exists in Greek HPs regardless of age, gender, level of study and negatively affects their lives. Focusing on improving this area, is expected to promote occupational health and safety of these workers.

Key words: health professionals; instrument; mobbing; nurses; psychometrics

1. Introduction

The phenomenon of mobbing involves employees "ganging up" on a target employee and subjecting him or her to psychological harassment [1]. This "mobbing" behavior exerts severe psychological and occupational effects on the victim. In Greece, it seems that the phenomenon of moral harassment exists

in all work environments including the health sector [2]. A study on the effect of mobbing on the professional life of nurses in seven Greek hospitals showed that nurses, men, and women (71%), had been victims of moral harassment during the past year and had psychosomatic symptoms (anxiety 54.3%, headaches 52%, denial of work 28%, depression 16.3% etc), [3]. Also, 22.8% of the respondents stated that they had been harassed at some time by a colleague during working in the hospital. Of the victims of moral harassment, only 38.2% appealed for help. The majority (80%) said that their personal life [3] had been affected. In a study by Yildirim and Yildirim [4], on the moral harassment of nurses in public and private healthcare facilities by their heads and colleagues that lead to mental and physical health effects, it was found that the vast majority (85.6%) were victims of moral harassment over the last 12 months. A research in Cyprus among the Health-care professionals for the prevalence and forms of workplace bullying has shown that 135 employees (45.6%) were exposed to at least one bullying behavior at work within the previous 12 months, whereas 9.9% were exposed to at least one bullying behavior at least once weekly within the previous 12 months [5]. In another similar study by Sahin et al. [6], registered doctors of Turkish origin who worked in private hospitals and as auxiliary staff at university institutions reported that they were more exposed to moral harassment behaviors (87.7%) than permanent medical staff. A study in Taiwan by Pai and Lee [7] in nurses in public hospitals investigating the risk factors and the consequences of physical and psychological violence for their mental health showed that of 521 participants, 102 (19.6%) reported that they had been subjected to physical violence, 268 (51.4%) had suffered verbal abuse, 155 (29.8%) had experienced/threats and 67 (12.9%) had sexual harassment. A recent study by Erdogan & Yildirim [8] for the exposure of healthcare professionals' to mobbing behaviors reported that the rate of exposure to one of the subdimensions of mobbing scale at least once in the last year was 66.4% for isolation, 71.8% for attack on professional status, 78.1% for attack on personality, and 28.4% for direct negative behaviors. Females as compared with males and participants with low income as compared to high income were more exposed to mobbing. Postgraduate participants less commonly suffered from mobbing. The nurses as compared with doctors were more exposed to mobbing and the individuals with an occupational experience of >10 years were more exposed to mobbing.

In a recent study in Turkey about mobbing behaviors encountered by nurses and their effects on nurses, showed that among the nurses participating in this study, 62.2% stated that they encountered mobbing behaviors in the workplace once or for more times over the last twelve months. The most frequent mobbing behaviors experienced by the nurses were in the form of "Attack on Professional Status" (67.7%). [9]

Although there is a small number of studies in Greece-[10–14] for the impact of mobbing on healthcare providers, according to studies from abroad, it is imperative to validate the specific tool to measure psychological violence and behaviors that will help to investigate these effects. According to the effects of mobbing behaviors on healthcare providers, recent studies have shown that they cause many mental and physical health problems and have a negative impact on their quality of life. In the study by Durmus et al. [9], mobbing behaviors in the workplace often affected the nurses psychologically.

In a study conducted with nurses in Turkey, Yildirim [15] found that reactions to mobbing behaviors tended to be physical disorders such as fatigue and stress, followed by over-eating or poor appetite and headaches. Silva Joao and Saldanha Portelada (2016) reported similar results, too. In their study, the nurses who were exposed to mobbing frequently experienced anxiety, insomnia, restlessness, failure, distrust feelings and impaired concentration. Therefore, it is consistently difficult for an unhappy, sleepless, anxious and distracted member of the nursing profession with low self-esteem and profoundly disturbed wellbeing state to carry out the nursing process successfully and to provide quality services [16,17].

When the effect of mobbing on the performance of the nurses was evaluated, the nurses marked statements such as decreased commitment to work, lack of concentration and making more mistakes. Thus, the diminished work efficiency or motivation of a nurse who is suffering from mobbing directly leads to poor quality of care for patients/healthy individuals. A decrease in patient care quality may cause many risk factors such as prolongation of hospital stay by adversely affecting patients' health [16,17]. A 117 descriptive study in Turkey by Ekici and Beder [18] assessed the prevalence of intimidation in the workplace of 201 doctors and 309 nurses working at a university hospital in Turkey, as well as the effects of the phenomenon. The study showed that psychological violence in the workplace has a significant effect on the development of the depressive disorder of both doctors (27%) and nurses (33%). The study of Malinauskiene and Einarsen [19] investigates intimidation in the workplace and the symptoms of post-traumatic anxiety disorder in family doctors in Lithuania. The prevalence of post-traumatic symptoms was 15.8%, quite high for general practitioners. A study in Iran by Najafi and his colleagues [20] investigated the perceptions and experiences of Iranian nurses about past experiences of violence against them, as well as the implications of workplace violence by patient relatives, colleagues and their directors/supervisors. In addition to the negative impact on the personal and family lives of the nurses identified, workplace violence can lead to lower quality of care for patients and a negative attitude what the nursing profession [20]. A very recent qualitative study by Hassanjhani et al.[21] took place in Iran on the consequences of mobbing in the lives of 16 nurses working in the emergency departments of five hospitals in Azerbaijan.

It has been found that the practice of violence and harassment in the workplace can lead to consequences that negatively affect their quality of life in general. In particular, it can lead to psychological and psychiatric disorders, organic diseases, questioning their professional integrity, and social stigma and withdrawal. People who suffer from ethical and psychological violence/harassment at work have increased cooperative difficulties, have reduced stress resistance, and feel physical discomfort [22]. The serious consequences of the mobbing at the workplace are not limited to the victim itself but extend to the body/service where such phenomena occur. The organizational and team productivity and efficiency of public services are undermined [23]. Negative effects for the HPs have significant impact both in their professional and personal lives, contributing to a negative climate in the organization as whole. Mobbing can be responsible for a wide variety of psychological and social problems, which can include absence from the workplace, lower productivity at work, burnout, stress, anxiety and even depression [24]. Also, the critical review of Fountouki et al. [25] about the effect of anxiety in nursing staff has shown that nurses when they are in situations under heavy stress that has a negative impact on their professional lives, such as insufficient work recourses, dissatisfaction with psychosocial work environment, poor communication with superiors, lowering levels of education achieved and pay, splitshifts and prolonged night shifts, high demanding tasks, verbal abuse, mobbing and antagonistic attitudes in work place and poor organization at work [25].

On the other hand, a well-developed reliable taxonomy of workplace bullying has not yet been established and workplace bullying has been categorized often with little scientific evidence. Nevertheless, the work of Rodriguez-Carballeira et al. [26] is a considerable step towards this direction, placing emphasis, on emotional and physical isolation, which is considered as a separate category.

The development of a reliable and widely accepted taxonomy could play a critical role in instrument development or refinement and allow the reliable measurement and description of this phenomenon. Although mobbing is frequent, one only validated instrument has been used to measure it in Greece. Besides The Negative Acts Questionnaire (NAQ-22), which is measuring perceived exposure to workplace bullying in teachers, and the Greek version of Leymann Inventory of Psychological Terror (LIPT) instrument, which was validated by Zachariadou et al. [5], no other instrument exists in our country for the measurement of psychological violence that health professionals are exposed to in the workplace. The instrument proposed by Yildirim and Yildirim [4] comprises a wide range of mobbing behaviors, it is designed especially for nurses and has been validated in the Turkish nurse population. The purpose of the present study was to validate this instrument in Greek language in Greece, as cultural variations may result in significant different perceptions of mobbing.

1.1. The importance of the study

“Mobbing” or “harassment syndrome” is a reality for most workers. It is observed—if not all in most professions—and in most workplaces, and thus in that of Hospitals, which in any case on its own, is entrusted owing to its special character. Mobbing does not seem to have been studied in depth and wide enough to cover all occupations in all.

The phenomenon has been alarming in our country, even though extensive and in-depth investigations have not been carried out as opposed to foreign countries. The first scientifically substantiated studies [27–31] show that this phenomenon is detrimental to the physical and mental health of workers and, by extension, to their families and is one of the most important causes of abandonment [27–31]. Given that:

- *“the actual dimension of mobbing is not yet widely known,*
- *it has a significant impact on the mental and physical health of the employees and also affects their family, professional and social life,*

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- *it is an interesting scientific subject, which needs more study and exploration and finally it has not been studied enough in our country’s healthcare professionals and we believe it is necessary to carry out research to study the moral harassment of HP’s and how it affects their quality of life” [32–34].*

The present study through the questionnaire accurately captures the magnitude of the problem in the working sector of health services in Greece, behaviors of moral harassment, forms of harassment as well as investigate who these behaviors come from, at this workplace. Finally, it helps to tackle the phenomenon through performing appropriate intervention tools and procedures (information and prevention programs) by both mental health professionals and decision-makers in the field of interdisciplinary teamwork of occupational health and safety services in Greece.

2. Materials and methods

The study’s convenience sample consisted of 1536 HPs, working in 11 public hospitals for at least one year, in two health prefectures in Greece. The WPVB instrument used in this study, was initially comprised of 33 items and according to its inventors, shows a four-factor construct. A) Individual’s isolation from work, B) Attack on professional status, C) Attack on personality, D) Direct attack. Within the Greek version of this instrument, 11 items are related to “individual’s isolation from work”, 9 items related to “attack on professional status”, 9 items related to “attack on personality” and 4 items related to

“direct attack”, other than “direct attack”, were shown to have quite high levels of internal consistency. The Greek version of WPVB questionnaire has been proven reliable and valid, with a Cronbach’s α found to be 0.93. HPs were asked to mark the frequency within the last 12 months that they had faced items on the given list they were given of workplace antagonistic and unethical behaviors that have had a negative effect on their work performance and to mark also, by whom every behavior they had been exposed to had come from (supervisor, coworker, subordinate or other). A six-point Likert type scale was used for the determination of frequency of mobbing behaviors as follows: 0 = I have never faced, 1 = I have faced once, 2 = I face this sometimes, 3 = I have faced several times, 4 = I frequently face this, 5 = I constantly face this. Individuals who receive a score from the scale divided by the number of items finally included in the instrument (total score/31), that is one or greater, can be said to have faced intentional workplace mobbing behaviors. Questions no.13 and 33, (B1 and D1 in the original version respectively) were excluded from the analysis since they were answered by four individuals only.

2.1. Statistical analysis

Continuous variables are presented with mean and standard deviation (SD) or with median and inter-quartile range (IQR). Qualitative variables are presented with absolute and relative frequencies. In order to evaluate the construct validity of the questionnaire, a confirmatory factor analysis (CFA) with maximum likelihood procedure was performed. The variance of the latent constructs was fixed at one during parameter estimation. The fit of the CFA model was assessed using the chi-square (χ^2), the comparative fit index (CFI), the goodness of fit index (GFI) and the root mean square error of approximation (RMSEA) [35]. For the CFI and GFI indices, values close to or greater than 0.95 are taken to reflect a good fit to the data [36]. RMSEA values of less than 0.05 indicate a good fit and values as high as 0.08 indicate a reasonable fit [36]. Also, a non-significant chi-square statistic indicates a good fit, but chi-square is usually sensitive to sample sizes and usually significant for large sample sizes [35]. The internal consistency of the questionnaire was analyzed with Cronbach’s α . Reliability equal to or greater than 0.70 was considered acceptable. Spearman correlations coefficients were used to explore the association among the WPVB subscales and the association of WHO-Bref, GHQ-28 and Social Support dimensions with WPVB subscales in terms of convergent validity. The correlation coefficient between 0.1 and 0.3 was considered low, between 0.31 and 0.5 moderate and over 0.5 was considered high. In terms of discriminative validity, the WPVBs subscales were compared according to sex using Mann-Whitney tests, while Kruskal-Wallis tests were used for comparisons according to the occupation. Bonferroni correction was used in case of multiple comparisons for occupation. P values reported are two-tailed. Statistical significant level was set at 0.05 and analysis was conducted using SPSS 22.0 and AMOS (SPSS, Chicago, IL, USA) Statistical Software.

3. Results

Participants were 528 men and 1008 women ($N = 1536$) with a mean age of 39.2 years ($SD = 10.3$ years). Sample characteristics are presented in Table 1. 47.3% of the participants were married and 56.5% had children. 23.2% were doctors, 48.4% were nurses, 16.4% were administrative personnel, 3.7% technicians and 8.3% other health professionals, 23.7% of the sample reported as having a health problem. Descriptive statistics for the WPVB items are shown in Table 2. Items 1, 2 and 11 had a median value equal to 1. A CFA was conducted to estimate if the model fitted the data well. The CFA indicated an adequate fit of the four-factor model ($RMSEA = 0.078$, $CFI = 0.961$ and $GFI = 0.932$). None of the item cross-loadings exceeded the item loadings on the intended latent construct. The chi-square test of the model was significant as expected ($p < 0.05$). Corrected item-total correlations and Cronbach's and if an item was deleted per factor are presented in Table 3. All corrected item-total correlations were high and internal consistency reliability was accepted with Cronbach's alpha equal to 0.90 for Attack on personality, 0.92 for Attack on professional status, 0.93 for Individual's isolation from work and 0.78 for Direct attack. Cronbach's alpha for all questionnaire was equal to 0.87.

The inter-correlations of the WPVB subscales are shown in Table 4. All subscales were significantly and positively correlated with each other and the correlations were high. Correlations of WPVBs subscales with WHO-Bref subscales were all negative and significant (Table 5). Also, WPVBs subscales were significantly and positively correlated with all GHQ-28 dimensions. Furthermore, all WPVBs dimensions were significantly and negatively correlated with all Social Support dimensions.

Association of WPVBs subscales with sex and occupation are presented in Table 6. All subscales had lower values in women as compared to men.

Lower scores on "Attack on personality" and "Total mobbing" score were recorded in nurses as compared to doctors. Doctors had lower scores on "Individual's isolation from work" as compared to administrative personnel, while had greater scores on "Individual's isolation from work" as compared to technicians. Nurses had significantly lower scores on "Attack on professional status", "Individual's isolation from work", "Direct attack" and "Total mobbing" score as compared to administrative personnel. Technicians had lower score on "Individual's isolation from work" as compared to nurses, while administrative personnel had greater scores on "Attack on professional status", "Individual's isolation from work" and "Total mobbing" score as compared to technicians. Also, technicians had lower scores on "Attack on professional status" and "Individual's isolation from work", as compared to others.

Table 1. Sample characteristics.

	N (%)	Mean (SD)
Sex		
Men	528 (34.4)	
Women	1008 (65.6)	
Age, mean (SD)		39.2 (10.3)
Educational Status		
At most High school/ College	341 (22.3)	
Technical university	536 (35.1)	
University	316 (20.7)	
MSc/ PhD	336 (22.0)	
Marrital Status		
Married	725 (47.3)	
Having children	851 (56.5)	
Living		
Alone	339 (23.0)	
With others	1137 (77.0)	
Occupation		
Doctors	348 (23.2)	
Nurses	726 (48.4)	
In administration	246 (16.4)	
Technicians	56 (3.7)	
Other	124 (8.3)	
Working		
No	76 (5.0)	
Yes	1446 (95.0)	
Residence		
Athens	786 (51.2)	
Out of Athens	750 (48.8)	
Health status		

Continued on next page

	N (%)	Mean (SD)
Very bad	53 (3.5)	
Bad	71 (4.6)	
Neither bad nor good	366 (23.8)	
Good	697 (45.4)	
Very good	349 (22.7)	
Having health problem	364 (23.7)	

Table 2. Descriptive statistics for the WPVB items.

	Mean (SD)	Median (IQR)
item 1	1.51 (1.43)	1 (0–3)
item 2	1.17 (1.35)	1 (0–2)
item 3	1.17 (1.40)	0 (0–2)
item 4	0.81 (1.38)	0 (0–1)
item 5	0.83 (1.33)	0 (0–2)
item 6	0.45 (1.04)	0 (0–0)
item 7	1.22 (1.53)	0 (0–2)
item 8	1.01 (1.27)	0 (0–2)

item 9	1.15 (1.38)	0 (0–2)
item 10	0.54 (1.02)	0 (0–1)
item 11	1.09 (1.24)	1 (0–2)
item 12	0.67 (1.08)	0 (0–1)
item 13	0.57 (0.99)	0 (0–1)
item 14	0.59 (1.03)	0 (0–1)
item 15	0.29 (0.78)	0 (0–0)
item 16	1.23 (1.45)	0 (0–2)
item 17	1.04 (1.46)	0 (0–2)
item 18	0.84 (1.20)	0 (0–2)
item 19	0.59 (1.08)	0 (0–1)
item 20	0.36 (0.97)	0 (0–0)
item 21	0.51 (1.07)	0 (0–0)
item 22	0.68 (1.29)	0 (0–1)
item 23	0.78 (1.29)	0 (0–2)
item 24	0.43 (1.01)	0 (0–0)
item 25	0.88 (1.24)	0 (0–2)
item 26	0.47 (1.09)	0 (0–0)
item 27	0.28 (0.83)	0 (0–0)
item 28	0.38 (0.93)	0 (0–0)
item 29	0.59 (1.13)	0 (0–1)
item 30	0.39 (0.99)	0 (0–0)
item 31	0.69 (1.22)	0 (0–1)
item 32	0.42 (0.95)	0 (0–0)
item 33	0.25 (0.73)	0 (0–0)

Table 3. Corrected Item-Total Correlations, internal consistency reliability and descriptive statistics of the WPVB factors.

	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's a	Mean (SD)	Median (IQR)
<i>Attack on personality</i>					
item 1	0.69	0.89	0.90	8.78 (8.79)	6 (0–14)
item 2	0.68	0.89			
item 3	0.76	0.88			
item 4	0.67	0.89			
item 6	0.52	0.90			
item 7	0.73	0.89			
item 8	0.79	0.88			
item 9	0.74	0.89			
item 15	0.49	0.90			
<i>Attack on professional status</i>					
item 5	0.71	0.91	0.92	6.61 (8.16)	4 (0–10)
item 10	0.76	0.91			
item 11	0.76	0.91			
item 12	0.76	0.91			
item 13	0.78	0.91			
item 14	0.79	0.91			
item 16	0.67	0.92			
item 21	0.75	0.91			
item 29	0.59	0.92			

*Individual's isolation
from work*

item 17	0.66	0.93	0.93	7.16 (9.94)	3 (0–10)
item 18	0.71	0.92			
item 19	0.73	0.92			
item 20	0.53	0.93			
item 22	0.77	0.92			
item 23	0.76	0.92			
item 24	0.68	0.93			
item 25	0.77	0.92			
item 26	0.76	0.92			
item 30	0.75	0.92			
item 31	0.77	0.92			

Direct attack

item 27	0.58	0.73	0.78	1.33 (2.69)	0 (0–2)
item 28	0.67	0.69			
item 32	0.64	0.70			
item 33	0.47	0.78			

Table 4. Intercorrelations among WPVBs subscales.

	Attack on personality	Attack on professional status	Individual's isolation from work	Direct attack	Total mobbing score
Attack on personality	1.00				
Attack on professional status	0.79	1.00			
Individual's isolation from work	0.74	0.82	1.00		
Direct attack	0.64	0.63	0.71	1.00	
Total mobbing score	0.92	0.92	0.91	0.72	1.00

Note: all correlation coefficients were significant ($p < 0.001$).

Table 5. Correlation of WPVBs subscales with WHO-Bref, GHQ-28 and Social Support subscales.

	Attack on personality	Attack on professional status	Individual's isolation from work	Direct attack	Total mobbing score
<i>WHO-Bref</i>					
Total score	−0.14***	−0.08**	−0.12***	−0.17***	−0.11***
Physical health	−0.20***	−0.13***	−0.13***	−0.17***	−0.15***
Psychological health	−0.17***	−0.14***	−0.14***	−0.14***	−0.15***
Social relationships	−0.19***	−0.13***	−0.15***	−0.17***	−0.16***
Environment	−0.19***	−0.11***	−0.12***	−0.16***	−0.13***
<i>GHQ-28</i>					
Somatic symptoms	0.14***	0.16***	0.15***	0.17***	0.15***
Anxiety/insomnia	0.17***	0.19***	0.19***	0.19***	0.19***
Social dysfunction	0.08**	0.13***	0.08**	0.13***	0.10***
Severe depression	0.06*	0.15***	0.12***	0.13***	0.10***
Total score	0.14***	0.20***	0.17***	0.20***	0.18***
<i>Social Support</i>					
Total support	−0.18***	−0.14***	−0.18***	−0.20***	−0.17***
Support from family	−0.19***	−0.13***	−0.17***	−0.18***	−0.17***

Support from friends	-0.16***	-0.14***	-0.16***	-0.17***	-0.15***
Support from significant other	-0.18***	-0.13***	-0.16***	-0.19***	-0.17***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6. Association of WPVBs subscales with sex and occupation.

	Attack on personality	Attack on professional status	Individual's isolation from work				Direct attack		Total mobbing score	
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)
Sex										
Men	10.27 (9.47)	8 (1.5–18)	7.54 (8.5)	5 (0–12)	8.31 (10.81)	3 (0–13)	1.83 (3.11)	0 (0–3)	27.95 (29.82)	17 (4–47)
Women	8.13 (8.41)	6 (0–13)	6.2 (8.03)	3 (0–9)	6.66 (9.52)	2 (0–9)	1.1 (2.45)	0 (0–1)	22.1 (26.05)	15 (2–30)
P^1	<0.001	<0.001	0.017	<0.001	<0.001					
Occupation										
Doctors ^A	9.34 (7.79) ^B	9 (3–15)	6.39 (7.17)	5 (0–10)	6.36 (7.8) ^{C,D}	3 (0–10)	1.32 (2.24)	0 (0–2)	23.41 (22.54) ^B	17 (6–32)
Nurses ^B	8.26 (8.84) ^C	6 (0–14)	6.23 (8.43) ^C	3 (0–9)	6.97 (10.46) ^{C,D}	2 (0–9)	1.32 (2.9) ^C	0 (0–1)	22.78 (28.44) ^C	14 (2–29)
Administrative ^C	9.98 (9.01)	8 (2–18)	7.76 (7.53) ^D	6 (0–12)	8.78 (9.72) ^D	5 (0–13)	1.54 (2.75)	0 (0–2)	28.07 (27.03) ^D	19 (5–44)
Technicians ^D	8.73 (10.51)	4 (0.5–12)	5.84 (10.67) ^E	1 (0–7)	6.7 (13.37) ^E	0 (0–7)	1.13 (2.85)	0 (0–0)	22.39 (36.66)	4 (2.5–27)
Other ^E	8.84 (9.86)	5.5 (0–15)	8.22 (9.22)	6 (0–13)	8.11 (10.47)	4 (0–14)	1.24 (2.53)	0 (0–1.5)	26.41 (29.03)	17 (5–41)
P^2	0.003	<0.001	<0.001	0.049	<0.001					

Note: ¹Mann-Whitney test; ²Kruskal-Wallis test; A, B, C, D, E indicates significant differences.

4. Discussion

According to the findings of the present study, there is no instrument in Greece for measuring health professionals' perception of workplace psychological violence inflicted on them by their managers, co-workers and/or subordinates and this is the first study conducted nationally on this subject. In addition, the Greek version WPVB Instrument's Cronbach's value was found to be high (0.93).

The NAQ-22 scale applied in the study by Karatza et al. [11] has shown that men face mobbing behavior more than women do. However, on the NAQ-22 scale concerning the distribution of roles, it is noted that women regard themselves as victims more than men do [11]. These two findings, which at first sight appear contradictory, are clarified by the difference in the responses of men and women to mobbing behavior, which is another finding of the present study. As shown in the study by Zachariadou et al. [5] women were exposed to at least one mobbing behavior more often than men within the previous 12 months. Another study by Al-Omari [37] about gender-related result showed that female nurses report 0.5-fold less physical harassment than male nurses and 1.5% more times reported having experienced verbal harassment than male nurses. A similar study in Palestine by Jaradat et al. [38] among nurses showed that male nurses reported a higher prevalence of intimidation than female nurses. Newer and older nurses reported a higher prevalence of exposure to physical and verbal aggression and intimidation. Other recent studies showed that male health professionals are experiencing mobbing behaviors to a greater extent than women [39–41].

According to Mantzouranis et al. [42] study of assess workplace violence in a Greek tertiary hospital, shown that verbal violence was the most common type of incident and the vast majority of employees had experienced work-related violence. Also, HPs (nurses and other health care staff), reported that feeling safer than physicians. Two-thirds of the men and one-third of the women perceive mobbing behavior as normal. This difference of gender in terms of response to mobbing behavior also indicates the viewpoints and perceptions of individuals concerning the phenomenon. In this context, men effectively face mobbing behavior more than women do. However, women regard themselves as victims more than men do. The reason for this is that men consider such behavior to be something normal which can happen in the workplace while women find it unacceptable.

International research suggests that gender-related experiences of workplace bullying could be country-specific. Cortina et al. [43], found that American women reported more workplace bullying experiences than men did. Niedhammer et al. [44] came to the same conclusion about France, whilst Ólafsson and Jóhannsdóttir [45] found that men experienced more workplace bullying in Iceland than women did. Ortega et al. [46] found no significant differences between Danish men and women. Furthermore, Namie [47] found that the perpetrators of 62% of American men who experienced bullying were men. In another similar study by Zachariadou et al. [5] regarding the formal position of perpetrators, superiors were pointed out as mobbers by 57.5% of the overall study population. It might be assumed that professionals who have less power could be in a more vulnerable position for exposure to bullying behaviors.

Nurses in our study have experienced mobbing behaviors in a lesser degree than doctors, and mostly behaviors of attack on the personality and attack on professional status. This is in contrast to research in nurses in Turkey that showed The most frequent mobbing behaviors experienced by the nurses were in the form of “Attack on Professional Status” and this sub-scale was followed by the “Attack on Personality” [9].

Surprisingly enough, fewer than five individuals answered the items “Having physical violence used” and “Always having errors found in your work and work results”, namely the B1 & D1 items of the original instrument. Moreover, our mean values suggest considerable workplace bullying. These differences could be attributed to cultural and methodological issues. Firstly, physical violence might seem unacceptable in the nursing working environment and thus “considered out of the question”. According to Karatza et al. [11] study using NAQ-22 as a research tool, the most prevalent bullying behaviors in the nursing workplace were related to work itself (unmanageable workloads, being assigned tasks below one’s level of competence) and being subjected to “anger expressed by third

parties”, while “physical violence” was minimum (4.4 points within a range of 3 to 15). According to Zachariadou et al. [5] study using LIFT as a research tool, another interesting finding of this study was that 9.4% of participants reported that they were bullied by their subordinates, indicating that a managerial position does not guarantee protection from bullying. The above findings suggest that the lack of a firm leadership contributes to the manifestation of mobbing behaviors from all the levels of the hierarchy ladder of the organization. Another study by Iftikhar and Qureshi [48] in nurses reported that the form of this mobbing behavior had a negative impact on the work performance of nurses, their motivation for work, their productivity, their relationships with patients, and symptoms of depression. Zhang et al. [49] conducted a study in 28 provinces in China in 14 cities to investigate the prevalence of the phenomenon of moral harassment and the factors that affect it. 4125 questionnaires were distributed and 3004 nurses of all grades were finally involved in the survey. The results showed that 25.77% of the respondents had experienced physical violence, 63.65% verbal abuse and 2.76% sexual harassment. The study also showed that low-skilled nurses, part-time nurses, and nurses working in China’s emergency and pediatric departments have low levels of tolerance in stress and are more likely to experience any form of harassment and violence. On the other hand, detection of errors might be considered as a privilege of superiors, compatible with the organizational culture in Greece, when compared to the rest of Europe some interesting findings emerge regarding the Greek values referring to working behavior. The comparisons revealed that people in Greece attribute significantly more importance to power/achievement, conformity/tradition, among other values [50].

In this working climate, it is possible that several dimensions differ from those of Yildirim and Yildirim [51]. Besides, the instrument creators in their study mentioned that their study had several limitations. Indeed, that study was only conducted with female participants in the nursing, female-dominant, profession and in the largest university hospital in Instabul, Turkey, while in our study a great range of hospitals participated [51]. This fact could also explain the considerable difference in scores between the two studies, ours being significantly higher, suggesting workplace psychological violence. Our study emphasizes the need for further validation studies in different cultural environments, in accordance with the creators of the tool, who stated that “As the tool was developed from data collected from nurses in Turkey it reflects the cultural characteristics of the society in which it was developed. For this reason, it is recommended that this instrument is tested in samples of nurses with different cultural characteristics and with different professional groups”.

The modified Greek version of the WPVB questionnaire exhibits excellent validity and reliability and emphasizes the need for developing mobbing measurement instruments culturally adjusted. In that context, special norms could be created for different populations and the phenomenon could be studied

with accuracy. In our study, although the sample was large, it is not absolutely representative of the nursing population (35,420 in Greece) [52]. Some HPs due to work overload were reluctant to participate and all hospitals included are not represented proportionally in the sample. In this context, it is difficult to construct a norm for the entire nurse population. A future well-designed study, with a random and representative sample of Greek HPs, could end up with a norm for the Greek nursing population.

5. The implication to research and practice

The Greek version of the WPVB questionnaire is a valid and reliable instrument to measure mobbing within the Greek population. This instrument can be a valuable tool for HPs and health care providers for use in planning strategies for mobbing provision in Greece. International studies mainly in Turkey reported that this instrument helps to investigate the phenomenon of mobbing and to design appropriate hospital management strategies [4–8,11]. The issue of moral harassment in Greece has not yet been thoroughly explored, but as it emerges from International Studies, it is imperative because it has a negative impact on the quality of life of health professionals and causes problems for both the worker himself and his family and work environment [10,53–55]. Areas of investigation of mobbing are satisfied or dissatisfied with can be identified. This tool can be used as a basis to initiate changes in clinical practice both in a hospital and in community health care working settings.

6. Future research

The Greek version of the WPVB questionnaire can be used as a tool for further investigating of mobbing provided in Greece and obtaining a better understanding of the meaning of mobbing, of the dealing with the phenomenon and of the needs, and of the expectations against mobbing at health professionals. It is anticipated that the Greek version of the WPVB will contribute to further development of the research in the field of health sector service and other working fields in Greece.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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