Original Article

The Relationship Of Tobacco Smoking To Depressive Symptoms Among Male Expatriate Workers In Saudi Arabia: A Cross Sectional Study.

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ABSTRACT:

Background & Aims: Mental health issues have been associated with tobacco smoking. Several studies conducted in large samples of general population found significant relationship between tobacco smoking and depressive symptoms. However, previous research conducted in Saudi Arabia reported high prevalence of depression and smoking among a small-scale sample of male expatriate workers but found no correlation. This study aims at investigating the association between self-reported tobacco smoking (cigarette and water pipe smoking) and depressive symptoms in a large representative sample of expatriate workers.

Methods: A cross-sectional survey involving face-to-face interviews of 4575 male expatriate workers in 270 businesses/companies in Riyadh, Saudi Arabia was conducted using a multi stage stratified cluster sampling technique to randomly select businesses/companies and participants. Trained research assistants used the Composite International Diagnostic Interview instrument applicable to clinical depression to assess DSM-IV for major depressive disorder and episodes among participants. Smoking was assessed using the WHO standard questions for assessing tobacco exposure and other covariates with a standardized questionnaire. The data were analysed using logistic regression.

Results: Current smoking is associated with significantly increased likelihood of depressive symptoms (Crude Odds Ratio=1.790 - 1.284) 1.516)). The association remained statistically significant after adjusting for age, self-reported health and income (Adjusted Odds Ratio=- 1.341) 1.590 1.886)).

Conclusions: This study provides new insights into the relationship between tobacco smoking and depressive symptoms. In expatriates, current smoking is associated with significantly increased risk of depressive symptoms. Future

الملخص

الخلفية والأهداف: ارتبطت قضايا الصحة العقلية بتدخين التبغ. وجدت العديد من الدراسات التي أجريت في عينات كبيرة من عامة السكان علاقة ذات دلالة إحصائية بين تدخين التبغ والأعراض الاكتئابية. لكن الأبحاث السابقة التي أجريت في المملكة العربية السعودية ذكرت ارتفاع معدل انتشار الاكتئاب والتدخين بين عينة صغيرة من العمال المغتربين الذكور ، لكنها لم تجد أي ارتباط. تهدف هذه الدراسة إلى التحقق من العلاقة بين تدخين التبغ المبلغ عنه ذاتياً (تدخين السجائر والشيشة) والأعراض الاكتئابية في عينة كبيرة من العمال المغتربين.

الطريقة: تم إجراء دراسة مقطعية مستعرضة تشمل مقابلات شخصية وجهاً لوجه لـ ٤٥٧٥ من العمال المغتربين الذكور في ٢٧٠ شركة / شركة في الرياض ، وقد أجريت المملكة العربية السعودية باستخدام تقنية العينة العنقودية متعددة المراحل لاختيار الأعمال / الشركات والمشاركين بشكل عشوائي. استخدم الاستطلاع Composite International Diagnostic Interview التي تنطبق على الاكتئاب السريري DSM-IV للاضطرابات الاكتئابية الرئيسية والحالات بين المشاركين. تم تقييم التدخين باستخدام الأسئلة القياسية لمنظمة الصحة العالمية لتقييم التعرض للتبغ والمتغيرات المشتركة مع استبيان موحد. تم تحليل البيانات باستخدام الانحدار اللوجستي.

النتائج: يرتبط التدخين الحالي بزيادة احتمالية حدوث أعراض اكتئابيّة (نسبة الأرجحية Crude Odds = ١,٥١٦ (١,٢٨٤ - ١,٧٩٠)). بقيت العلاقة ذات دلالة إحصائية بعد تعديل العمر ، الصحة والدخل المبلغ عنها ذاتيا (نسبة الأرجحية المعدلة = ١,٥٩٠ (١,٣٤١ – ١,٨٨٦)).

الاستنتاجات: تقدم هذه الدراسة رؤى جديدة في العلاقة بين تدخين التبغ

research is needed to clarify directionality and mechanism explaining the relationship. Health professionals and policy makers should be aware of the increased risk of depressive symptoms in expatriate workers who are tobacco smokers.
Key-words: Tobacco smoking, depressive symptoms, expatriates, tobacco control, mental health services

والأعراض الاكتئابية. في المغتربين ، يرتبط التدخين الحالي بزيادة خطر الإصابة بأعراض اكتئابية. هناك حاجة إلى بحث مستقبلي لتوضيح الاتجاه والآلية التي تشرح العلاقة. يجب أن يكون المهنيون الصحيون وصانعي السياسات على دراية بالخطر المتزايد للأعراض الاكتئابية لدى العمال المغتربين الذين هم مدخنون للتبغ.

INTRODUCTION

Globalization of the workforce has been described as one of the most significant trends that will affect workers especially expatriates. An expatriate worker can be considered an individual who is to be employed, is employed or has been employed in a salaried occupation in a country of which the individual is not a national [1]. The Kingdom of Saudi Arabia (KSA) is home to 10.4 million expatriates which constitute a third of the population [2] and they represent a significant potential in the context of labour and skill shortages. Previous research by Alkhamis, Hassan [3] suggests that expatriates have different health insurance plans that may affect the quality of care provided in KSA. Expatriate workers are expected to pay an average of 10% (specialist physician's fees) or 30% (consultant physician fees) of their salary to cover co-payments, excluding the cost of transportation and other expenses. The wages of Asians and non-Asian expatriate workers are lower when compared to that of the local workforce and expatriates are also willing to work longer hours [4]. The stress of expatriate work, in addition to cultural, professional and personal transitions may cause expatriates to smoke cigarette and tobacco related products to self-medicate anxiety. Tobacco smoking includes cigarette, cigar, pipe, hookah, shisha or water pipe and other tobacco products. Tobacco smoking is the number-one cause of preventable death and kills more than half of its users with more than 6 million deaths each year because of direct tobacco use [5]. Smoking is decreasing globally and in many countries, but the prevalence of tobacco smoking appears to be increasing in the WHO Eastern Mediterranean Region. The WHO report claims if tobacco prevention programs in Saudi Arabia continue at the same pace, the projection is that by 2025 approximately 6,268,400 individuals, about 24% of the population will be smokers [6]. It is well established that there is no safe level of tobacco use. Smoking as few as one to four cigarettes per day increases the risk of cardiovascular disease and other chronic conditions[7]. This indicates tobacco smoking causes significant socioeconomic costs due to increased absenteeism, deteriorating general health status and reduced productivity in the workforce.

A recent study that involved a cross sectional survey of 400 expatriate workers in one company in Al-Qassim, KSA using the Center For Epidemiological Studies Depression scale (CES-D) found depression prevalence of 20% which was considerably high in the small scale non-representative study sample [8]. Duration of stay, living condition, current cigarette smoking were not significant corre-

lates of depression but age, stress, and self-reported health status. However, previous research [9-12] and the report from the United States Department of Health (Surgeon General) [13] have shown significant relationship between tobacco consumption and depression. Yet the association of tobacco smoking and depressive symptoms has not been comprehensively investigated among a large representative sample of expatriate workers in KSA. This study, consequently aimed to extend the previous research using data from a cross sectional study and add to the evidence base. The Saudi Arabia general population or health professionals, particularly those not involved in tobacco and health, still do not commonly know the relation between smoking and depressive symptoms. Research in this area is important to effectively focus potential preventative efforts on this population that is frequently underserved, vulnerable and often experience significant health disparities, for example, lower income, high co-payments for medical care and cultural minority status. This study investigates expatriates tobacco smoking and expected that it would have a negative relation with depressive symptoms.

MATERIALS AND METHODS

A cross-sectional survey of 4,575 male expatriates was conducted among expatriate workers in businesses/companies that were identified from the Saudi Ministry of Labour database (sampling frame). Riyadh City, the capital of Saudi Arabia, was selected as the setting for the study because the Riyadh region contains more than one-third of expatriates and one-fourth of the Saudi population [14]. This study was part of a main study that investigated expatriates access and barriers to healthcare and the study methods have been described elsewhere [15, 16].

A stratified multi-stage business/company systematic selection design with an equal chance of each expatriate worker being selected from the target population was used in this survey. Participants businesses/companies were identified from the Ministry of Labour database and were stratified based on location, business type, company size, and number of employees. To estimate the sample size with 95% confidence and 2% margin of error, 2,000 expatriates were required, but was multiplied by the design effect of 2 because cluster sampling was employed, resulting in an initial sample size of 4,000 expatriate workers. The calculation was done in Epi-Info 3.5.1. In order to determine how many samples for each economic sector and company size, we divided 4,000 (the sample size) by the total number of companies (102,495) in Riyadh. The fraction was used to multiply the total number of companies in each economic sector, to determine the number of companies to be selected from each economic sector. Each company was assigned a minimum of 30 samples to be surveyed during the selection process. If the company had less than 30 workers, another randomly selected company with a similar size was studied to reach the 30 workers representing both the sector and company size. However,

more companies were added to some sectors to have a minimum of four companies covering all four different sizes of companies. Due to this adjustment, the sample size required was 4,629. Based on their size and economics sectors, companies were selected from the database by systematic random sampling. This was done using the Statistical Package for the Social Sciences (SPSS) software, companies' names and any related information were concealed and the means of identification was the company's code number known only to the manager of the Statistics Department at the Ministry of Labour.

Employees in the selected organizations were approached after obtaining due approval from the company owner and/or general manager of the company. The human resources department of large businesses/ companies provided a list of expatriate staff from which participants were randomly selected. To be eligible for survey, participants must be 18 years or over and non-Saudi nationals. Expatriates workers who refused to sign the inform consent form were excluded. Participants were approached for interviews during break/lunch time or at the close of work. The purpose of the study was explained to all participants. In addition, anonymity and confidentiality were assured and the right to refuse participation without affecting their healthcare plan and employment was explained. Ethical approval was obtained from the Institutional Research Board of King Abdullah International Medical Research Centre.

This current study reports on the aspects of the survey that determined the association between tobacco smoking exposure and depressive symptoms in a large representative sample of expatriate workers. To ensure uniform data collection, ten research assistants' from the dominant languages of expatriate workers were recruited. The research assistants were trained on interview techniques, skills on how to advertise the importance of the survey and educating selected participants. To test the questionnaire and procedure, it was piloted in Al Batha, a well-known gathering area for expatriate workers with a sample of 150 participants.

The main independent variable of interest was whether or not an individual reported tobacco smoking. The three recommended basic questions by WHO that must be included in all surveys that measure tobacco exposure were used to assess participants' exposure to tobacco smoking (17). Participants were asked if they smoke cigarette, moasel or hubble-bubble (water pipe) based on three topics: 1. Current tobacco smoking status 2. Past daily smoking status (for current less than daily smokers) 3. Past smoking status (for current non-smokers). Those who responded that they have no lifetime history of smoking were categorized as never smokers and those who indicated they smoke everyday were classified as everyday smokers. Participants who reported smoking at least once a week in the last 30 days were grouped as occasional smokers and those who indicated previous history of smoking but have not smoked in the last 30 days were classified as

ex-smokers. The rationale for assessing self-reported tobacco smoking use was based on previous research that suggests self-reports of tobacco smoking are rather reliable, particularly in observational studies [18, 19]. Other covariates included were age < 30, 30 – 49, ≥ 50), income (≤2000SR, 2001-6000SR, > 6000SR) and self-reported health status. To assess their health status, participants were asked to rate their overall health status with five response options; excellent, very good, good, fair and poor. The variable used in this analysis had two categories after merging very good, good with excellent, and fair with poor (good and poor). Age and self-reported health status were found in previous research conducted in KSA to be associated with depression among expatriates workers and hence were considered potential confounders in this current study analysis. Income was included as a potential confounder in the analysis because existing studies suggest that low socioeconomic status (SES) is generally associated with high psychiatric morbidity and poorer access to health care and income-related inequality was more pronounced in mental health than in general health [20, 21]21. These covariates were assessed using the validated Medical Expenditure Panel Survey (MEPS) questionnaire [22].

The main outcome variable of interest was depressive symptoms. The Composite International Diagnostic Interview (CIDI) instrument [23] applicable to clinical depression was used to assess DSM-IV symptom criteria for major depressive episodes and symptoms (24) using the full range of questions on depression, for the past 12 months. The CIDI is a valid standardized structured diagnostic interview instrument designed for assessment of mental disorders worldwide by trained lay interviewers. Participants' responses were grouped into two categories based on the summation of their responses (yes vs no) to the individual symptom item [25, 26]. The outcome variables of interest were (1. No, depressive symptoms and 2. Yes, had depressive symptoms). Therefore, the category depressive symptoms based on the DSM-IV criteria consists of participants with major depressive disorder and episodes.

The data were analyzed using the Statistical Package for the Social Sciences Windows Version 24.0. Data were processed using descriptive statistics and logistic regression. Prevalence estimates were calculated and described for never smokers, current smokers and ex-smokers. Associations between depressive symptoms and all potential predictors were analysed in univariate regression followed by multivariate logistic analysis using backward stepwise method. The covariates were entered into the logistic regression as categorical variables, indicator and first. Statistical significance was based on two-tailed tests and level of significance was set at 0.05. Odds ratios (ORs) and 95% confidence intervals (CIs) were generated for each variable.

RESULTS

In this study, all participants who an-

swered the tobacco smoking and depression questions were included (n=4575) which is a response rate of 98.83%. There are no missing data. Table 1, displayed detailed sociodemographic and workplace characteristics of the study participants. The majority of the samples were in the age category 30-49 years (69.4%). The prevalence of depressive symptoms, the crude odds ratio and adjusted odds ratio between depressive symptoms with smoking status (Never smokers, ex-smokers and current smokers (which collapsed occasional smokers because the small numbers prevented its separate analysis)) are listed (see table 2). Hence, current smokers refer to participants who smoked at least once in the 30 days before the survey. The highest prevalence of depressive symptoms was reported by current smokers (19.85%) followed by ex-smokers (18.45%) and never smokers (15.14%). Current smokers compared to never smokers were associated with statistically significant increased risk of depressive symptoms (OR=1.516 (1.284, 1.790)). However, the association between previous history of self-reported smoking but not currently smoking and depressive symptoms (OR=1.347 (.971, 1.869)) was not statistically significant in the final model (p>0.05). In the multivariate logistic regression, the association between self-reported current smoking and depressive symptoms remained statistically significant after adjusting for age, income and self-reported health (AOR=1.590 (1.341,1.886)).

Table 1. Sociodemographic and workplace characteristics of study participants.

Variable	Number of study participants, n (%)
Nationality	
India	1100 (24.0%)
Bangladesh	1159 (25.3%)
Pakistan	498 (10.9%)
Egypt	819 17.9%)
Philippine	200 (4.4%)
Yemen	234 (5.1%)
Others	565 (12.3%)
First Language	
Arabic	1480 (32.4%)
Urdu	949 (20.7%)
Hindi	443 (9.7%)
Malayalam	171 (3.7%)
Bengali	1111 (24.3%)
Tagalog	182 (4.0%)
Others	239 (5.2%)
Age category (Years)	
< 30	1014 (22.2%)
30 - 49	3176 (69.4%)
≥ 50	385 (8.4%)
Education	
Primary school or less.	1331 (29.1%)
Elementary or high school completed.	1654 (36.1%)
Diploma or university degree	1590 (34.8%)
Income (monthly)	
≤ 2000SAR	3085 (67.4%)
2001 - 6000SR	1342 (29.3%)
> 6000	148 (3.2%)

Marital Status	
Single/Divorced.	842 (18.4%)
Married, family in KSA.	750 16.4%)
Married, family outside KSA.	2983 (65.2%)
Duration of stay (years)	
<1	818 (17.9%)
1 - 5	2233 (48.8%)
> 5	524 (33.3%)
Occupation group	
Specialist/Professionals.	1189 (26.0%)
Manual workers.	2064 (45.1%)
Unskilled workers.	1322 (28.9%)
Smoking status	
Non-smokers	3308 (72.3%)
Current smokers	1046 (22.9%)
Ex-smokers	221 (4.8%)
Self-reported physical health	
Very good	4424 (96.7%)
Poor	151 (3.3%)

DISCUSSION

To the best of our knowledge, this is the first study that investigated the relationship between self-reported smoking status and increased risk of depressive symptoms in a large representative sample of male expatriate workers in KSA. The similarities and representativeness of our study sample characteristics to the expatriate population have been described elsewhere [15]. Our study found current smoking is associated with significantly increased risk of depressive symptoms that persisted after adjusting for age, income and self-reported health and high prevalence rate of depressive symptoms among current smokers. The current findings are consistent with a recent study conducted by the British Heart Foundation (BHF) that found tobacco smokers were 70% more likely to suffer from anxiety and depression overall compared to non-smokers [27,28]. Moreover, our findings are similar to previous research among the general population samples that found tobacco smoking is significantly associated with in-

Table 2: Prevalence and logistic regression of smoking status and depressive symptoms.

Smoking status	Total (%) N=4575	Depressive symptoms	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Never Smokers	3308 (72.3%)	590 (15.14%)	1	1
Current Smokers	1046 (22.9%)	259 (19.85%)	1.516 (1.284, 1.790)*	1.590 (1.341,1.886)*
Ex-smokers	221 (4.8%)	50 (18.45%)	1.347 (0.971,1.869)	1.181 (0.843,1.654)

CI (Confidence Interval), * p<0.001 Adjusted for age, income and self-reported health.

creased risk of clinical depression and depressive symptoms [26, 29].

This evidence that smoking is associated with significantly high levels of risk for depressive symptoms among expatriate workers is open to alternative explanations based on our study' cross sectional design and findings from existing work. First, tobacco smoke is a complex brew containing more than 7,000 compounds including more than 70 known compounds or toxins that can cause cancer [30]. Recent studies [30, 31] demonstrate tobacco smoking damages deoxyribonucleic acid (DNA) in cellular tissues directly exposed to smoke as well as speeds up mutational cellular processes in organs that are both directly and indirectly exposed to smoke. As a result, one possible explanation for the observation noted here is that tobacco smoking causes distortion in the brain cellular processes in a way that results in the depletion of serotonin, norepinephrine and dopamine leading to increased risk of depressive symptoms through neurologic pathways.

Second, research suggests expatriate workers are prone to anxiety and depressive symptoms due to professional and personal transitions. Evidence shows that migration is a risk factor for depressive symptoms in some individuals and married expatriate workers living without their families in the host country are at higher risks of smoking [16, 32] 32 Therefore, another explanation could be that individuals with depressive symptoms are at increased risk of smoking. In addition, existing study[33] reported a shared genetic predisposition to smoking and mental illness. However, other important clinical evidence suggests that after a few weeks of quitting smoking, mood improves above that reached when the individual was smoking [34]. A recent meta-analysis that investigated changes in mental health after smoking cessation reported that quitting for at least six weeks is associated with reduced depression, anxiety and stress, improved positive mood and quality of life compared to individuals with mental disorders who continued to smoke [35].

Interestingly, large longitudinal research [26, 36-38] that found smoking was associated with mental health disorders have enabled researchers to account for previous history of mental illness as a confounder in their analyses.

The possible alternative explanations for this association have potential important clinical implications. On one hand, it provides evidence that targeting smoking (tobacco cessation) among expatriate workers could reduce the risk of depressive symptoms. On the other hand, it implies a comprehensive healthcare program delivery with smoking cessation programs integrated with mental health services may be a suitable approach among this group. This approach will promote smoking cessation and improve mental health status. Thus, there is a need for a future study comparing a (usual) smoking cessation intervention with a smoking cessation intervention integrating mental health evaluation/ services. This study has a number of limitations. First, the cross-sectional study design

limits the authors' ability to make causal inference. The cause–effect relationships are not well known; additional research that includes using cellular or genetic information to determine the causal relationship between smoking and depressive symptoms is needed to understand the direction and pathophysiologic mechanisms of association. Second, the findings cannot be generalized to the female expatriate population as we focused on the male expatriate population. Nonetheless, compared to male, female constitute a small proportion of smokers (1.1%) in the general population [39]. Additionally, there are few female expatriate in the private sector work and most of them are in healthcare and as housemaids [15, 40]. Segregation in the workplace would have made it difficult to access them. Third, participants may have underreported their smoking habits due to social desirability. However, a recent cross sectional study of a representative sample of the general population conducted in KSA reported a current smoking male prevalence of 21.5% (39). Our study found a comparable prevalence of 22.9%. For that reason, the high prevalence of current smoking reported by participants makes it unlikely there was underreporting due to social desirability. Fourth, there is a possibility that smoking is a confounder that is, related independently to a third factor that is the real cause of the depressive symptoms. Lastly, the study only focused on major depressive disorder and episodes. We did not account for other mood disorders such as bipolar disorders, anxiety and stress that could be potential confounders or effect modifiers in this study. However, longitudinal studies [36, 37] that accounted for history of mental illness in their analyses found tobacco-smoking increases the risk of depression. The strength of the current study is the representativeness of our study sample who are the main expatriate groups in Saudi Arabia.

In summary, this research is important showing smoking is associated with significantly increased risk of depressive symptoms among expatriate workers. Nonetheless, the use of a cross-sectional design in this study does not allow a temporal relationship to be established between smoking and depressive symptoms. Regardless of the direction of association between smoking and depressive symptoms, the findings suggest the need for anti-tobacco interventions among this group to reduce the risk of depressive symptoms and the integration of tobacco smoking cessation and mental health services. Health policy makers and healthcare professionals should consider this possible pathway when designing smoking cessation programs for expatriate workers in Saudi Arabia. More research is required to clarify directionality and mechanism explaining the relationship. In addition, future study comparing a (usual) smoking cessation intervention with a smoking cessation intervention integrating mental health evaluation/services is needed. This will ensure that healthcare programs implemented on tobacco cessation and preventative mental health are relevant and effective.

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Competing interests

The authors declare no conflicts of interest.

Ethics approval and consent to participate

Ethical approval was obtained from the Ethical Review Board at King Abdullah International Medical Research Centre (KAIMRC), Riyadh, Saudi Arabia. Written consent to participate was obtained from all participants. All participants signed a consent form and freely agreed to participate in this study. All participants were asked for permission to publish the study findings and assured of anonymity and confidentiality.

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