

Research Article

Obstructive Sleep Apnea and Obesity in Gulf Cooperation Council (GCC) Countries

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Abstract

This paper aims to review and summarize the literature related to obstructive sleep apnea and obesity in the Gulf Cooperation Council (GCC) Countries, and to provide recommendations for the future. A PubMed and Google scholar search were performed using a combination of related terms. Relevant studies were summarized and tabulated. Recommendations and guidelines based on the findings were provided at the end.

Keywords: Obstructive sleep apnea; Obesity; Gulf; GCC

Background

Obstructive sleep apnea (OSA) is characterized by recurrent episodes of apnea lasting >10 seconds with relaxation of the upper laryngeal muscles during sleep that causes upper airway obstruction and leads to cessation of breathing [1]. The global prevalence rate is estimated at 9-38% [2]. OSA can lead to long-term complications such as excessive daytime fatigue, hypertension, diabetes mellitus, and cardiovascular diseases such as arrhythmias, myocardial infarction and respiratory failure [3].

OSA is linked to a number of risk factors that influence severity of the disease. One of the important predictive risk

factors of OSA severity is obesity and the level of obesity [4]. In the pediatric population, the severity of OSA increases with obesity and morbid obesity, with a OSA prevalence rate ranging from 46-60%. Among adults, the prevalence of OSA is twice higher when comparing obese vs. normal adults [2].

The causal relationship between obesity and OSA has not been extensively studied. Studies have reported obesity as an independent risk factor for the development of OSA, and the greater the level of obesity, the more progressive OSA and its complications become [5]. OSA affects 25% of the adult population, and 70% of patients diagnosed with OSA have obesity. Those who are obese without OSA diagnosis are also at an increased risk of developing the disease. The association between OSA and obesity can be further supported by anatomic and physiologic changes that occur during apneic episodes. Some of these changes include disruption of the pharyngeal airway due to fat deposition in the upper airway, increase in appetite hormones regulated during sleep metabolism, glucose intolerance and insulin resistance, lower levels of HDL (high-density lipoprotein) and higher levels of LDL (low-density lipoprotein) cholesterol and overall sleep deprivation [5-7]. OSA is diagnosed by polysomnography and it is treated with combination therapies. The cornerstone of treatment in OSA is a combination of lifestyle therapy (weight loss) and positive pressure airway to prevent upper airway collapse. Weight loss can be achieved via diet and exercise or surgically in cases of complicated obesity by bariatric surgery [6].

In the Middle East region, a literature review reported a high prevalence of obesity, with the highest rates coming from the Gulf area. In order of countries with the highest prevalence of obesity by population is Kuwait at >50% of the population being clinically overweight and at least 10% of the population being morbidly obese, followed by Qatar, Saudi Arabia, and UAE (United Arab Emirates). More than 35% of the population of Saudi Arabia is considered clinically overweight with the rates being higher in males than females and observed in middle aged adult age group. In contrast, the United Arab Emirates, Qatar, and Kuwait had higher rates of obesity amongst females than males with 39.9% of females for UAE, 45% of females for Qatar and 48% of Kuwaiti females were found to be obese. Like Saudi Arabia, obesity had been observed in middle aged adults (30-60 years of age) [8]. Therefore, the aim of this paper was to review and summarize the literature related to obstructive sleep apnea and obesity in the Gulf Cooperation Council (GCC) Countries, and to provide recommendations for the future.

2. Methodology

A PubMed search was conducted on Dec 6, 2020. A combination of the following search terms were used: Obstructive sleep apnea, Obesity, Qatar, Kuwait, Oman, Bahrain, Saudi Arabia, United Arab Emirates. Articles discussing OSA and obesity in any of the Gulf Cooperation Council countries were included. While literature reviews and case reports were excluded.

3. Results

The PubMed search returned 54 articles. Of which, only 3 articles were applicable. In addition, Google scholar was also searched, where 5 additional articles were identified. The retrieved studies presented research conducted in

Oman, Qatar, Saudi Arabia, and UAE. The type of studies were retrospective data review, descriptive, cross sectional, and cohort. A summary of each of the studies is listed in (Table 1).

	Authors, year	Country	Design	Sample size	Gender	Age	Objectives	Obesity related measurements	OSA related measurements	Main findings	Limitations	Concluding remarks
1	Al-Abri et al, 2011 (Al-Abri et al., 2011)	Oman	Descriptive study, retrospective data review	1,042 listed in the registry, only 608 meeting inclusion criteria and evaluated for PSG (Polysomnography)	F & M	Adult patients >18 years	To assess the effects of BMI, age, gender, and prevalence of OSA in Oman over an 11-year period (Jan 1995 – December 2006)	BMI (body mass index)	PSG, AHI (apnea-hypopnea index)	1) The prevalence of AHI >15 among men significantly higher than women 2) In men with AHI >15, hypertension, hypothyroidism and IDH was prevalent and in women with AHI > 15, IDH, hypertension, hypothyroidism, chronic obstructive pulmonary disease (COPD)/asthma was prevalent	1) 374 reports excluded due to missing data or not meeting inclusion criteria 2) Bias in study due to the number of male records to female records were 3:1 (can overestimate results) 3) Hospital-based study, so more likely to have selection bias 4) Sleepiness symptoms (excessive somnolence, daytime sleepiness) was not assessed by a validated sleep screening tool (BQ (Berlin questionnaire), ESS (Epworth Sleepiness Scale))	1) Obesity a risk factor for OSA among men 2) Age a risk factor for OSA among women
2	Ibrahim et al, 2007 (Ibrahim et al., 2007)	Qatar	Cross sectional	227 (191 included)	F & M	Adult patients >18 years	To assess OSA frequency and risk factors among snorers	BMI, neck circumference (NC)	PSG, ESS	1) 72.7% of males and 39% of females had OSA 2) OSA associated with ESS, being male, and history of apnea	1) Patients were referred to PSG based on clinical judgment 2) PSG diagnosis of OSA may not reflect magnitude of OSAS	1) Being male, ESS, history of apnea are predictors of OSA 2) BMI is a predictor in morbidly obese females
3	Al Langawi	Qatar	Retrospecti	286	F & M	Adult	To explore the risk	BMI	PSG, AHI	1) OSA in males>	Differences in	OSA in Qatar and UK

	et al, 2011, (Al Langawi et al., 2011)		ve data review	subjects (88 from UK and 198 from Qatar)		patients	factors and characteristics of OSA			females 2) OSA in UK (83%)> Qatar (55%) 3) BMI higher in Qatar >UK 4) Alcohol and smoking consumption more in UK > Qatar	PSG equipment such as the portable PSG may have overestimated OSA cases by diagnosing more cases	have similar risk factors and associations
4	Al Ansari, 2007 (Al Ansari et al., 2007)	Qatar	Descriptive study	187 Subjects	F & M	Adult patients	To assess the predictive value of NC vs BMI in evaluating OSA	BMI, NC	PSG	1) 43% of subjects had OSA 2) OSA group were male predominant and older in age 3) OSA more common in non-Qatari > Qatari group 4) BMI has no predictive value in assessing increased risk of OSA, NC proved to be a better predictor	-	NC is a better predictor than BMI for assessment of risk diagnosis of OSA and can reduce number of patients referred to do PSG if used as a predictive screening tool.
5	Alshehri et al, 2019 (Alshehri et al., 2019)	Saudi Arabia	Cross-sectional study	878 (803 included only)	F & M	Adult patients, males: 44.9±15.9 females: 47.2±15.6	To determine the relationship between obesity and the severity of OSA	BMI	PSG, AHI	1) 75% of the sample had OSA 2) Higher prevalence rates were observed among obese patients (77%) 3) Severity of OSA was higher among obese patients (85%)	1) 75 patients were excluded due to incomplete or missing data and loss to follow-up 2) Missing and/or inaccurate data from records	1) Obesity a considerable risk factor for the development of OSA and may increase the severity 2) Future research should focus on the impact of unhealthy lifestyle
6	Ahmad et al, 2019 (Ahmad et al., 2019)	Saudi Arabia	Cross-sectional study	319 patients	F & M	18-80 years	To screen patients for sleep apnea, and identify any associated conditions	BMI	BQ, ESS	1) BQ showed a prevalence of high risk of sleep apnea of 29.8% based on BQ, and 32.0% based on ESS 2) Obesity and hypertension associated with high risk of sleep apnea	1) BQ and ESS are used as screening tools for sleep apnea risk. The gold standard for diagnosis PSG 2) Sample size represented only patients at one medical clinic 3) Study design does not allow assessment of causality	Physicians must recognize sleep apnea in their patients in order to provide proper care

7	Alotair & BaHamma m, 2008 (Alotair & BaHamma m, 2008)	Saudi Arabia	Descriptive, cohort study	384 patients	F & M	Adult patients	To examine gender differences among Saudi OSA patients	BMI	PSG, ESS, AHI	1) Women were older than men at the time of diagnosis of OSA (55 years vs 65 years of age) 2) BMI of women > BMI of men diagnosed with OSA 3) Women tended to have higher rates of co-morbid conditions than men such as asthma, hypothyroidism, hypertension, and diabetes 4) Men had higher AHI episodes than women and higher desaturation index, but women had lower sleep efficiency	1) Interviewer was not blinded, 2) Responses can be biased based on the educational level of patient 3) Presence of spouse or family member can present bias to responses during the interview 4) The PSG performed was a split-night study and not equivalent to a full-night PSG study	Physicians should be aware of gender differences between men and women diagnosed with OSA as there may be genetic and important pathophysiologic changes which could impact their treatment
8	Mahboub et al, 2013 (Mahboub et al., 2013)	United Arab Emirates	Cross-sectional study	1214 patients	F & M	14-81 years	1) To estimate the prevalence of symptoms and risk of OSAS in the primary health care setting in Dubai 2) To determine the relationship between obesity and OSA	BMI	BQ	1) Prevalence of high risk of sleep apnea of 20.9% 2) Highest prevalence observed between age 51 to 60 in both genders 3) 70% of high-risk group had BMI ≥ 30 kg/m ²	1) Study did not include information on BQ and patient outcome 2) Self-report of symptoms	1) High prevalence of OSAS symptoms 2) Screening, evaluation, and counseling can be beneficial

Table 1. A summary of studies investigating OSA and obesity in the Gulf region

*ESS: Epworth sleepiness scale, OSA: obstructive sleep apnea, BMI: Body mass index, PSG: polysomnography, BQ: Berlin Questionnaire, NC: Neck circumference, AHI: apnea-hypopnea index

3.1 Oman

A retrospective study conducted at the Sleep Laboratory of the Clinical Physiology Department of Sultan Qaboos University Hospital, Oman between January 1995 and December 2006 aimed to look at the prevalence, age, sex, and risk factors predisposing patients to OSA in the Omani population. PSG reports including the subjects' demographic data such as age, sex, BMI, and other clinical data like the apnea-hypopnea index and co-morbid conditions were evaluated and compared for statistical significance and correlation to OSA. Of a sample of 1,042, 608 of these sleep studies met the inclusion criteria for analysis. 47.9% of those diagnosed with OSA (apnea-hypopnea index (AHI) >15) were men as compared to 33.5% in women. Women were older and had higher BMI as compared to men. Co-morbidities such as hypertension, ischemic heart disease and hypothyroidism was higher in men with AHI>15 than those with AHI<15 while women had higher prevalence of COPD (Chronic obstructive sleep apnea), asthma, diabetes, and hypothyroidism at AHI > 15 [9].

Additionally, men had an overall more significant prevalence of OSA based on AHI at any given level of BMI, while women were more likely to be diagnosed with OSA at a higher AHI if they were of advanced age, irrespective of BMI level. The significance of these findings means that age plays more of a role in the prediction of OSA progression in Omani women, while BMI predicts OSA progression and disease in Omani men. This may be attributed to hormonal differences in progesterone and estradiol affecting AHI in perimenopausal vs postmenopausal women as the risk of OSA increases with age [9].

3.2 Qatar

The first study from Qatar is a quantitative questionnaire utilizing the Epworth Sleepiness Scale (ESS) was conducted amongst men and women referred for PSG. This study aimed to identify the predictive risk factors influencing the development of OSA based on the presence or absence of snoring as their primary complaint. Of the 227 patients referred for PSG, 36 were excluded and 191 were included in the analysis. The following significant findings were reported based on PSG parameters. Men made up the majority of the snorer patients at 84% as compared to women at 21.5%. OSA was diagnosed based on disrupted respiratory breathing with a respiratory disturbance index (RDI ≥ 5) and arousal index. 66% of the 191 were found to be positive for RDI ≥ 5 with a higher arousal index than those not diagnosed with OSA. Furthermore, the majority of these apneic episodes occurred more frequently in men than women and OSA was more prevalent in non-Qatari individuals at 72.4% vs 52% in Qatari individuals [10].

There were 4 distinct groups divided based on the RDI: normal, mild, moderate, and severe OSA. OSA group had higher apnea-hypopnea index and had higher neck circumference (NC) than the normal group. Males had higher NC > females in the OSA groups, and the group with severe OSA (RDI >30) had the most statistically significance NC difference as compared to the mild and moderate OSA groups (RDIs <15 and 15-29.9 respectively). Furthermore, the OSA group had higher mean age, more apneic episodes, and higher scoring on ESS than the OSA negative group.

In conclusion, the most significant independent predictors of OSA were male gender, increased age, high neck

circumference, high score on ESS, and presence of apneic episodes. Obesity was not found to be a statistically significant risk factor for OSA as much as neck circumference, especially in the male population. Conversely, BMI predicted severity of OSA and progression of disease in the female population in Qatar [10].

The second study from Qatar is a retrospective study aimed to look at the characteristics and risk factors of patients diagnosed with OSA. The data from 286 records were reviewed: 198 subjects data representing the Middle East population (Qatar) and 88 subjects data representing the Western (UK) population. Patients were referred for sleep studies and underwent a full-overnight PSG in Qatar, while in the UK patients were screened for sleep studies at home using calibrated PSG machines while an attending physician recorded the findings. Clinical, demographic and risk factors were reviewed and these included age, BMI, sex, smoking, alcohol intake and sleep symptoms such as snoring, insomnia, nocturia, apnea and nasal obstruction. This was assessed using a modified version of the ESS. Further information regarding co-morbidities such as DM, hypertension and coronary disease were also included [11].

The findings of the study were significant in several aspects and drew some comparisons and differences between the two groups. In the UK group, the majority of patients referred were diagnosed with OSA at 82.1% while in Qatar only 55% of the patients referred were diagnosed with OSA. In both groups, OSA was more prevalent amongst males than females. In the UK group, smoking and alcohol intake were statistically significant and correlated positively with OSA while in Qatar, BMI was statistically significant in those diagnosed with OSA. Sleep symptoms and co-morbidities had similar rates in both groups except for hypertension which was statistically significant in both groups. Some PSG indices were higher in Qatar than the UK such as higher RDI and desaturation rates at baseline. In conclusion, there are many risk factors contributing to OSA development. In this study, OSA prevalence which was higher in the UK correlated positively with smoking and alcohol intake. The proposed mechanism for OSA development may be due to inflammatory processes causing an increase in upper airway resistance in smokers and increased nasal/pharyngeal tone in alcohol drinkers. While in the Qatar group, BMI played the most significant correlation to OSA [11].

The third study from Qatar examined the differences in neck circumference vs BMI as a better predictive value of obstructive sleep apnea. 187 patients were evaluated for risk of OSA and the parameters included age, sex, nationality (Qatari vs non-Qatari), neck circumference, BMI and for sleep parameters RDI events were calculated. Of the 187 patients referred for PSG, 80 patients were diagnosed to have OSA (defined as an RDI >15 events/hr of sleep), the majority of which were males and Non-Qataris (p value <0.01). The OSA group had a higher mean age of 50 years as compared to 45 years mean age in the non-OSA group. Furthermore, neck circumference was statistically significant in the OSA group and impacted the number of RDI events, while BMI had no significant effect on RDI events in the OSA and non-OSA group [12].

This study has shown that neck circumference is a more accurate measurement than BMI in predicting OSA. Neck circumference measures fat deposition in the upper airway as compared to BMI which compares weight and height

ratios and is representative of central/overall obesity. Many previous studies have suggested fat deposition in the upper airway region is an important pathophysiologic factor causing OSA and objective assessment of upper airways such as upper airway examination, computerized tomography (CT) scans and magnetic resonance imaging (MRI)'s have demonstrated these findings of fat distribution in OSA patients [12].

Moreover, as established in previous studies, this study has shown a male predominance > females in OSA group and this can be attributed to a few differences. Firstly, women tend to have more fat distribution in the lower waist/hip region as compared to men. Secondly, hormonal differences in women may contribute to less upper airway collapsibility than men, however this needs to be investigated more. Finally, research has shown that women have increased pharyngeal muscle activity and less relaxed upper airway structure so the rate at which the upper airway collapses is significantly less as compared to men; which may explain the increased OSA rates amongst the male population [12].

3.3 Saudi Arabia

A cross sectional study conducted at a sleep center in the King Abdul-Aziz University Hospital (KAUH) between January 2012 to September 2017 aimed to assess the causal association between obesity, particularly BMI level, and the development of OSA and the severity of the illness. Demographic and clinical characteristic data was taken from records and the polysomnography report such as age, gender, height, weight, and associated laboratory markers including glycated hemoglobin level, lipid profile, oxygen saturation and the apnea-hypopnea index. The study included a group of 803 patients who fit the inclusion criteria and were observed to have clinical signs and symptoms of OSA such as daytime sleepiness, excessive fatigue, snoring, and a higher than normal BMI who were then referred to the sleep center [13].

The results of this study found that the majority of patients referred to the sleep center were mostly diagnosed with OSA (74.8%). Of these patients diagnosed with OSA a few findings were observed. Firstly, there was a higher incidence of OSA in males (56.5%) than females. This was attributed to possible differences in structure of the upper airway as well as higher rates of snoring amongst males than females. Secondly, there was a strong correlation between obesity, obesity level and OSA in these patients. The findings showed an overall higher rate of OSA in obese patients (70.4%) vs. non-obese patients. In the study, it was also observed that those patients with obesity level III (50.1% of the patients enrolled in the study) had a higher AHI score and lower O₂ resting saturation rate indicating severity of OSA. Lastly, those that were older were observed to have higher rates of severe OSA with a mean age of 45 years [13].

Based on the above findings, it was found that there is a strong association between obesity and OSA. This can be attributed to excessive fat deposition and accumulation in the upper airway and muscles leading to upper airway obstruction. BMI and neck circumference served as positive predictive values for indicators of obesity, with higher specificity seen for females with BMI and neck circumference for males, respectively. The apnea-hypopnea index, a predictor for severe OSA was higher in the obese than non-obese patients and this was reflected on the findings in

the polysomnography report. A positive correlation can thus be inferred from these findings and indicate that patients with higher BMI levels had a greater AHI index and suffered from severe obstructive sleep apnea [13].

The second study from Saudi Arabia was a prospective, cross-sectional study aimed to screen the risk of sleep apnea among female and male adults. This study included 380 patients, 319 which were screened for sleep apnea using two validated questionnaire instruments: the Berlin Questionnaire and the Epworth Sleepiness Scale [14]. This study also aimed to identify independent but potentially inter-related variables that are risk factors for sleep apnea such as obesity, hypertension, diabetes mellitus, smoking, hypothyroidism, and hyperlipidemia [15].

The results of this study showed that the BQ tool and the ESS tool each showed a high prevalence of sleep apnea at 29.8% and 32%, respectively. Furthermore, of the above mentioned variables, only obesity and hypertension were found to be significantly correlated with OSA. This study concluded that the use of BQ and ESS can be used as screening tools for the risk assessment of patients for sleep apnea to allow for earlier diagnosis and treatment of OSA. It also identified important risk factors that if treated and managed appropriately can help lessen the severity of the symptoms associated with sleep apnea [15].

The third study from Saudi Arabia was a descriptive survey aimed to analyze the gender differences in a sample of Saudi OSA patients (191 women and 193 men). Clinical presentation including symptoms, BMI, and medical conditions as well as demographic data such as age and gender were obtained through personal interview using the Wisconsin Sleep Cohort Scale and the Epworth Sleepiness Scale. Patients suspected to have OSA and who met the inclusion criteria were later referred to the Sleep Disorders Centre where an overnight PSG confirmed the diagnosis of OSA [16].

The following findings were reported: 1) women were significantly older than men at age of diagnosis of OSA (mean peak age of 55 years for men, and 65 years for women) which was attributed to post-menopausal state in women, 2) women had higher BMI than men, 3) women had higher prevalence of co-morbid conditions such as insomnia, hypertension, hypothyroidism, cardiac disease, asthma and diabetes 4) women had higher BMI than men, 5) men experienced greater and more frequent episodes of apnea/hypopnea, however this was mainly observed in non-REM (non-rapid eye movement) sleep. As compared to other ethnicities, OSA was more prevalent in Saudi women as compared to Caucasian women. Saudi women also had higher AHI than Caucasian women even though the age of presentation of OSA was the same and so was the BMI. Men on the other hand, had higher overall prevalence of OSA diagnosis in Saudi as compared to Saudi women but risk factors such as declining age, co-morbid diseases, obesity, and gender-related differences in upper airway anatomy can contribute to almost similar OSA rates in women [16].

3.4 United Arab Emirates

A prospective one-year study conducted between September 2011 to March 2012 in Dubai Health Authority primary health care settings in Dubai, United Arab Emirates aimed to estimate the prevalence of obstructive sleep apnea

amongst female and male patients aged 14 and older. The association between obesity and sleep apnea was also explored [17]. The Berlin Questionnaire was used as a screening tool to assess patients for risk of sleep apnea and then further subdivided into low and high-risk categories. A total of 1214 patients were included in this study and screened, with 254 participants meeting the criteria for high risk assessment scoring. Of these, 20.9% were classified as high risk and the rest were low risk. The findings of this study showed the following: high prevalence of OSA symptoms amongst males as compared to females, the mean age average of OSA symptoms for the high risk category was 39 years in females and 41 years for males and the highest prevalence for OSA was more apparent in older adults (above 50) than in younger adults. In addition, OSA was more prevalent in the participants with a higher BMI, especially those greater than $>30 \text{ kg/m}^2$, suggesting a strong correlation, while those who were classified as low risk for sleep apnea had BMI's $<30 \text{ kg/m}^2$ [17].

Obesity is very predominant in the UAE, ranking as the 18th most obese country in the world. This study showed that obesity plays an important role in the risk assessment of OSA and can co-exist to worsen OSA symptoms. Therefore, it is crucial to identify symptoms earlier using a validated screening tool such as the Berlin Questionnaire to assess which patients are at high or low risk and to appropriately manage them [17].

4. Discussion

This paper reviewed the literature related to OSA and obesity in Gulf countries. These studies highlight the relationship between the two diseases and are in concordance with global reports on the topic, associating obesity with OSA [2, 18]. Research has shown that obesity is an independent risk factor for OSA [19] in both children and adult populations [2]. This relationship is clearly outlined in the studies reviewed here, with gender differences reported in a few studies.

This review also explored the quality and quantity of sleep medical services in the Middle East, specifically in Saudi Arabia and UAE. It was noted that the facilities were limited, with only 7 centers in Saudi Arabia and 8 specialized sleep labs in UAE dedicated to the diagnosis and treatment of OSA [8].

As far as recommendations, patients with a high BMI ($>33 \text{ kg/m}^2$) should be screened for sleep-related complaints and undergo evaluation for severe symptoms, particularly those related to OSA. By doing so, a healthy lifestyle can be implemented and provide a preventative strategy to decrease the morbidity associated with obesity in the development of severe OSA [20]. Furthermore, establishing sleep services is a dire need in the region, as it requires further development in order to accommodate the increasing number with sleeps related disorders [8]. Reports have shown that the current level of sleep related services and infrastructure is not comparable to those of developed nations [21]. Moreover, education efforts at the level of practitioners and awareness campaigns at the level of the general population are also recommended to increase the level of overall knowledge about sleep disorders and how and when to address them [8, 22]. Finally, this review highlights the lack of studies conducted on the pediatric population in the region, which is another aspect future researchers can probably help tackle.

In relation to the field of sleep medicine in general, there is a lack of established screening tools for patients with

OSA-related symptoms in the initial phase of disease detection. Although ESS and BQ are used to screen patients, there are no definitive tools that can assess patients or predict their risk for OSA severity prior to PSG diagnosis. A literature review conducted by the American Academy of Sleep Medicine task force reported that no tool currently fulfils their criteria for screening or assessment of OSA [23]. Additionally, there is no consensus on a BMI cut-off value for assessing OSA patients and decreasing rate of OSA complications. More research is needed to establish such a cut-off value and a validated definitive screening tool for OSA as there is a lack of evidence regarding the benefits vs the harm of OSA screening [24].

5. Conclusion

Thus, it can be concluded from this review that obesity is a rising epidemic in the Gulf region and there is a strong correlation to OSA, and the development of complications associated to this disease. The sleep medical services needed to diagnose and adequately treat these patients is lacking in equipment, beds, and qualified staff. This poses a huge problem because obesity increases the risk for obstructive sleep apnea and other chronic diseases and due to the lack of awareness of such a condition, many of these patients may be left undiagnosed with OSA increasing both health and financial burdens in these countries [8]. In all, advancing the field of sleep medicine in the Arab world in general and in the gulf region in specific requires the collaboration of efforts on several levels involving policy makers, health care practitioners, and the general population [8, 25].

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