Chronic obstructive pulmonary disease (COPD) is a debilitating and complex disease with an underlying pathology such as asthma. We set out to systematically review existing published research on the prevalence and risk factor of COPD conducted in the United Arab Emirates (UAE). We performed a systematic search in PubMed and Scopus to identify relevant articles. Search limits using the Medical Subject Headings terms were restricted to studies conducted between 2007 and 2016, mainly focussing on the UAE population (both citizens and expatriates). The review yielded eight studies about the ‘prevalence and risk factors’ of COPD in the UAE, including cross-sectional studies (n = 6), observational population-based study (n = 1) and a prospective, multi-centre, multinational study (n = 1). The COPD prevalence in the studies reviewed ranged from 3.7% to 5.3%. Smoking, male gender, outdoor and indoor air quality, for example, purposely smelling gasoline fumes or car exhaust were the most frequently observed COPD risk factors. COPD is not only a major health concern for health-care bodies but it is also a leading contributor of disability and reduced quality of life in communities worldwide. The study suggests that COPD requires regular follow-up, education and holistic care. Medication compliance with precise focus on using the correct inhaler method is recommended. Longitudinal studies in the future are needed to investigate the determinants and prognosis of this condition.

Keywords: Chronic obstructive pulmonary disease, prevalence, risk factors, United Arab Emirates

Submission: 31-03-2019; Accepted: 27-08-2019; Published: 20-02-2020

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic state regarded as a slowly progressive obstruction of airflow, that is irreversible as well as is an increasing cause of disability and mortality globally.[1] It was previously described as emphysema or chronic bronchitis. Predominantly, the symptoms include a productive cough, slowly progressive breathlessness on exertion and wheeze.[2] The WHO Global Burden of Disease (2016) reported a prevalence of 251 million cases of COPD globally.[3] At initial stages, COPD is considerably symptomless, later on, long coughing episodes accompanied by the increase in frequency of cough develops. In later stages, large portion of lung function and capacity declines, as well as dyspnoea symptoms develops.[4]

COPD is diagnosed at later stages because physicians worldwide are either not aware of or not responding to COPD symptoms or diagnostic delays may either be due to the patient’s gradual adaptation to declining function of the lungs.[5] The primary COPD risk factor includes cigarette smoking along with other irritants such as environmental dust, chemical fumes, air pollution (both indoor and outdoor), occupational risk and vulnerability, domestic fuel and allergens.[6] Male sex and old age are also associated with COPD.[7] Spirometry universally acknowledged as the gold standard is necessary for making a confident diagnosis of the irreversible obstruction of airways while the measurement of choice is the Forced Expiratory Volume (FEV1); (GOLD guidelines: post-bronchodilator FEV1/forced vital capacity <0.7).[8,9]

One of the large observational population-based survey including a large sample of respondents (aged >40 years) from 10 of the Middle Eastern and North African revealed that overall COPD prevalence is 3.6% ranging from 1.9% in the United Arab Emirates (UAE) to 6.1% in Syria[10] Such prevalence is predicted...
to rapidly increase with the emergent rates of smoking and age factor.[11-14] This systematic review is a first comprehensive review that aims to provide a wide-ranging knowledge about the burden of COPD and summarises the prevalence in addition to risk factor studies conducted in the UAE.

**Methodology**

**Research design**
A systematic review of the previously published evidence was performed based on the ‘PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)’ guidelines. A systematic review primarily attempts to collate all empirical evidence that fits pre-specified criteria for eligibility to answer a specific research question.

**Search strategy**
After identification of the relevant ‘Medical Subject Headings terms’, a systematic search from January 2007-December 2016 of the PubMed, and Scopus was conducted for extracting the studies estimating the risk factors and prevalence of COPD in the UAE. Cross-references of the publications retained were additionally hand searched for studies omitted in the preliminary search. Our key terms included ‘COPD’, ‘emphysema’, ‘chronic bronchitis’, ‘prevalence’, ‘risk factors’, ‘epidemiology’, ‘airway obstruction’, ‘UAE’, ‘Dubai’, ‘Ras al-Khaimah’, ‘Abu Dhabi’, ‘Ajman’, ‘Al-Ain’, ‘Sharjah’, ‘Fujairah’ and ‘Umm al-Quwain’. The search strategy details are illustrated in Figure 1.

**Inclusion and exclusion criteria**
This review included original studies conducted in the UAE. The extracted articles provide estimates of the COPD cases, prevalence and relevant population-based information from which prevalence of the COPD can be further estimated. The studies having unclear methods and study design, secondary articles (viewpoints, reviews or editorials), studies with insufficient information on the risk factors and prevalence of COPD, studies conducted before 2007, on non-UAE population were excluded. Moreover, no language restriction was applied.

**Data extraction and analysis**
The broad search used in this review resulted in 38 hypothetically relevant articles. The full text of these research articles was reviewed and extracted to confirm eligibility. A total of 8 were chosen for review which met the inclusion criteria. All extracted data were stored into Excel 2013 (Microsoft Corporation, Redmond, WA, USA), including the names of the first author, publication year, sample, settings, specific outcomes, future implications and recommendations. A parallel extraction and search were performed using two independent reviewers. Any disagreements between the reviewers were resolved by consensus.

**Results**
Following a systematic search to identify prevalence and risk factors articles on COPD in the UAE, 8 studies met the inclusion criteria, including cross-sectional studies (n = 6), observational population-based study (n = 1) and a prospective, multicentre, multinational study (n = 1).

**Prevalence and risk factors of chronic respiratory diseases**
Of the eight studies[15-22] reporting on Chronic Respiratory Diseases, six were cross-sectional studies, one included observational population-based study and a prospective, multicentre, multinational study. Seven studies reported the prevalence of ‘Chronic Respiratory Diseases’. While five studies reported the risk factors of ‘Chronic Respiratory Diseases’.

Based on the studies being reviewed, the prevalence of COPD ranges from 3.7% to 5.3%, whereas the asthma prevalence ranged from 12.3% to 13%. In the MENA (Middle East and North Africa) region, epidemiological COPD data are considerably limited. In 2012, the BREATHE study addressed the symptom prevalence related to COPD in MENA region. BREATHE was the largest regional study carried on 11 countries. For the COPD population, 2187 (3.5%) subjects satisfied the benchmark for inclusion. The ‘spirometry data’ were attained from 1847 (14.2%) subjects to whom this was projected. This study gathered a large amount of evidence regarding COPD variables from a representative sample of the general population.[19] Alzaabi[17] studied the prevalence of COPD (40–80 years old) in a cross-sectional study conducted in Abu-Dhabi. The prevalence of COPD was reported to be low, i. e., 3.7% and 95% CI (2.0–5.3). Conversely, another ‘prospective, multicentre, multinational study’ recruited ‘8167 consecutive patients hospitalised with Acute Coronary Syndrome in ‘six of the Middle Eastern’ countries. The COPD prevalence was reported to be 5.3%.[15]
The remaining four studies focussed on the asthma prevalence in the UAE. Another study conducted in the Emirates of Al-Ain, UAE, demonstrated 13% of self-reported asthma prevalence,[16] whereas another study conducted in the nine UAE regions demonstrated 12.3% of asthma prevalence.[20] Conversely, the asthma symptoms prevalence was also reported in a cross-sectional study undertaken in the public locations across the seven emirates of the UAE. The prevalence of individual respiratory symptom from the ‘ECRHS screening questionnaire’ ranged from 8% to 10%. With respect to the age group, individuals 20–44 years presented a reduced prevalence (P < 0.05) in all symptoms.[18] Gender differences in asthma warranted further investigation. On the other hand, prevalence of asthma in the young generation between ‘6 and 14 years’ in a cross-sectional study demonstrated childhood asthma prevalence in Abu Dhabi (eastern region) was higher among children in ‘consanguineous families’ than non-consanguineous families.[21]

The two most significant risk factors for Chronic Obstructive Respiratory Diseases included outdoor and indoor air quality, for example, inhaling gasoline fumes, burning black ants, car exhaust, ink correctors, glue[20] and tobacco smoke[17,20,22] (exposure to second-hand smoke and personal smoking). Those who smoke cigarettes intensify their risk of developing asthma, COPD and lung cancer. Family history,[16] male gender and consanguineous families,[21] i.e., paternal asthma being sole predictor for boys were also some of the associated risk factors [Table 1].

**DISCUSSION**

The overarching goal of the study is to inform health-care policy-makers on the magnitude of COPD in the UAE and to provide relevant data that can underpin operational interventions for improving management and detection. Studies conducted on the prevalence of COPD in UAE are rare and involves only certain population. Therefore, the review aims to demonstrate the burden of this condition in the UAE population, by summarising the local studies on the topic. The review will serve to raise awareness and draw attention on this emerging condition.

The results of the review instigated that COPD is a great cause of concern for health-care bodies.[11] The review provided summary of epidemiological studies on COPD prevalence and risk factors in the UAE that were published between 2007 and 2016. Around seven studies presented data on the prevalence, whereas only five studies presented data on the risk factors. Based on the results extracted from the reviewed articles, the overall prevalence of COPD varied from 3.7% to 5.3%,[15,17] whereas the asthma prevalence ranged from 12.3% to 13%.[16,20] A similar trend though with higher proportions when compared to the estimated prevalence from four sub-Saharan African countries ranged between 4.1% and 24.8%. Different definitions and methodologies were used for estimating the COPD prevalence.[23,24] COPD prevalence in high-income countries has been well documented. For instance, COPD prevalence rates of 26.1% and 10.7% in Austria,[25] 18% and 9% in Iceland (COPD Stages I and II),[26] 13.2% in Germany (Stage I),[27] using BOLD (Burden of Lung Disease) methodology. This method is used as an initiative to gather country-wide-specific data on the economic, social burden, risk factors and the prevalence of COPD using structured interviews based on spirometry and questionnaires.[28]

Outdoor and indoor air quality, tobacco smoking, occupational risks, family history and consanguineous families, were major contributory factors responsible for this epidemic. In the future, teen smoking may become a serious and alarming health-related concern. A cross-sectional study among adolescents (aged 13–20 years), reported the smoking behaviour to be more prevalent among Arab population prompting increased COPD burden.[20] Furthermore, biomass fuel exposure (for instance wood for coal and cooking) and use of water pipes (shisha) elevates the COPD risk. The findings of the study are consistent with the findings of a study conducted in Saudi Arabia by Al Ghabain.[29] The study also highlights the significance of developing educational campaigns to inform the young generation regarding the health-related threats of inhaling gasoline fumes, or car exhaust that are found to be significant predictors of wheeze and dry cough. There is also strong evidence linking paternal asthma increasing the risk in both girls and boys in the consanguineous families,[21] while, being a sole predictor in males. The prevalence of Asthma in childhood was significantly high in consanguineous families in the same study. The results are consistent with findings reported earlier in Brazil signifying that ‘consanguineous marriages’ carry a high risk of developing disease often possessing a genetic basis, either partially or completely.[30] Another study conducted in five Middle-Eastern countries indicated that adjusted asthma prevalence in the Middle East ranges from 4.4% to 7.6%, which is comparatively lower than the reported prevalence in Europe and North America.[31]

COPD was reported to be more frequent in men (5.2%) than in women (1.8%).[10] This is consistent with other studies conducted in England signifying a higher incidence of men diagnosed with COPD.[32] On the contrary, the incidence of COPD in women is also rising as noted by a study conducted in the United States.[33] It is owing to a difference in the patterns of smoking between women and men and greater vulnerability in women to the adverse effects of smoking cigarettes.[34] Smoking and subsequent COPD development is an ever-increasing epidemic in the Arabian Gulf and Middle East countries.[35,36]

This study is subjected to numerous limitations. First, only eight studies were included in the study. These studies demonstrated substantial heterogeneity in patient characteristics, settings and study design. Such differences might have influenced the reported prevalence together with limiting the generalisability of the results. Second, the results of cross-sectional do not inevitably indicate causality. Thirdly, as with any review based
**Table 1: Published papers on the prevalence and risk factors of chronic obstructive pulmonary disease in United Arab Emirates from 2007-2016**

| Author/reference | Year | Aim | Study design | Settings | Study population | Study key findings | Future implications OR Recommendation |
|------------------|------|-----|--------------|----------|------------------|-------------------|---------------------------------------|
| Hadi et al.[15]  | 2010 | To report the prevalence and the significance of clinically recognized chronic obstructive pulmonary disease (COPD) during acute coronary syndrome (ACS) | Prospective, multicentre, multinational study of patients hospitalised with ACS | 6 Middle Eastern countries | Data collected from: February to June 2007; 8167 Consecutive patients hospitalised with ACS | Prevalence of COPD - 5.3% COPD patients were older and more likely to have hypertension, diabetes, and dyslipidaemia than non-COPD patients. Atypical presentations were more common in COPD patients. Likely to be treated with: thrombolytic therapy ($P=0.001$), beta-blockers ($P=0.001$), and glycoprotein IIb/IIIa inhibitors More likely to receive: ACE inhibitors. | The study highlighted the significance of investigating about the interaction between COPD medications in addition to ACS in the future prospective studies |
| Alsowaidi et al.[16] | 2010 | To study asthma prevalence and independent risk factors | Cross-sectional survey | Al-Ain, UAE | 6543 subjects; Adolescents and adults; 53% were males | Self-reported asthma prevalence: 13%; A significant ($P=0.001$) interaction between age and gender: in the group aged 13-19 years, males had a significantly higher prevalence of asthma (17 and 14%; adjusted OR: 1.45; 95% CI: 1.10-1.90); in the group aged >19 years, males had a significantly lower asthma prevalence (11 and 13%; adjusted OR: 0.77; 95% CI: 0.60-0.95) than females. | Risk factors Family history and (50% of nationals of Bedouin origin) More likely to receive: ACE inhibitors. | Studies in the future are needed to study the possible role of specific asthma risk factors |
| Al Zaabi et al.[17] | 2011 | To study COPD prevalence in Abu-Dhabi | Cross-sectional survey | Abu Dhabi, United Arab Emirates | 520 participants- 40-80 years old | The COPD prevalence=3.7% Risk factors Increased COPD prevalence was reported in 70 years and older; Use of cigarette smoking was considerably low (12% former and 12% current smokers) Use of pipe (0%), shisha (5%), or exposure to passive smoking (5%) High biomass exposure (33%) and use of bakhoor (78%) None of the reported risk factors above were associated with the COPD risk | Studies in the future are required to study the low prevalence of this epidemic and the absence of associations with smoking cigarette or with supplementary inhaled local exposures |

Contd...
Table 1: Contd...

| Author/reference          | Year   | Aim                                                                 | Study design          | Settings                                                                 | Study population | Study key findings                                                                                                                                                                                                 | Future implications or recommendation                                                                 |
|--------------------------|--------|----------------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Mahboub et al., 2012     | 2012   | Determination of the asthma symptoms prevalence in the general UAE population | Cross-sectional study | Public locations across the seven emirates of UAE                           | 1225 individuals (66.5% males and 33.5% females) | Prevalence of ’individual respiratory symptom’ from the ECRHS screening questionnaire: ranged between 8 and 10%; (women reporting more individual symptoms than men); Individuals 20-44 years presented a reduced prevalence (P<0.05) in all symptoms | Gender differences in asthma needs more investigation                                                                                       |
| El Hasnaoui et al., 2012 | 2012   | Estimation of the regional prevalence of COPD symptoms within the general population in the MENA region | Observational population-based survey | 10 Middle Eastern and North African countries (Egypt, Algeria, Lebanon, Jordan, Saudi Arabia, Morocco, Syria, Turkey, Tunisia, Pakistan and United Arab Emirates) | 10,000 subjects ≥40 years of age | The overall response rate was found to be 74.2% For the ‘COPD’ population, 2187 (3.5%) subjects satisfied criteria for inclusion Evaluable spirometry data were attained from 1847 (14.2%) participants to whom it was proposed The study successfully gathered information in large amount on COPD variables from a representative sample of the general population of ten countries | The data obtained in the study can be used for comparison in other regional COPD initiatives |
| Barakat-Haddad et al., 2015 | 2015   | To investigate the role of air quality in accordance to dry cough, wheeze, asthma, emphysema, and chronic bronchitis among UAE adolescents | Cross-sectional survey | 9 UAE regions                                                                 | 6363 adolescents aged 13 to 20 years | Asthma prevalence: 12.3%, followed by emphysema (0.5%) and chronic bronchitis (1.8%) Risk factors Air quality and behavioural factors for example, purposely smelling gasoline fumes, burning black ants, car exhaust, correctors, glue, and smoking are are significant predictors of wheeze and dry cough | Knowledge regarding the environmental predictors and detailed profile of such symptoms are critical for undertaking public health planning; Educational campaigns should be developed further to inform adolescents regarding the health threats |
| Joseph et al., 2009      | 2009   | The asthma prevalence in children between 6-14 years were explored | Cross-sectional study | Eastern region of Abu Dhabi Emirate                                          | 1136 children from 295 local Arab UAE families | Childhood asthma prevalence was reported to be higher among children in consanguineous families (43.3%) in comparison to non-consanguineous (22.6%, P<0.001) Girls from consanguineous families experienced more asthma than boys Risk factor Sole predictor for boys was paternal asthma In consanguineous families, paternal asthma enhanced the risk for asthma for both girls and boys (P=0.021 for boys, P<0.001 for girls), whereas, maternal asthma had no significant impact on asthma in offspring | Such interesting observations merits additional studies on both larger sample as well as in various other consanguineous communities for confirmation |

Contd...
Table 1: Contd...

| Author/reference | Year | Aim | Study design | Settings | Study population | Study key findings | Future implications OR Recommendation |
|------------------|------|-----|--------------|----------|------------------|--------------------|---------------------------------------|
| Mabhoub et al.[22] 2014 | Assessing the value of ‘Peak expiratory flow rate’ as a screening tool by comparing it to spirometry | Cross-sectional survey | Dubai, UAE | Adult respondents 18 years and older; 1607 individuals; 577 participated in the study; 40 years and older were invited for COPD screening including of a short socio-demographic questionnaire, PEFR, and spirometry | 141 participants reported airflow limitation compatible with COPD Sensitivity=73.5% and specificity=80%; In general, 68 participants (12.9%, 95% CI 10.3% to 16.1%) had airflow limitation compatible with COPD The COPD case finding before spirometry confirmation can be assisted by PEFR PEFR is reported to be a cheap, easy and non-biased tool to screen smoker >40 years of age | PEF has been proposed as a good indicator of COPD mortality risk in hospital |

COPD: Chronic obstructive pulmonary disease, ACS: Acute coronary syndrome, ACE: Angiotensin-converting enzyme, OR: Odds ratio, CI: Confidence interval, UAE: United Arab Emirates, MENA: Middle East/North Africa, PEFR: Peak expiratory flow rate

on published data, one is incapable to rule out the likelihood of publication bias. We have made necessary attempt to reduce the bias by searching and requesting local studies, governmental reports and full-text of the relevant articles. Nonetheless, we feel that the reported findings offer substantial information on the subject.

Conversely, the strength of this review directs that this is the first systematic review, to our knowledge, based on the COPD prevalence and its associated risk factors in the UAE. Therefore, this data may help in facilitating efforts to reduce COPD by reducing the control of risk factors for the disease. This study may also be used as basic data to resolve issues related to COPD. Such data will afterwards lead to improving the management of disease, increase COPD research, together with patient education. Furthermore, this review has included a thoughtful number of studies from countless geographical regions of UAE. Cross-references of all included evidence were undertaken by the researcher and hence that it can be recalled proficiently for inspection and sorting over the course of this study.

**Conclusion**

COPD is a common and debilitating disease with an underlying pathology such as asthma. It causes far greater mortality and morbidity than asthma but has so far received limited attention. Early and accurate diagnosis may lead to improved life expectancy, patient’s quality of life and reduced costs for the UAE health system and society. Government of UAE, including the Ministry of Health and Prevention, has made remarkable and outstanding progress in reducing the consumption of tobacco products and cigarettes. It is also one of the key performance indicators of the pillar of world-class health care of the UAE National Agenda. Given the social acceptance of smoking, high tobacco products availability, and higher tobacco usage globally among adolescent, UAE government has adopted local strategies such as introducing and fully implementing the tobacco tax (50% additional to the base price) and health education campaigns in schools to curb this behaviour, developing anti-smoking clinics to reduce the burden of respiratory illnesses among adolescents. Smoking cessation with the use of brief interventions, for instance, therapies such as cognitive-behavioural therapy and the use of educational pamphlets and workbooks have also been successfully implemented. Medication compliance with precise focus on using the correct inhaler method is recommended in the future. Personalised, dynamic, and holistic approaches, i.e. pulmonary rehabilitation, are needed to tackle the multifaceted disease in future. There is a need to reinforce sufficient efforts in reducing the source pollution from all sectors such as energy, transport and industrial. Furthermore, longitudinal studies in the future are needed to investigate the determinants and prognosis of this condition in the Arab world.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Divo MJ, Casanova C, Marin JM, Pinto-Plata VM, de-Torres JP, Zulueta JJ. COPD comorbidities network. Eur Respir J 2015;46:640-50.
2. Postma DS, Bush A, van den Berge M. Risk factors and early origins of chronic obstructive pulmonary disease. Lancet 2015;385:899-909.
3. World Health Organization. Chronic Obstructive Pulmonary Disease, 2017. Available from: http://www.who.int/mediacentre/factsheets/fs315/en/. [Last accessed on 2018 Feb 21].
4. World Health Organization. Chronic Obstructive Pulmonary Disease;
