

## Measuring Secondhand Smoke in Muscat, Oman

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### قياس التعرض للتدخين السلبي في مسقط، سلطنة عمان

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**ABSTRACT: Objectives:** This study aimed to measure exposure to secondhand smoke (SHS) and assess venue compliance with the municipal Law against smoking indoors in public places in Muscat, Oman. **Methods:** Following the selection of 30 public indoor venues within the Muscat governorate, the concentration of suspended SHS particulate matter (PM<sub>2.5</sub>) in the venues' indoor air was measured throughout July and August 2010. **Results:** Almost all of the venues were found to be compliant with the smoke-free municipal, with the exception of a café that served waterpipes for smoking indoors. The concentration of PM<sub>2.5</sub> in this venue showed an average level of 256 µg/m<sup>3</sup> which was 64 times the level of that found in the non-smoking venues. **Conclusion:** Aside from one café, the majority of the assessed indoor public venues abided by the smoke-free municipal law. However, the enforcement of policies banning smoking in indoor public recreational venues should be re-examined in order to protect member of the public in Oman from exposure to SHS.

**Keywords:** Tobacco Products; Secondhand Smoke; Particulate Matter; Oman.

**المخلص: الهدف:** هدفت الدراسة إلى قياس التعرض للتدخين السلبي وتقييم امتثال الأماكن التي تم اختيارها لقرار البلدية بحظر التدخين في الأماكن العامة المغلقة في مسقط، بعمان. **الطريقة:** حدد الباحثون 30 موقعا من الأماكن العامة المغلقة في محافظة مسقط، تم قياس تركيز مادة الجسيمات المعلقة (PM<sub>2.5</sub>) الناتجة من التدخين السلبي فيها خلال شهري يوليو وأغسطس 2010م. **النتائج:** تبين أن معظم الأماكن الممتثلة لقانون حظر التدخين في الأماكن العامة المغلقة باستثناء مقهى واحد يوفر الأرجيلة في القاعات المغلقة. وسجل متوسط مستوى تركيز PM<sub>2.5</sub> فيها 256 ميكروغرام/م<sup>3</sup>. وكان هذا 64 مرة ضعف مستوى تلك التي وجدت في أماكن يحظر التدخين فيها. **الملاحظة:** وبصرف النظر عن هذا المقهى، فإن الغالبية العظمى من الأماكن المغلقة التي تم تقييمها التزمت بالقانون البلدي بحظر التدخين في الأماكن العامة. ورغم ذلك فإنه يجب إعادة النظر في تنفيذ سياسات حظر التدخين في الأماكن الترفيهية المغلقة مثل المقاهي والتي لا تزال تسمح بالتدخين فيها من أجل حماية الجمهور في سلطنة عمان من التعرض للتدخين السلبي.

**مفتاح الكلمات:** منتجات التبغ؛ دخان التبغ السلبي؛ مادة الجسيمات؛ عمان.

GLOBAL TOBACCO USE IS THE SECOND leading cause of preventable mortality and the sixth leading cause of disability-adjusted life years lost.<sup>1</sup> The World Health Organization (WHO) estimates that almost six million people die from tobacco use each year, both from direct tobacco use and secondhand smoke (SHS).<sup>2</sup> It has been projected that by 2020, this number will increase to 7.5 million, accounting for 10% of all deaths worldwide.<sup>2</sup> Tobacco use is also a major cause of morbidity. In total, 11% of deaths from ischaemic heart disease (leading cause of mortality worldwide) and more than 70% of deaths from lung, trachea and bronchus cancers are attributable to tobacco use.<sup>3</sup> Exposure to SHS is estimated to kill 600,000 people (10% of all tobacco-related deaths) each year.<sup>4</sup> In addition, it is a well-documented risk factor for coronary artery diseases and multiple malignancies in adults, as well as asthma, middle-ear infections and sudden infant death syndrome.<sup>5</sup>

In 2005, Oman acceded to the WHO Framework Convention on Tobacco Control (FCTC), a global treaty to reduce the world's tobacco burden.<sup>6</sup> Article 8 of this international framework requires parties to adopt and implement measures to protect individuals from exposure to tobacco smoke in indoor workplaces, indoor public places, public transport and other public places as appropriate.<sup>7</sup> In October 2009, for the first time, the Muscat Municipal Council issued a ban on all forms of indoor smoking in public places in the capital city, effective from April 2010.<sup>8</sup> This study, conducted in July 2010, aimed to test the extent of compliance with this ban and to monitor SHS levels in a variety of public indoor venues within the Muscat governorate, Oman. The smoking behaviour of people within these venues was also observed in order to identify sources of SHS exposure and subsequently provide evidence to support more progressive smoke-free policies.

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## Methods

The areas targeted for this study were government offices with public access, healthcare and educational facilities, recreational venues (cafés/restaurants/bars) and public transportation. The selected sample of indoor venues included the following: six tertiary hospital areas (including hospital visitor cafeterias), six public and private educational colleges (including student canteens and teacher lounges), nine government buildings (including working offices, lobbies and staff cafeterias), six recreational venues (two bars, two restaurants [one of which was a waterpipe café] and two fast food outlets) and three public transportation buses. Visits to the government, educational and health buildings, as well as the public buses, were made between 7 July and 12 August 2010 at times of typical occupancy (9:00 am to 2:00 pm), while visits to the recreational sites were made between 10:00 pm and 1:00 am.

The study was conducted by two trained personnel using a belt-mounted laser photo meter SidePak<sup>®</sup> Personal Aerosol Monitor AM510 (TSI Inc., Shoreview, Minnesota, USA) that measured the concentration of suspended SHS particulate matter (PM<sub>2.5</sub>) in indoor air.<sup>9</sup> Indoor air monitoring was conducted for 30 minutes at each of the selected venues. A 10-minute measurement of PM<sub>2.5</sub> was also recorded outside each venue before and after entering so as to control for outdoor ambient contributions. A special form was developed to record the entry time, recording start time, recording end time and the exit time at each venue, in order to determine the duration of indoor and outdoor measurements. Approximate dimensions (height, length and width) of the room under observation were noted. The number of active smokers, the number of cigarette butts on the floor and the presence, or lack of, a tobacco smell in the venue were also documented. Daily recorded data on the SidePak<sup>®</sup> Personal Aerosol Monitor AM510

were downloaded and saved using the manufacturer-supplied TrakPro software, Version 3.40 (TSI Inc., Shoreview, Minnesota, USA).

Prior to each visit, a formal letter was sent to the administration of the selected government, health or educational facilities explaining the objectives of the study and requesting their assistance to facilitate the required work. No formal letter was given to the recreational venues or public buses as these venues are open and accessible to the public as long as the services provided are paid for. Prior to the commencement of the study, ethical approval was obtained from the Ethical & Research Committee of the Oman Ministry of Health (#2/D/39/1288). The study was conducted in collaboration with the Johns Hopkins Bloomberg School of Public Health and the Eastern Mediterranean Regional Office of the WHO.

## Results

A total of 30 venues were monitored for an overall duration of 2,400 minutes. It was found that 83% of the recreational venues included in the study had visible 'no smoking' signs displayed in the venue, while active smokers were noticed in 17% of the recreational venues and a tobacco smell detected in 33%. In public buses, 67% exhibited 'no smoking' signs with no noticeable cigarette butts or tobacco smell [Table 1].

Of all the studied public venues, evidence of smoking was found in only one building: a café serving waterpipes for smoking. This venue had an average PM<sub>2.5</sub> level of 256 µg/m<sup>3</sup>, which was 64 times higher than the indoor venues where no smoking was observed [Table 2]. The waterpipe café was the venue where the highest concentration of PM<sub>2.5</sub> was detected (20 times higher than the concentration in the outdoor control area), followed by public buses (on average 1.8 times higher than outdoor control areas). The concentration of PM<sub>2.5</sub> was lowest in educational,

**Table 1:** Observational findings of tobacco use in public indoor venues by venue type in Muscat, Oman, 2010

Venue type	n	Frequency in %			
		Smoking	Cigarette butts	Tobacco smell	Signs prohibiting smoking
Educational colleges	6	0	0	0	100
Government hospitals	6	0	0	0	100
Government public offices	9	0	0	0	100
Transportation	3	0	0	0	67
Recreation	6	17	0	33	83

**Table 2:** Concentrations of particulate matter in selected indoor public venues in Muscat, Oman, 2010

Smoking observed per venue type	n	PM <sub>2.5</sub> concentration in µg/m <sup>3</sup>			
		Mean	Min	Median	Max
<b>Educational colleges</b>					
No	6	4	0	3	11
Yes	0	-	-	-	-
<b>Government hospitals</b>					
No	6	5	2	4	9
Yes	0	-	-	-	-
<b>Government public offices</b>					
No	9	6	3	4	11
Yes	0	-	-	-	-
<b>Transportation</b>					
No	3	20	4	22	34
Yes	0	-	-	-	-
<b>Recreation</b>					
No	5	13	6	10	22
Yes	1	256	256	256	256
<b>Outdoor/control</b>	30	13	3	12	37

PM<sub>2.5</sub> = particulate matter; Min = minimum; Max = maximum.

health and government venues (on average three to four times lower than the outdoor control areas).

## Discussion

This is the first study to provide a brief examination of SHS levels in 30 venues within the governorate of Muscat in Oman. No evidence of smoking was found inside the selected colleges, hospitals, government offices or public buses. Despite the lack of comprehensive national legislation for tobacco control in Oman, several of the examined facilities (with the exception of a waterpipe café) appeared to be fully compliant with the guidelines for Article 8 of the FCTC.<sup>10</sup> This may be attributed to the recent law passed by the Muscat Municipality council which banned smoking in all indoor public places, as well as several ministerial decisions to ban smoking in educational, health and public transportation facilities.<sup>8</sup> Similar educational establishments in Bahrain and Iran were also found to have no evidence of SHS when measured using identical methods.<sup>11</sup> However, in other Eastern Mediterranean countries, such as Djibouti, Iraq, Pakistan, Sudan and Yemen, smoking was observed with high levels of PM<sub>2.5</sub> detected in similar public

places (schools, hospitals, government offices and public buses).<sup>11</sup>

SHS is a pollutant that causes serious illnesses in adults and children.<sup>12</sup> There is no risk-free level of SHS exposure; even brief exposure can be detrimental to human health.<sup>13</sup> In the current study, the average PM<sub>2.5</sub> level detected in the recreational venue where smoking was observed (the waterpipe café), was 256 µg/m<sup>3</sup> over a period of 30 minutes. As such, visitors to this venue would be exposed to levels 10 times higher than the acceptable limits for a whole day (25 µg/m<sup>3</sup>), as defined by the WHO.<sup>12</sup> Similar findings of high average PM<sub>2.5</sub> levels were reported from recreational sites in Bahrain (200 µg/m<sup>3</sup>), Pakistan (200 µg/m<sup>3</sup>), Djibouti (250 µg/m<sup>3</sup>) and Sudan (2,000 µg/m<sup>3</sup>).<sup>11</sup> On the other hand, lower average PM<sub>2.5</sub> levels were reported from recreational venues in Yemen (30 µg/m<sup>3</sup>), Iran (50 µg/m<sup>3</sup>) and Iraq (70 µg/m<sup>3</sup>) than the average levels reported in the current study.<sup>11</sup>

Of all of the recreational venues included in the current study, the waterpipe café was the only place where smoking was observed and where high levels of PM<sub>2.5</sub> were recorded. Thus, in Muscat, such cafés appear to be the main source of exposure to SHS in indoor public places and are in clear violation of the 2010 local Municipal law against smoking in indoor public venues.

Public buses displayed the lowest proportion (67%) of signs prohibiting smoking compared to schools, health facilities and other public places. Throughout 2009 and 2013, the Oman National Tobacco Control Committee (NTCC) printed and freely distributed 'no smoking' sign stickers to selected government and private sector businesses to display in indoor public areas. Thus, public transport facilities might have a higher display rate of such signs if the NTCC worked closely with the national transport authorities.

To further facilitate and maintain good compliance with legislation designating smoke-free public places, there is a need for national health authorities to consistently raise awareness and inform the public about the dangers of SHS exposure. Policymakers should also consider extending the current ban on indoor smoking to include other public places, such as those accessible to children or mass-gatherings, such as open-door sport events. Fully enforcing existing smoke-free laws and policies with effective and deterrent penalties for violators may enhance the implementation of these laws in the Muscat governorate and beyond. Regular monitoring and evaluations of compliance to 100% smoke-free policies is paramount to the success of any national tobacco control programme.

The 2007 Global Youth Tobacco Survey reported that 29.8% of males and 25.2% of females aged between 13 and 15 years old in Oman were exposed to SHS outside of their homes.<sup>14</sup> As such, a further survey with a wider scope than the current study is warranted to gauge current levels of exposure to SHS and to further evaluate the recent municipal law banning smoking in indoor public areas in Muscat.

The current study had several limitations. First, the venue selection was arbitrary and did not follow a random sample selection from a sampling frame. This may have led to an underestimation of SHS levels. Second, the administrations of the government, health and educational venues were informed of the date of the monitoring visit. This may have biased results and also led to an underestimation of SHS levels at these venues. However, this study also measured public smoking behaviours and these individuals visited the selected facilities at random. Thus, the authors believe that this bias would have been minimal, if it occurred at all. Third, the PM<sub>2.5</sub> measurements in this study were not specific to tobacco smoke but also included pollutants from other sources, such as cooking, vehicles and other ambient/background sources. However, this bias was minimised by avoiding measurements where such pollutants co-existed and by measuring ambient outdoor PM<sub>2.5</sub> levels.

## Conclusion

All indoor public places assessed in this study appeared to adhere to the municipal smoking ban in Muscat, with the exception of a café serving waterpipes for smoking in indoor areas. The enforcement of smoke-free policies in recreational venues in Oman needs to be urgently re-examined in order to protect the health of the visitors and workers in such venues. Efforts are needed to ensure that waterpipe cafés comply with the municipal smoke-free indoor law of 2010. Enforcing this law will fulfil one of Oman's main obligations towards Article 8 of the FCTC.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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