

# Exposure to second-hand smoke in selected public places in the WHO Eastern Mediterranean Region

Report of a pilot study

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## Writers

Lisa Hepp, Johns Hopkins University Bloomberg School of Public Health, Baltimore, United States of America

Farrukh Qureshi, WHO Regional Office for the Eastern Mediterranean, Cairo, Egypt

Fatimah El-Awa, WHO Regional Office for the Eastern Mediterranean, Cairo, Egypt

## Data analysis

Mark Travers, Roswell Park Cancer Institute, Buffalo, United States of America

## Reviewers

Steve Tamplin, Johns Hopkins University Bloomberg School of Public Health

Mustapha Kamal, Egyptian Smoking Prevention Institute

## Contributors

Ejlal Faisal Al Alawi (Bahrain)

Samira Ali Hugo (Djibouti)

Sahar Latif Labib (Egypt)

Abbass Jabbar Sahib (Iraq)

Behzad Valizadeh (Islamic Republic of Iran)

Malek Habashneh (Jordan)

Georges Saade (Lebanon)

Jawad Al Lawati (Oman)

Azhar Hussain (Pakistan)

Rudwan Yahya Ibrahim (Sudan)

Mohammad Al Khawlani (Yemen)

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# Executive summary

Countries of the WHO Eastern Mediterranean Region have taken steps towards implementing smoke-free policies in enclosed public places. Almost half the countries have nearly comprehensive smoke-free legislation and many others have exercised restrictions through ministerial decrees or executive notifications. Effective implementation of comprehensive smoke-free policy requires more than laws that prohibit smoking indoors. It also includes posting of “no smoking” signage, clear assignment of enforcement responsibility and periodic monitoring of public places to ensure compliance.

A number of countries have expressed interest in learning about best-practice techniques for monitoring second-hand smoke. This report describes the results of a pilot study conducted in 11 countries of the Region that documented the second-hand smoke levels in selected public places to assess compliance with smoke-free policies and legislation. Based on findings from participating countries, the report suggests steps that can help improve enforcement of 100% smoke-free policies.

Second-hand smoke is a dynamic and complex mixture of thousands of compounds in vapour and particulate phases and it is not possible to directly measure second-hand smoke in its entirety. The two most commonly used and preferred methods of measuring second-hand smoke exposure are nicotine and fine particle (PM<sub>2.5</sub>) sampling. PM<sub>2.5</sub> is a close approximation of the respirable fraction of particles, or those that are breathed deep into the lungs, and this size fraction will include virtually all tobacco smoke particles suspended in air. The WHO Regional Office for the Eastern Mediterranean collaborated with the Johns Hopkins Bloomberg School of Public Health’s Institute for Global Tobacco Control to provide training and equipment to measure second-hand smoke particles in selected public places in 11 countries of the Region: Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Oman, Pakistan, Sudan and Yemen.

The specific objectives of the initiative were to: introduce PM<sub>2.5</sub> second-hand smoke measuring equipment as a tool to monitor compliance to smoke-free policies; undertake a pilot assessment of second-hand smoke levels from a cross-section of public places in the capitals of participating countries; and use the evidence to enhance support for 100% smoke-free policy implementation in the Region.

The types of venue sampled included health facilities, educational facilities, indoor offices, recreational venues (including restaurants and other entertainment venues) and public transport vehicles. Although this pilot study involved convenience-based

sampling, the selection of venues was based on specific criteria. Countries were strongly encouraged to sample at least 3 locations for each venue type.

The SidePak AM510 (TSI Inc, United States of America) personal aerosol monitor was used to measure PM<sub>2.5</sub> concentrations, for a minimum of 30 minutes in each site within a venue. In addition, observational data were collected related to presence of smoking, cigarette butts, no-smoking signage, presence of designated smoking areas, and tobacco advertising and sales.

A total of 244 venues across 11 participating countries were sampled and observed in this study. Active smoking was observed in 98 venues. Recreational venues had the highest percentage of observed smoking, followed by public transport. Smoking was also observed in nearly a fourth of educational and health venues.

Across all countries, about one-third of health care facilities, educational facilities and indoor offices, one-half of public transport venues and two-thirds of recreational venues had evidence of smoking. Higher PM<sub>2.5</sub> levels were measured in places with observed smoking compared to those with no smoking in nearly all 11 countries in this project. Across all venues, mean PM<sub>2.5</sub> concentrations were 6.2 times higher in places with observed smoking (129 µg/m<sup>3</sup>), compared to places with no observed smoking (21 µg/m<sup>3</sup>)

Health care facilities were most likely to have signage prohibiting smoking (59%), followed by indoor offices (53%), educational facilities (49%), recreational venues (27%) and public transport venues (20%). Tobacco advertising was rarely seen in any of the venues studied in this project. However, cigarettes were being sold in educational facilities in 4 countries and in recreational venues in 8 countries.

This was a pilot study that measured second-hand smoke in selected venues across a number of countries in the Region, although in limited numbers of settings. While a total of 244 venues were sampled in this study, the small sample size within each country or type of venue limits the ability to interpret and generalize results. However, the results still provide useful insights into the status of compliance with smoke-free policies and legislation.

To overcome existing barriers to making all public venues 100% smoke-free, WHO recommends that countries of the Region should:

- Completely ban smoking in all indoor public places.
- Use clear and non-debatable language in legislation
- Strengthen implementation by adopting innovative enforcement mechanisms
- Develop and implement regular monitoring and evaluation mechanisms as an integral part of the ban on smoking in public places.

# Introduction

Scientific evidence has unequivocally established second-hand smoke as a major health hazard that equally affects all populations and at all ages. Second-hand smoke is a combination of smoke from the burning end of a cigarette (or from other tobacco products being burned) and smoke exhaled by the smoker. Second-hand smoke is considered to be three to four times more toxic than the inhaled smoke.

Tobacco control is becoming a political and legislative reality in the WHO Eastern Mediterranean Region. Eighteen countries of the Region have become Parties to the WHO Framework Convention on Tobacco Control (FCTC). Countries of the Region have taken measures to update and adopt legislation to fulfil their WHO FCTC obligations and meet international best practice standards. Implementing effective smoke-free policies has been a major area of focus during the past few years. However, effectively enforcing the provisions of national legislation remains a challenge.

Almost all countries of the Region have taken steps to move towards smoke-free policies in enclosed public places. Almost half the countries have nearly comprehensive smoke-free legislation and many others have exercised restrictions through ministerial decrees or executive notifications.

Effective implementation of comprehensive smoke-free policy requires more than laws that prohibit smoking indoors. It also requires: laws that provide for proper posting of “no smoking” signage, clear assignment of enforcement responsibility to the individuals holding managing public places and offices, and periodic monitoring of public places to ensure compliance. Monitoring compliance with smoke-free policies can be done in a number of ways, including through the establishment of compliance check teams, observational assessments and measurement of second-hand smoke in the air.

This report describes the results of a pilot monitoring study conducted in 11 countries of the Region that documented the second-hand smoke levels in selected public places to assess compliance with smoke-free policies and legislation. The report provides a snapshot of second-hand smoke levels in selected public places. Based on findings from participating countries, WHO suggests steps that can help improve enforcement of 100% smoke-free policies.



## The WHO FCTC and smoke-free policies

Article 8 of the FCTC addresses the issue of protecting people from the dangers of second-hand smoke. It states:

Parties recognize that scientific evidence has unequivocally established that exposure to tobacco smoke causes death, disease and disability. (FCTC Article 8.1)

Each Party shall adopt and implement in areas of existing national jurisdiction as determined by national law and actively promote at other jurisdictional levels the adoption and implementation of effective legislative, executive, administrative and/or other measures, providing for protection from exposure to tobacco smoke in indoor workplaces, public transport, indoor public places and, as appropriate, other public places. (FCTC Article 8.2)

The Parties to the FCTC have unanimously adopted implementation guidelines for countries to follow in meeting their FCTC obligations under Article 8. Among other things, these guidelines state the following.

Effective measures to provide protection from exposure to tobacco smoke, as envisioned by Article 8 of the WHO Framework Convention, require the total elimination of smoking and tobacco smoke in a particular space or environment in order to create a 100% smoke-free laws environment.

Approaches other than 100% smoke-free laws environments, including ventilation, air filtration, and the use of designated smoking areas ... have been repeatedly shown to be ineffective and there is conclusive evidence, scientific and otherwise, that engineering approaches do not protect against exposure to tobacco smoke.<sup>1</sup>

The guidelines state that all people should be protected from exposure to tobacco smoke; all indoor workplaces and indoor public places should be smoke-free; and that clear and enforceable legislation is necessary to protect people from exposure to tobacco smoke.

## Health effects of second-hand smoke

Exposure to second-hand smoke is a significant public health problem. For non-smokers, breathing second-hand smoke has immediate harmful effects on the cardiovascular system that can increase the risk for heart attack. Non-smokers who are exposed to second-hand smoke at home or work increase their heart disease risk by 25%–30% and their lung cancer risk by 20%–30%. In children, exposure to second-hand

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<sup>1</sup> WHO *Framework Convention on Tobacco Control: guidelines for implementation*. Geneva, World Health Organization, 2011

smoke causes ear infections; more frequent and severe asthma attacks; respiratory symptoms and infections; and a greater risk for sudden infant death syndrome.<sup>2</sup>

Exposure to second-hand smoke is significantly impacting the lives of people throughout the Eastern Mediterranean Region. A recent retrospective review of the burden of disease from exposure to second-hand smoke shows the following.<sup>3</sup>

- An estimated 33%–38% of children, 25%–35% of women, and 21%–24% of men are exposed to second-hand smoke among various groups of countries in the Region (those classified by WHO as “B” and “D” according to mortality levels).<sup>4</sup>
- In 2004, second-hand smoke was responsible for an estimated 64 100 deaths in the Region; almost half of these occurred in children due to respiratory infections.
- Second-hand smoke exposure was responsible for the loss of 1 609 000 disability adjusted life-years (DALYs); two-thirds of the lost DALYs were among children.
- Overall, more women die compared to men due to effects of second-hand smoke; whereas children become ill two times more than adults due to second-hand smoke exposure.

Egypt was the first country in the Region to complete a comprehensive primary survey on tobacco use, the 2009 Global Adult Tobacco Survey. Results of the survey indicate the following.<sup>5</sup>

- More than 70% of the Egyptian population are exposed to second-hand smoke in their homes.
- More than 60% of those who work indoors are exposed to second-hand smoke.
- About 80% of Egyptians using public transport are exposed to second-hand smoke.
- Almost 50% of Egyptians visiting health care facilities are exposed to second-hand smoke.

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<sup>2</sup> *The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General*. Atlanta, Centers for Disease Control and Prevention, 2006.

<sup>3</sup> Oberg M et al. Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. *The Lancet*, 2011, 377:139–46.

<sup>4</sup> *The World health report 2002* defined “B” as low child mortality and low adult mortality (Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia and the United Arab Emirates); “D” refers to high child mortality and high adult mortality (Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan and Yemen).

<sup>5</sup> Global Adult Tobacco Survey. Methodology. [http://www.emro.who.int/tfi/GATS\\_2009/Methodology3 .htm](http://www.emro.who.int/tfi/GATS_2009/Methodology3.htm), accessed 11 April 2011.

- More than 70% of those who visit shopping malls, restaurants, public offices and non-government buildings are exposed to second-hand smoke.

These results call for initiating immediate steps to ensure effective and strict implementation of smoke-free policies in all countries to reduce second-hand smoke-related morbidity and mortality among the people of the Region.

## **Status of smoke-free legislation in the Region**

Countries of the Region can be divided into five categories in relation to smoke-free public places legislation.

1. Countries with 100% smoke-free public places covering all indoor public places
2. Countries with mostly 100% smoke-free public places, but with exceptions for some indoor public places (usually restaurants and cafes)
3. Countries with some 100% smoke-free public places and a partial ban for other places where designated smoking areas are allowed
4. Countries with a partial ban on smoking in all public places
5. Countries with no ban at all on smoking in public places

During the past five years, most countries of the Region adopted national laws or regulations that regulate smoking in public places. According to the most recent information, a number of countries have taken steps to improve their smoke-free laws to reflect a 100% smoke-free policy. However, not all indoor facilities are covered in many countries.

Table 1 shows the status of smoke-free policies in the Region. Some of the salient features are as follows.

- The Islamic Republic of Iran and Pakistan are among the countries that have completely banned tobacco use in enclosed public places.
- Smoke-free laws in Djibouti and Egypt also conform to 100% smoke-free policies for the most part. However restaurants and other eating places are not covered.
- The public health law in Jordan has mandated stronger smoke-free rules since 2008. However, designated smoking areas are allowed with official approval after considering health and safety concerns.
- Since 2009, the Syrian Arab Republic has prohibited smoking in all public places with the exception of government buildings, airports and waiting lounges and restaurants, where designated smoking areas are allowed.

**Table 1. Various venue types covered by 100% smoke-free policies in countries**

Country	Health care facilities	Educational facilities	Government facilities	Indoor offices	Restaurants	Bars	Public transport
Afghanistan	Yes	Yes	No	No	No	No	Yes
Djibouti	Yes	Yes	Yes	Yes	No	No	Yes
Egypt	Yes	Yes	Yes	Yes	No	No	Yes
Islamic Republic of Iran	Yes	Yes	Yes	Yes	Yes	—	Yes
Jordan	Yes	Yes	Yes	No	No	No	Yes
Lebanon	Yes	Yes	Yes	Yes	No	No	Yes
Libya	Yes	Yes	Yes	Yes	Yes	—	Yes
Morocco	Yes	Yes	Yes	Yes	No	No	No
Pakistan	Yes	Yes	Yes	Yes	Yes	—	Yes
Saudi Arabia	Yes	Yes	Yes	No	No	—	No
Syrian Arab Republic	Yes	Yes	No	No	Yes	Yes	Yes
United Arab Emirates	Yes	Yes	No	No	No	No	No
Occupied Palestinian territory	Yes	Yes	Yes	No	Yes	No	Yes
Bahrain	No	No	No	No	No	No	No
Iraq	No	No	No	No	No	No	No
Kuwait	No	No	No	No	No	—	No
Oman	No	No	No	No	No	No	No
Qatar	No	No	No	No	No	No	No
Somalia	No	No	Yes	Yes	No	No	No
Sudan	No	No	No	No	No	—	No
Tunisia	No	No	No	No	No	No	No
Yemen	No	No	No	No	No	No	No

Source: WHO report on global tobacco epidemic, 2011. *Warning about the dangers of tobacco*. Geneva, World Health Organization, 2011.

— Information not available

- Bahrain, Oman, Saudi Arabia and the United Arab Emirates have implemented restrictions on tobacco use in enclosed places through ministerial decrees. However, designated smoking areas are allowed.
- Since 2011, Lebanon has banned smoking indoors. However recreational venues are exempted until August 2012.
- Throughout the Region, hospitals and other health care facilities are the most widely designated 100% smoke-free public places. At the same time, restaurants and other eating places are 100% smoke-free in only 3 countries of the Region.

Although a number of countries do not have 100% smoke-free laws, in general, all of the participating countries are making some attempt to reduce exposure through regulations or official decrees.

Irrespective of level of regulation, many countries are faced with issues of non-compliance. Levels of compliance vary among the countries. For instance, among the countries that agreed to participate in this pilot study, a review by WHO of compliance suggests that Bahrain, Islamic Republic of Iran, Jordan and Oman have good levels of compliance. However, reports from other participating countries indicate low compliance levels in relation to smoke-free implementation (Table 2).

**Table 2. Status of smoke-free legislation and compliance in participating countries**

Country	Venues with comprehensive bans on indoor smoking (100% smoke-free)	Venues with restricted smoke-free regulations (but not 100% smoke-free)	Levels of reported compliance (1=minimal, 10=complete)	Year when compliance reported
Bahrain	None	Health care facilities; educational facilities; universities; public offices; public transport; restaurants; all other indoor public places	9	2008*
Djibouti	Health care facilities; educational facilities; universities; public offices; public transport	None	3	2008*
Egypt	Health care facilities; educational facilities; universities; public offices; public transport	None	2	2010**
Iran, Islamic Republic of	Health care facilities; educational facilities; universities; public offices; public transport; restaurants; all other indoor public places	–	8	2010**
Iraq	None	None	1	2008*
Jordan	Health care facilities; educational facilities; universities; public transport; public places	Public offices; restaurants; all other indoor public places	7	2010**
Lebanon	Health care facilities; public offices; educational facilities; universities; public transport; public places	Restaurants	2	2010**
Oman	None	Health care facilities; educational facilities; universities; public offices; public transport; restaurants; all other indoor public places	8	2008*
Pakistan	Health care facilities; educational facilities; universities; public offices; public transport; restaurants; all other indoor public places	–	1	2010**
Sudan	None	Educational facilities; universities	2	2008*
Yemen	None	None	1	2008*

\* WHO report on the global tobacco epidemic, 2009. *Implementing smoke-free environments*, Geneva, World Health Organization

\*\*WHO report on the global tobacco epidemic, 2011. *Warning about the dangers of tobacco*. Geneva, World Health Organization

–Information not available

## **Measuring levels of second-hand smoke to monitor compliance**

It is in this context that a number of countries expressed interest in learning about best-practice second-hand smoke monitoring techniques and developing associated evidence-based approaches to smoke-free policy development and implementation, particularly in urban settings.

In response to this interest, the WHO Regional Office for the Eastern Mediterranean collaborated with the Johns Hopkins Bloomberg School of Public Health's Institute for Global Tobacco Control to provide training and equipment to measure second-hand smoke particles in selected public places in 11 countries: Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Oman, Pakistan, Sudan and Yemen.

Second-hand smoke exposure data were collected during the period July 2010–June 2011. This report presents an analysis of these data and an assessment of the nature and extent of exposure to second-hand smoke in public places in the participating countries with the overall aim of enhancing national efforts to reduce exposure and protect public health.

# Objectives and methodology

The overall aim of this initiative was to build capacity and enhance national efforts to monitor exposure to second-hand smoke and protect public health. In this context, the specific objectives of the initiative were to:

- introduce PM<sub>2.5</sub> second-hand smoke measuring equipment as a tool to monitor compliance to smoke-free policies;
- undertake a pilot assessment of second-hand smoke levels from a cross section of public places in the capitals of participating countries; and
- use the evidence to enhance support for 100% smoke-free policy implementation in the Region.

For the assessment, the WHO Regional Office for the Eastern Mediterranean contacted national focal points for tobacco control in countries of the Region, seeking their participation in a regional second-hand smoke monitoring project. After consultation, 11 countries agreed to participate: Bahrain, Djibouti, Egypt, Islamic Republic of Iran, Iraq, Jordan, Lebanon, Oman, Pakistan, Sudan and Yemen.

In general, a good marker of second-hand smoke exposure should be easily and accurately measured at an affordable cost, providing a valid assessment of second-hand smoke exposure as a whole. However, second-hand smoke is a dynamic and complex mixture of thousands of compounds in vapor and particulate phases and it is not possible to measure second-hand smoke in its entirety. The two most commonly used and preferred methods of measuring second-hand smoke exposure are nicotine and fine particle (PM<sub>2.5</sub>)<sup>6</sup> sampling. These methods are correlated with each other and with other second-hand smoke constituents.

Active PM<sub>2.5</sub> sampling, though less specific than nicotine, has several advantages for sampling fine particulate matter.

- Data can be collected quickly, discreetly and cost-effectively with a portable battery operated machine.
- Measurements are taken continuously and stored in memory so that changes in particle levels, including peak levels, can be readily observed.
- The machine is highly sensitive to tobacco smoke, being able to instantly detect particle levels as low as 1 microgram per cubic metre.

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<sup>6</sup> PM<sub>2.5</sub> refers to particulate matter with a mean diameter of less than 2.5 microns. These are the small particles that generally pass through the body's airway defences and reach the lungs.

- PM<sub>2.5</sub> has known direct health effects in terms of morbidity and mortality and there are existing health standards for PM<sub>2.5</sub> in outdoor air (e.g. WHO and the United States Environmental Protection Agency) that can be used to communicate the relative harm of PM<sub>2.5</sub> levels in places with smoking.

The SidePak AM510 (TSI Inc, United States of America) personal aerosol monitor was used to measure PM<sub>2.5</sub> concentrations. The SidePak is a portable, battery-operated device using a built-in sampling pump drawing air inside the device where the particulate matter in the air scatters the light from a laser. The mass concentration of particles is then calculated based on the amount of light scattered. SidePaks were equipped with 2.5 micron impactors to measure particles with an aerodynamic diameter of 2.5 microns or less, or PM<sub>2.5</sub>. PM<sub>2.5</sub> is a close approximation of the respirable fraction of particles, or those that are breathed deep into the lungs. This size fraction will include virtually all tobacco smoke particles which have a mass-median aerodynamic diameter of 0.2 microns. The SidePak records the PM<sub>2.5</sub> concentration continuously and the average level every minute is stored in the memory. The recorded measurements were then downloaded to a computer for analysis.

The types of venues sampled included health facilities, educational facilities, indoor offices, recreational venues (including restaurants, bars and other entertainment venues) and public transportation vehicles. Countries were strongly encouraged to use the recommended sample sizes for each location type as shown in Table 3.

Although the countries were encouraged to use convenience-based sampling for this pilot, the selection of venues was based on specific criteria. The criteria are provided in Box 1.

**Table 3. Venue types and sample sizes**

Venue type	Recommended sample size (minimum number of venues per country)
Health	3
Educational	3
Public office*	3
Recreational**	6
Public transport	3

\* Including government buildings, banks, etc.

\*\*Including hospitality venues such as restaurants, bars and other entertainment venues.



### **Box 1. Minimum criteria for selection of venues for monitoring by PM<sub>2.5</sub> surveys**

- The sites for this selected assessment were priority areas in the capital of the country as these sites would be expected to have the most potential for compliance.
- The selection of sites does is not necessarily representative of the entire country, but rather reflects average practice in relation to public exposure to PM<sub>2.5</sub> and compliance with smoke-free policies.
- The priority areas targeted were indoor offices with public access, health care facilities, educational facilities, recreational venues and public transport vehicles (trains and buses).
- The minimum number of selected sites for each venue type was 3.
- Assessment time targeted the regular working hours and public access to reflect average exposure time.
- The minimum time period to record observations for every facility was to be 30 minutes. A continuous track measurement was to be performed at various places within the facility, allowing appropriate exposure time (e.g. 10 minutes at each of 3 places within the facility). Part of the sampling protocol was to measure “outside” before going “inside.”

#### **Public offices**

Any office with public access for services (e.g. court rooms and halls, municipality buildings, post offices, banks etc.). No limits were placed on number of visitors or size of the building.

#### **Health venues**

The targeted facilities were either government or public health care centres and the selected sites were to have a minimum of either a 50-bed capacity for hospitals or 50 outpatients per day

#### **Educational venues**

Universities or high schools with student gathering areas (indoor cafeterias, halls or student services). Time to record observations was to be during regular school hours.

#### **Public transport venues: buses or trains**

Any train or bus service with a passenger capacity of 15 or more. Time to record observations was to be during busy working hours (e.g. the afternoon rush hour).

#### **Recreational venues: restaurants, bars and other entertainment venues**

Any restaurant or entertainment place with indoor facility with a minimum capacity of 15 visitors. Time to record observations was during regular business hours (e.g. lunch or dinner time) for average assessment of smoking exposure.

**Table 4. Observational questions answered for each venue**

Category	Questions
No-smoking signage	Any "no-smoking" signs visible from the outside? Any "no-smoking" signs on doors? Any "no-smoking" signs visible inside? Any signs with warnings of fines or penalty?
Designated smoking and non-smoking areas	Is there a non-smoking (restricted section) and smoking section? Any ashtrays in restricted (non-smoking) area? Any smoking visible in restricted (non-smoking) area?
Tobacco advertising and sales	Any cigarette vendors or vending machines? Any tobacco advertising? For restaurants, entertainment venues and cafes, any cigarettes on the menu?

Observational measurements were also made in each room visited in a venue at the time of data collection. Along with the times of entry and exit, the number of people inside the room and the number of burning cigarettes (or other burning tobacco products) were recorded every 15 minutes during sampling. These observations were averaged over the time inside the room to determine the average number of people on the premises and the average number of burning cigarettes. Room dimensions were also estimated and the room volume was calculated. The active smoker density was calculated by dividing the average number of burning cigarettes by the volume of the room in metres. Additional observational data were collected related to no-smoking signage, presence of designated smoking area, and tobacco advertising and sales (Table 4). Observational data collection and PM<sub>2.5</sub> sampling were carried out for a minimum of 30 minutes in each site within a venue type. Sampling was discreet in order not to disturb the occupants' normal behaviour. Observational data were then analysed in conjunction with the PM<sub>2.5</sub> recorded data.

In-person training along with video conferencing review sessions were conducted by WHO and the Johns Hopkins Bloomberg School of Public Health's Institute for Global Tobacco Control with data collectors in participating countries to instruct them on how to operate the monitoring instrument and how to collect data properly. When needed, follow-up training was conducted in the same manner. Second-hand smoke measurements were collected from July 2010 to June 2011. Each country was provided with a SidePak for use during data collection. Countries also received field guides and observational data collection sheets specific to their national language.

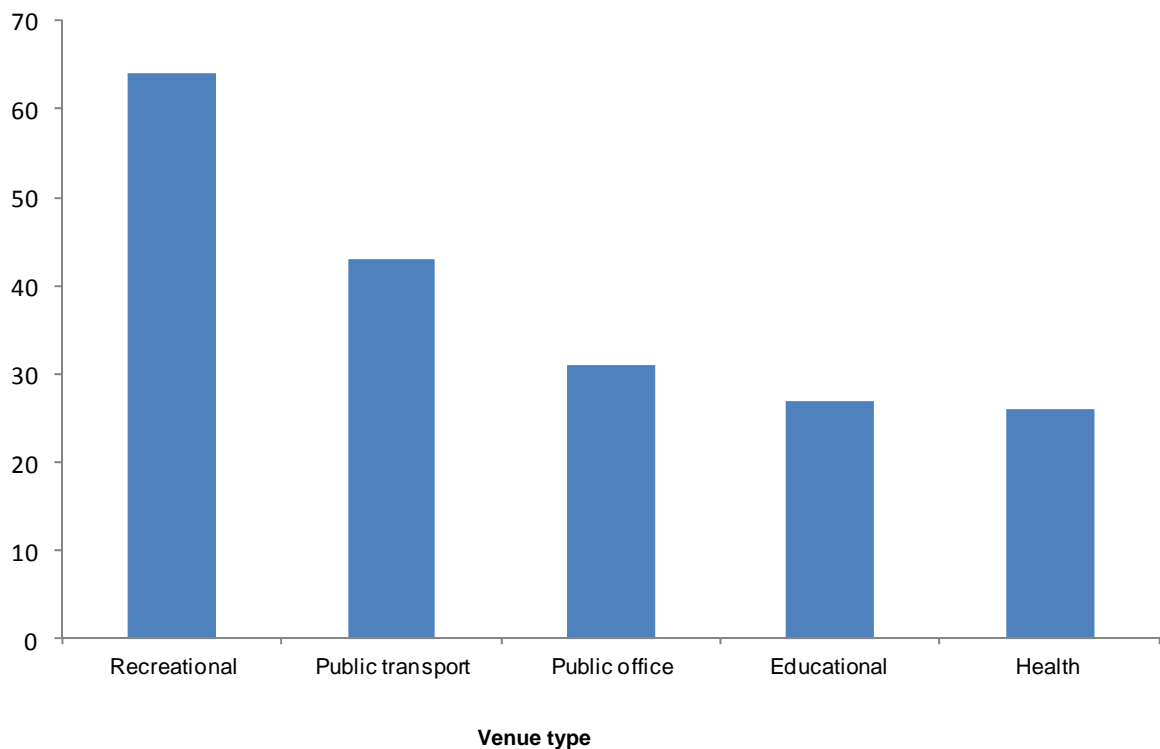
A calibration factor of 0.32, suitable for second-hand smoke, was applied to all data from the SidePak. For each venue, the first and last minute of logged data were removed because they are averaged with outdoors and entryway air. The remaining data points were averaged to provide an average PM<sub>2.5</sub> concentration within the venue. Descriptive data including mean, median, minimum and maximum PM<sub>2.5</sub> levels, mean room volume, mean number of burning cigarettes and mean active smoker densities were determined for each venue in each country. Non-parametric statistical testing was conducted using SPSS.

# Results

## Overview

The figures and tables below summarize the results of the PM<sub>2.5</sub> monitoring in the participating countries.

A total of 244 venues across 11 participating countries were sampled and observed in this study. Active smoking was observed in 98 venues. Recreational venues had the highest percentage of observed smoking, followed by public transport venues. Smoking was also observed in nearly a fourth of educational and health care venues. Figure 1 shows the relative frequency of observed smoking by venue type.



**Figure 1. Frequency of observed smoking by venue type (all participating countries combined)**

## PM<sub>2.5</sub> concentration in smoking and non-smoking venues

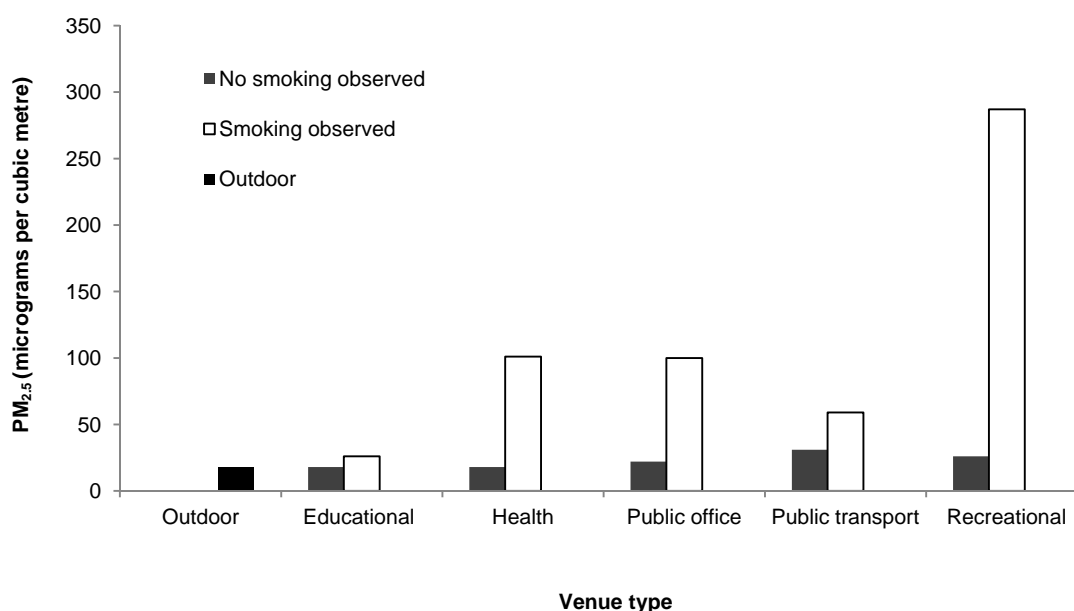
Higher PM<sub>2.5</sub> levels were measured in places with observed smoking compared to those with no observed smoking in nearly all 11 countries studied. Overall, across all 244 venues sampled in the 11 countries, mean PM<sub>2.5</sub> concentrations were 6.2 times higher in places with observed smoking (129 µg/m<sup>3</sup>) compared to places with no observed smoking (21 µg/m<sup>3</sup>). PM<sub>2.5</sub> levels in general showed a log-normal distribution so geometric mean levels were examined as well. Geometric mean PM<sub>2.5</sub> concentrations were 3.9 times higher in places with observed smoking (55 µg/m<sup>3</sup>) compared to places with no observed smoking (14 µg/m<sup>3</sup>); (Table 5).

Figure 2 shows PM<sub>2.5</sub> concentrations in all indoor places where smoking was observed, broken down by type of venue across all countries.

**Table 5. Indoor particulate air pollution by observed smoking or evidence of smoking across all countries**

		PM <sub>2.5</sub> concentration (µg/m <sup>3</sup> )		
		Sample size	Mean	Geometric mean
Smoking observed during sampling	No	147	21	14
	Yes	97	129	55
* Evidence of smoking during sampling	No	129	18	13
	Yes	115	115	50

\* Observed burning tobacco products, cigarette butts or smell of tobacco smoke



**Figure 2. Mean PM<sub>2.5</sub> concentrations by venue type (all participating countries combined)**

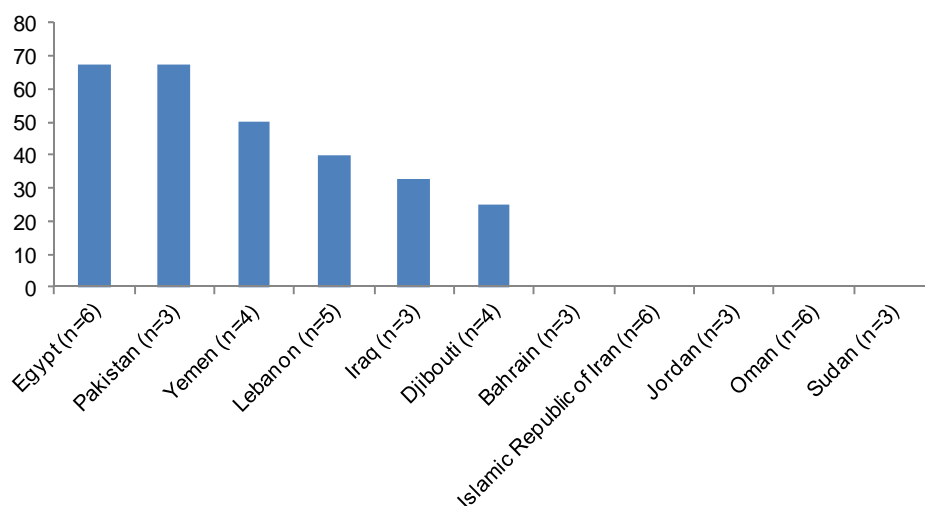
**Table 6. PM<sub>2.5</sub> levels in places with no observed smoking but with and without other evidence of smoking**

		PM <sub>2.5</sub> concentration ( $\mu\text{m}^3$ )		
		Sample size	Mean	Geometric mean
Cigarette butts or smell of tobacco smoke	Yes	18	37	30
	No	129	18	13
	Total	147	20	14

Among those places where, although no smoking was observed during sampling, there was other evidence of smoking (i.e. observed cigarette butts or the smell of tobacco smoke) PM<sub>2.5</sub> levels were approximately 2 times higher (Table 6).

## Observational findings

Figures 3a–e show the percentage of venues sampled within each venue and country where there was evidence of smoking (observed smoking, cigarette butts or smell of tobacco smoke). There is significant variability by country in the types of venue where at least some smoking was observed. For example, in Bahrain there was no observed smoking in any of the health care facilities, educational facilities, indoor offices or public transport venues visited, whereas in Djibouti, Iraq, Lebanon, and Yemen there was smoking observed in all of these venue types. There was smoking observed in the recreational venues in all 11 countries. Across all countries, about one-third of health care facilities, educational facilities and indoor offices, one-half of transportation venues and two-thirds of recreational venues had evidence of smoking.

**Figure 3a. Percentage of health venues with observed smoking**

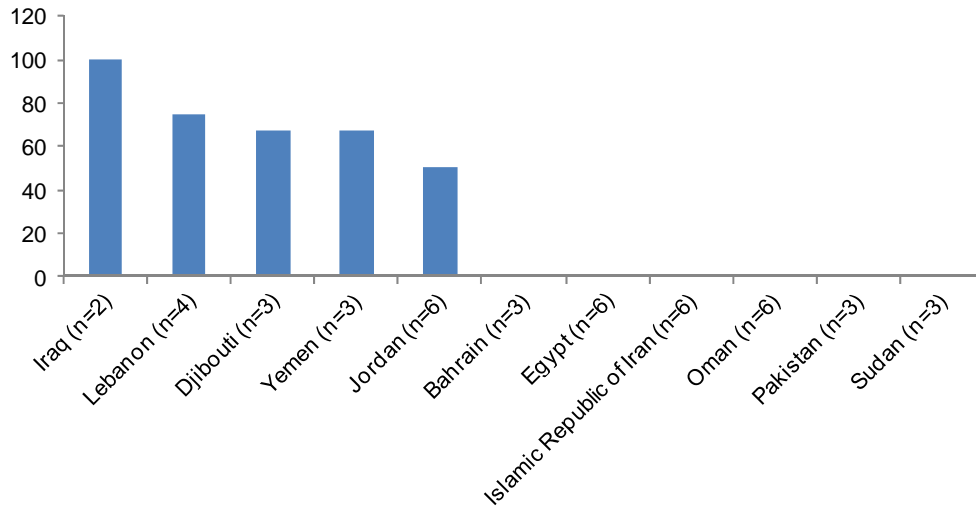


Figure 3b. Percentage of educational venues with observed smoking

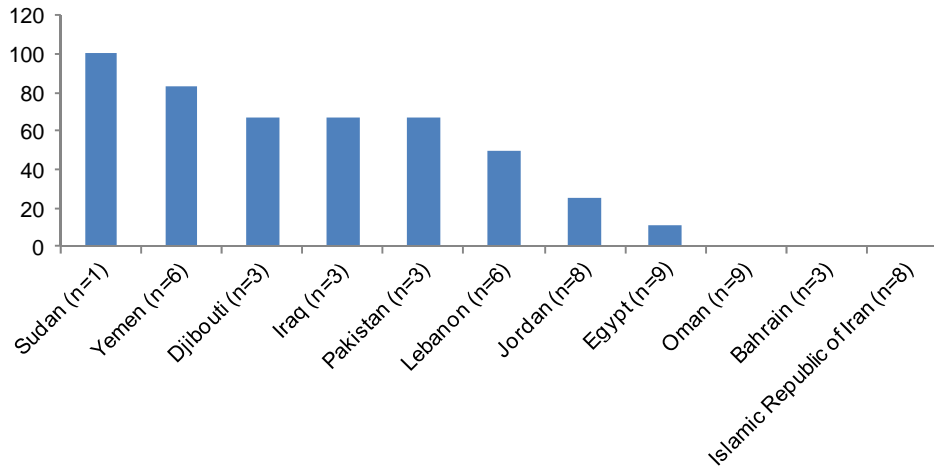


Figure 3c. Percentage of public offices with observed smoking

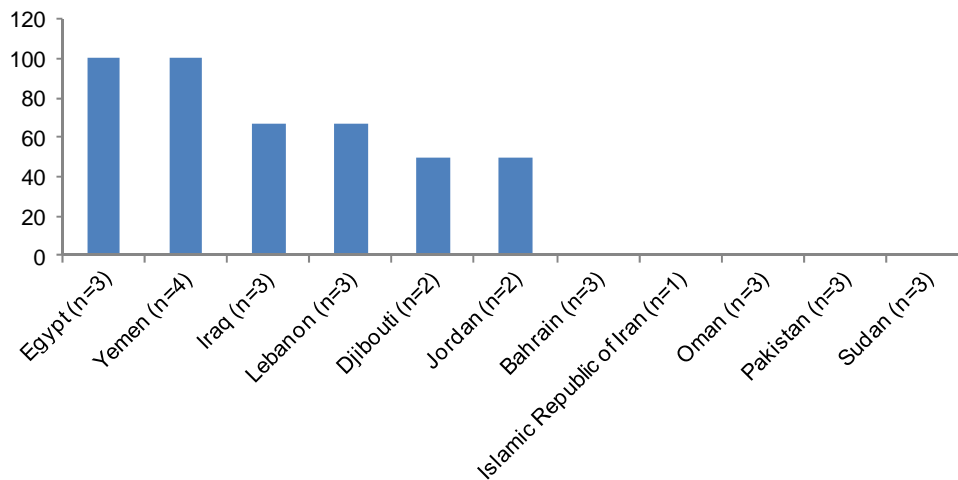
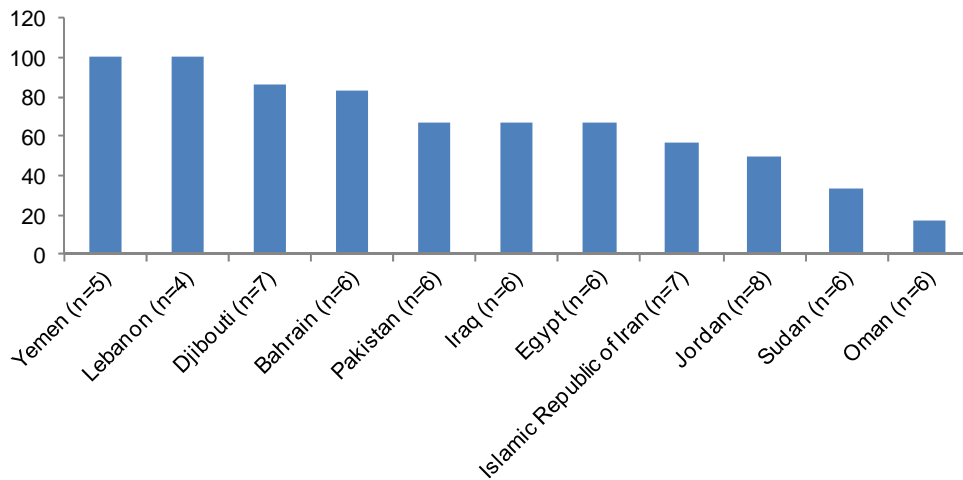
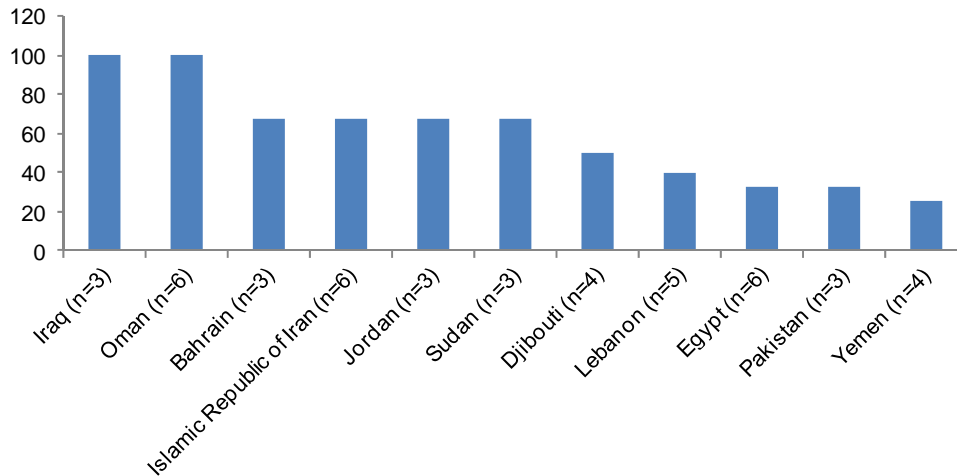


Figure 3d. Percentage of public transport vehicles with observed smoking



**Figure 3e. Percentage of recreational venues with observed smoking**

Similar to the observance of smoking, the presence of signs prohibiting smoking was also highly variable (Figures 4a–e). Health care facilities were most likely to have signage prohibiting smoking (59%), followed by public offices (53%), educational venues (49%), recreational venues (27%) and public transport venues (20%). Oman had the highest percentage of venues where no-smoking signs were observed (93%, 28 of 30).



**Figure 4a. Percentage of health venues with “no smoking” signs**

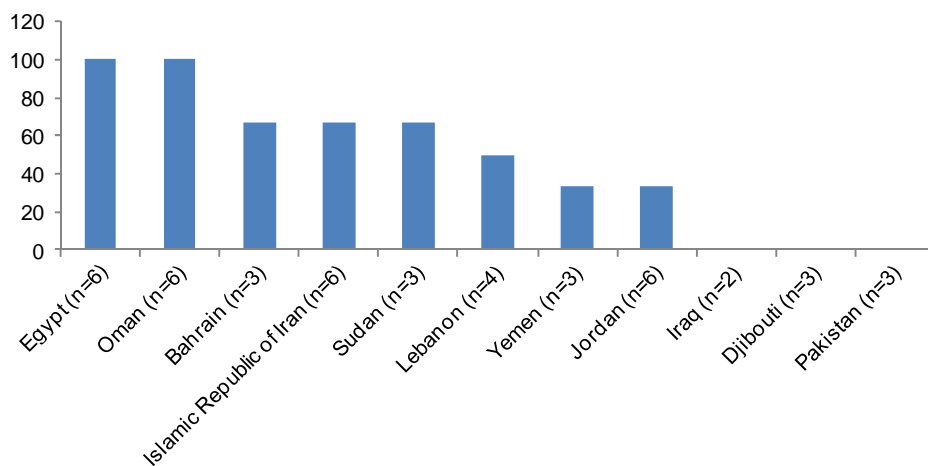


Figure 4b. Percentage of educational venues with “no smoking” signs

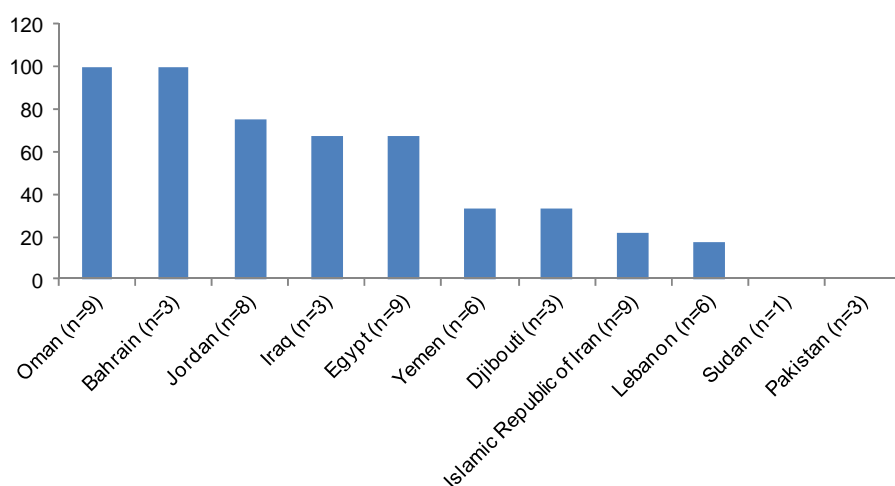


Figure 4c. Percentage of public offices with “no smoking” signs

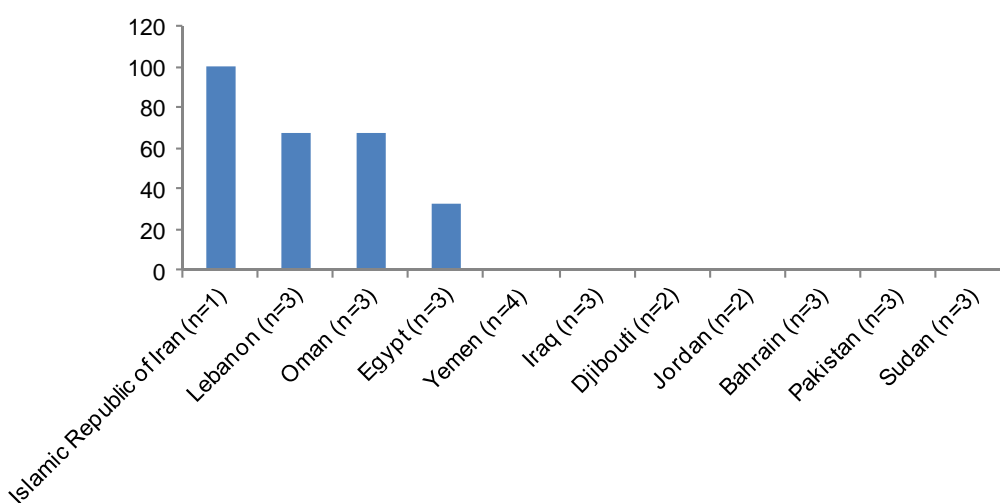
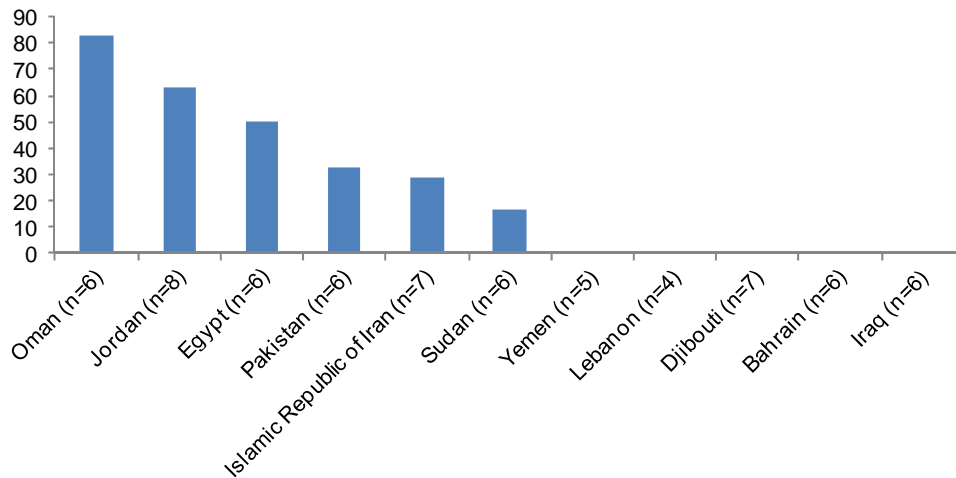


Figure 4d. Percentage of public transport vehicles with “no smoking” signs





**Figure 4e. Percentage of recreational venues with “no smoking” signs**

Tobacco advertising was rarely seen in any of the venues studied in this project. However, cigarettes were being sold in educational facilities in 4 countries and recreational venues in 8 countries.

Annexes 1–4 provide more detailed results on PM<sub>2.5</sub> levels and observational findings from participant countries. More detailed analyses of results and recommendations for each participating country are available separately in individual country fact sheets.

## Limitations

This was a pilot study that measured second-hand smoke in selected venues across a number of countries in the Region, in limited numbers of settings. While a total of 244 venues were sampled in this study, the small sample size within each country or type of venue limits the ability to generalize results. However, the results still provide useful insights into the status of compliance with smoke-free legislation. Overall, the objectives were to introduce PM<sub>2.5</sub> sampling as a tool to assess second-hand smoke exposure and compliance with smoke-free policies; make a pilot assessment of exposure to second-hand smoke from a cross section of public places; and generate evidence to enhance 100% smoke-free policy implementation. All of the objectives were achieved with this exercise.

Potential factors affecting the comparability of data across countries include:

- The diversity of geographical settings;
- The collection of data in different months across countries;
- Difficulty in assessing various aspects of building structures such as openness to the outside and ventilation; and
- Local environmental anomalies such as vehicle traffic density, juxtaposition of industry, and fires and sandstorms.

To mitigate the effects of the environmental anomalies, the data collectors were instructed to record observations outside the sample venue for 10 minutes before proceeding indoors.

While there may have been some inherent bias due to venues being selected on a convenience basis, this effect was minimized by developing the minimum criteria for venue selection (see Box 1).

The data collectors were newly trained on the use of the PM<sub>2.5</sub> monitors and the observational data collection protocols. To compensate for this relative lack of experience, support was provided to country teams through teleconferences, video conferences and repeated on-site training.

## Conclusions

The findings of this study show that locations in the Region with indoor smoking have dramatically higher levels of particulate air pollution than places without smoking.

Locations with smoking were much more likely to have PM<sub>2.5</sub> levels exceeding WHO's target air quality guidelines. This shows a need for comprehensive smoke-free air policies in countries across the Region.

Non-compliance with existing smoke-free policies is a challenge in some countries and venue types, highlighting the need for improved enforcement measures. For example, contrary to existing national comprehensive smoke-free policies, indoor smoking was routinely observed in recreational venues in Bahrain, Islamic Republic of Iran and Pakistan.

In light of the health consequences of exposure to second-hand smoke, it is prudent to eliminate indoor smoking which is a major source of PM<sub>2.5</sub> particulate pollution.

Smoke-free policies consistent with FCTC Article 8 have proven to be an effective means of dramatically reducing exposure to second-hand smoke when properly implemented and enforced. In addition, these policies serve to reduce smoking prevalence, increase quit attempts and decrease the social acceptability of smoking, all of which lead to improved health outcomes.

# The way forward

The results of this study show that although there is existing legislation that bans tobacco use in indoor public places in many countries, enforcement and compliance remain challenges. As well, very few countries include all public places in their ban on tobacco use. For example, except in a few countries, restaurants and cafes are usually excluded. In many countries, allowances are made for smoking areas or smoking sections in venues that are otherwise considered smoke-free. In some countries, this reflects a lack of public support for 100% smoke-free venues, particularly recreational venues. This lack of public support poses a challenge to decision-makers. Even in countries that totally ban smoking in all public places, enforcement and compliance are serious problems. These problems are further complicated by legislation in several countries that contains vague and inaccurate definitions and fails to delineate implementation and enforcement responsibilities. Furthermore, monitoring and evaluation are not always part of legislation regarding smoke-free public places.

To overcome existing barriers to making all public venues 100% smoke-free, WHO recommends that countries of the Region should, in the context of their unique legislative systems, undertake the following actions as a matter of urgency.

1. Completely ban smoking in all indoor public places.
2. Use clear and non-debatable language in legislation to avoid conflict during the implementation phase.
3. Strengthen implementation by adopting innovative enforcement mechanisms.
4. Provide regular training for those responsible for implementing the legislation.
5. Develop and implement evidence-based campaigns to raise public awareness of the dangers of second-hand smoke and the need for 100% smoke-free public places.
6. Ensure that prominent, clearly visible “no smoking” signs are posted in places where smoking is not allowed.
7. Strengthen the penalties for violating the provisions of national tobacco control legislation.
8. Develop and implement regular monitoring and evaluation mechanisms as an integral part of the ban on smoking in public places.
9. Integrate tobacco control-related knowledge in national educational curricula to ensure that the information is well transferred to all levels of society.
10. Ensure that the ban on smoking in public places is addressed within a comprehensive approach to tobacco control at national level that covers all other measures recommended by the FCTC and WHO.

# Annex 1. PM<sub>2.5</sub> concentrations of indoor places where smoking was observed, by venue type and country

Venue type	Country	Sample size	Mean no. burning cigarettes	Active smoker density*	PM <sub>2.5</sub> concentration (µg/m <sup>3</sup> )			
					Mean	Minimum	Median	Maximum
<b>Educational</b>	Bahrain	.	.	.	.	.	.	.
	Djibouti	2	0.8	1.92	21	14	21	27
	Egypt	.	.	.	.	.	.	.
	Islamic Republic of Iran	.	.	.	.	.	.	.
	Iraq	2	1.7	0.21	44	26	44	62
	Jordan	3	2.7	0.18	33	8	17	74
	Lebanon	3	0.8	0.24	33	19	38	43
	Oman	.	.	.	.	.	.	.
	Pakistan	.	.	.	.	.	.	.
	Sudan	.	.	.	.	.	.	.
	Yemen	2	1.3	2.60	15	11	15	19
<b>Health</b>	Bahrain	.	.	.	.	.	.	.
	Djibouti	1	1.3	0.37	24	24	24	24
	Egypt	4	0.3	0.36	56	27	61	75
	Islamic Republic of Iran	.	.	.	.	.	.	.
	Iraq	1	1.3	0.19	67	67	67	67
	Jordan	.	.	.	.	.	.	.
	Lebanon	2	1.7	0.74	259	48	259	469
	Oman	.	.	.	.	.	.	.
	Pakistan	2	1.5	0.69	149	111	149	187
	Sudan	.	.	.	.	.	.	.
	Yemen	2	2.7	1.15	16	8	16	24

\* Mean number of burning cigarettes per 100 cubic metres

Venue type	Country	Sample size	Mean no. burning cigarettes	Active smoker density*	PM <sub>2.5</sub> concentration (µg/m <sup>3</sup> )			
					Mean	Minimum	Median	Maximum
<b>Public office</b>	Bahrain	.	.	.	.	.	.	.
	Djibouti	2	1.7	0.17	34	24	34	43
	Egypt	1	2.0	0.05	77	77	77	77
	Islamic Republic of Iran	.	.	.	.	.	.	.
	Iraq	2	2.2	0.10	59	54	59	63
	Jordan	2	1.7	0.30	61	60	61	63
	Lebanon	3	2.0	1.70	68	57	61	85
	Oman	.	.	.	.	.	.	.
	Pakistan	2	1.5	1.88	368	364	368	371
	Sudan	1	0.7	0.93	61	61	61	61
	Yemen	5	9.8	8.42	28	21	22	39
	<b>Public transport</b>	Bahrain	.	.	.	.	.	.
Djibouti		1	0.7	NA	77	77	77	77
Egypt		3	1.9	1.34	129	93	37	165
Islamic Republic of Iran		.	.	.	.	.	.	.
Iraq		2	1.3	6.67	53	45	49	53
Jordan		1	1.0	2.08	42	42	42	42
Lebanon		2	0.7	3.47	31	23	31	40
Oman		.	.	.	.	.	.	.
Pakistan		.	.	.	.	.	.	.
Sudan		.	.	.	.	.	.	.
Yemen		4	3.5	NA	18	11	17	25
<b>Recreational</b>		Bahrain	5	16.5	1.14	211	60	147
	Djibouti	6	7.8	1.60	253	11	178	643
	Egypt	4	2.8	2.24	36	17	31	66
	Islamic Republic of Iran	4	4.6	4.33	51	20	31	123
	Iraq	4	2.8	1.02	73	47	70	105
	Jordan	4	3.0	0.38	29	19	25	48
	Lebanon	4	2.4	4.97	94	88	96	97
	Oman	1	22.7	2.05	256	256	256	256
	Pakistan	4	2.2	0.57	201	33	185	401
	Sudan	2	0.7	1.39	1947	543	1947	3351
	Yemen	5	4.7	4.94	31	22	24	61

\* Mean number of burning cigarettes per 100 cubic metres

## Annex 2. Percentage of buildings with evidence of smoking, by venue type and country

Type of venue	Country	Sample size	Staff smoking (%)	Smokers observed (%)	Butts found (%)	Tobacco smell detected (%)
<b>Educational</b>	Bahrain	3	0	0	0	0
	Djibouti	3	33	67	33	33
	Egypt	6	0	0	0	0
	Islamic Republic of Iran	6	0	0	0	0
	Iraq	2	100	100	100	100
	Jordan	6	50	50	50	67
	Lebanon	4	25	75	25	25
	Oman	6	0	0	0	0
	Pakistan	3	0	0	33	33
	Sudan	3	0	0	0	0
	Yemen	3	33	67	33	33
	<b>All countries</b>	<b>45</b>	<b>11</b>	<b>27</b>	<b>20</b>	<b>22</b>
	<b>Health</b>	Bahrain	3	0	0	0
Djibouti		4	0	25	50	25
Egypt		6	17	67	50	67
Islamic Republic of Iran		6	0	0	0	0
Iraq		3	33	33	0	33
Jordan		3	0	0	0	0
Lebanon		5	0	40	0	20
Oman		6	0	0	0	0
Pakistan		3	0	67	67	67
Sudan		3	0	0	0	0
Yemen		4	25	50	50	25
<b>All countries</b>		<b>46</b>	<b>7</b>	<b>26</b>	<b>20</b>	<b>22</b>

Type of venue	Country	Sample size	Staff smoking (%)	Smokers observed (%)	Butts found (%)	Tobacco smell detected (%)
<b>Public office</b>	Bahrain	3	0	0	0	0
	Djibouti	3	33	67	33	33
	Egypt	9	11	11	11	11
	Islamic Republic of Iran	9	0	0	0	0
	Iraq	3	33	67	67	33
	Jordan	8	38	25	25	63
	Lebanon	6	50	50	17	67
	Oman	9	0	0	0	0
	Pakistan	3	33	67	33	67
	Sudan	1	100	100	0	100
	Yemen	6	67	83	83	83
	<b>All countries</b>	<b>60</b>	<b>25</b>	<b>28</b>	<b>22</b>	<b>33</b>
	<b>Public transport</b>	Bahrain	3	0	0	0
Djibouti		2	50	50	0	0
Egypt		3	100	100	33	100
Islamic Republic of Iran		1	0	0	0	0
Iraq		3	33	67	33	67
Jordan		2	50	50	50	100
Lebanon		3	0	67	33	67
Oman		3	0	0	0	0
Pakistan		3	.	0	33	33
Sudan		3	0	0	0	0
Yemen		4	0	100	0	25
<b>All countries</b>		<b>30</b>	<b>20</b>	<b>43</b>	<b>17</b>	<b>37</b>
<b>Recreational</b>		Bahrain	6	0	83	0
	Djibouti	7	43	86	29	71
	Egypt	6	33	67	33	50
	Islamic Republic of Iran	7	43	57	14	57
	Iraq	6	17	67	50	67
	Jordan	8	38	50	0	38
	Lebanon	4	25	100	0	100
	Oman	6	0	17	0	33
	Pakistan	6	17	67	17	50
	Sudan	6	33	33	50	33
	Yemen	5	40	100	60	60
	<b>All countries</b>	<b>67</b>	<b>27</b>	<b>63</b>	<b>22</b>	<b>55</b>



## Annex 3. Percentage of buildings with signs prohibiting smoking, by venue type and country

Venue type	Country	Sample size	Signs prohibiting smoking (%)	"no smoking" signs visible outside (%)	"no smoking" signs on doors (%)	"no smoking" signs visible inside (%)	Warning signs of fines or penalty (%)
<b>Educational</b>	Bahrain	3	67	67	67	67	33
	Djibouti	3	0	0	0	0	0
	Egypt	6	100	100	100	100	0
	Islamic Republic of Iran	6	33	67	0	67	0
	Iraq	2	0	0	0	0	0
	Jordan	6	33	17	0	33	0
	Lebanon	4	25	0	0	50	0
	Oman	6	100	83	0	33	0
	Pakistan	3	0	0	0	0	0
	Sudan	3	67	33	33	67	0
	Yemen	3	33	33	33	33	0
	<b>Health</b>	Bahrain	3	67	33	0	67
Djibouti		4	50	25	50	50	0
Egypt		6	33	33	17	33	0
Islamic Republic of Iran		6	67	0	17	67	0
Iraq		3	100	33	67	100	0
Jordan		3	67	67	67	33	33
Lebanon		5	40	40	20	20	0
Oman		6	100	83	17	83	0
Pakistan		3	33	33	33	33	0
Sudan		3	67	0	0	67	0
Yemen		4	25	25	25	25	0

Venue type	Country	Sample size	Signs prohibiting smoking (%)	"no smoking" signs visible outside (%)	"no smoking" signs on doors (%)	"no smoking" signs visible inside (%)	Warning signs of fines or penalty (%)
<b>Public office</b>	Bahrain	3	100	100	67	67	0
	Djibouti	3	33	0	0	33	0
	Egypt	9	67	67	67	67	0
	Islamic Republic of Iran	9	22	0	0	33	0
	Iraq	3	67	33	33	67	0
	Jordan	8	75	63	13	75	50
	Lebanon	6	17	17	0	33	0
	Oman	9	100	100	33	56	0
	Pakistan	3	0	0	0	0	0
	Sudan	1	0	0	100	0	0
	Yemen	6	33	33	33	33	33
	<b>Public transport</b>	Bahrain	3	0	0	0	0
Djibouti		2	0	0	0	0	0
Egypt		3	33	0	0	33	0
Islamic Republic of Iran		1	100	0	100	100	0
Iraq		3	0	0	0	0	0
Jordan		2	0	0	0	0	0
Lebanon		3	67	33	33	67	0
Oman		3	67	0	33	67	0
Pakistan		3	0	0	0	0	0
Sudan		3	0	0	0	0	0
Yemen		4	0	0	0	0	0
<b>Recreational</b>		Bahrain	6	0	17	0	17
	Djibouti	7	0	0	0	0	0
	Egypt	6	50	50	50	50	0
	Islamic Republic of Iran	7	29	0	0	29	0
	Iraq	6	0	0	0	0	0
	Jordan	8	63	0	0	63	0
	Lebanon	4	0	0	0	0	0
	Oman	6	83	67	50	50	0
	Pakistan	6	33	50	0	33	0
	Sudan	6	17	0	17	17	0
	Yemen	5	0	0	0	0	0

## Annex 4. Percentage of buildings with tobacco advertising and sales, by venue type and country

Venue type	Country	Sample Size	Cigarette vendors or vending machines (%)	Tobacco advertising (%)	Cigarettes on menu*
<b>Educational</b>	Bahrain	3	0	0	.
	Djibouti	3	33	0	.
	Egypt	6	0	0	.
	Islamic Republic of	6	0	0	.
	Iran				
	Iraq	2	50	0	.
	Jordan	6	33	0	.
	Lebanon	4	0	0	.
	Oman	6	0	0	.
	Pakistan	3	0	0	.
	Sudan	3	67	0	.
	Yemen	3	0	0	.
	<b>Health</b>	Bahrain	3	0	0
Djibouti		4	25	0	.
Egypt		6	0	0	.
Islamic Republic of		6	0	0	.
Iran					
Iraq		3	0	0	.
Jordan		3	0	0	.
Lebanon		5	0	0	.
Oman		6	0	0	.
Pakistan		3	0	0	.
Sudan		3	0	0	.
Yemen		4	0	0	.
<b>Public office</b>		Bahrain	3	0	0

\*For restaurants, entertainment venues and cafes only

Venue type	Country	Sample Size	Cigarette vendors or vending machines (%)	Tobacco advertising (%)	Cigarettes on menu* (%)
<b>Public office</b>	Bahrain	3	0	0	.
	Djibouti	3	0	0	.
	Egypt	9	0	0	.
	Islamic Republic of	9	0	0	.
	Iran				
	Iraq	3	0	0	.
	Jordan	8	0	0	.
	Lebanon	6	17	0	.
	Oman	9	0	0	.
	Pakistan	3	0	0	.
	Sudan	1	0	0	.
	Yemen	6	0	33	.
<b>Public transport</b>	Bahrain	3	0	0	.
	Djibouti	2	0	0	.
	Egypt	3	33	0	.
	Islamic Republic of	1	0	0	.
	Iran				
	Iraq	3	0	33	.
	Jordan	2	0	0	.
	Lebanon	3	0	0	.
	Oman	3	0	0	.
	Pakistan	3	0	0	.
	Sudan	3	0	0	.
	Yemen	4	0	25	.
<b>Recreational</b>	Bahrain	6	17	17	83
	Djibouti	7	14	0	14
	Egypt	6	17	0	0
	Islamic Republic of	7	0	0	14
	Iran				
	Iraq	6	50	17	17
	Jordan	8	0	0	0
	Lebanon	4	0	0	50
	Oman	6	0	0	0
	Pakistan	6	17	0	17
	Sudan	6	33	0	50
	Yemen	5	0	0	0

\* For restaurants, entertainment venues and cafes only

*Exposure to second-hand smoke in selected public places in the WHO Eastern Mediterranean Region* reports on a pilot study that documented the second-hand smoke levels in selected public places, to assess compliance with smoke-free policies and legislation. Based on the findings from the 11 participating countries, the report suggests steps that can help improve enforcement of 100% smoke-free policies.

