جامعة قطر
QATAR UNIVERSITY
معهد البحوث الاجتماعية والاقتصادية المسحية
THE SOCIAL & ECONOMIC SURVEY RESEARCH INSTITUTE

**Policy Report**

# Indoor Air Pollution Insights in Qatar: Strategies for Better Air Quality

**December 2024**

www.sesri.qu.edu.qa • sesri@qu.edu.qa • 4403 3020 • sesri_qu • sesri_qu

This report presents the key findings of an indoor air quality survey conducted from January 14 to February 14, 2024. It aims to raise awareness about indoor pollutants, show the negative health impacts of indoor pollution, and provide some strategies to mitigate pollution inside houses. The target population of the survey included two population groups: Qatari nationals and white-collar expatriates residing in Qatar. The survey gathered information about the demographic characteristics of the participants, including education, gender, employment status, age, nationality, and income. It then proceeded to assess their awareness of indoor pollution. The participants were asked whether they were familiar with the concept of indoor pollution and its sources, particularly incense and scented candles, and how frequently they used these items. It also explored any symptoms they might have experienced related to indoor pollution. The respondents also provided insights into the frequency of their use of indoor pollutants and indicated their level of agreement with various strategies and policies designed to reduce indoor pollution. The survey was administered using a computer-assisted telephone interview (CATI) mode. Unlike many existing studies that rely on estimated exposure and health risks, this study was a specific, empirical investigation of the conditions of indoor air quality within Qatar. This report presents policy recommendations on the above-mentioned topic, aiming to provide valuable information to decision makers.

**THIS REPORT WAS PREPARED BY:**
Dr. Sana Abusin, Ph.D., Research Associate, LPI of the project
Dr. Kien T. Le, Ph.D., Associate Research Professor
Catalina Petcu, Research Assistant
Noor K. Al-Thani, Research Assistant
Alaa Al-Shareef, Project Manager
Nada Rayan, Technical Editor.

**DATA COLLECTION:**
John Lee Pratt Holmes, Section Head of Computer Assisted Telephone Interview Operations
Abdulrahman Abdulaziz Rahmany, Assistant Data Collection Specialist
Anis Miladi, Section Head of Survey Programming and Development
Isam M. Abdelhameed, Senior Survey Programming Specialist
Ayman Al-Kahlout, Field Operations Support

**THIS REPORT WAS REVIEWED BY:**
Prof. Kaltham Al-Ghanim, Ph.D., Research Professor, SESRI Director
Dr. Noora Lari, Ph.D., Policy Department Manager

Visit http://sesri.qu.edu.qa/ to see the online version of this report and relevant policy briefs from current projects.

# TABLE OF CONTENT

# List of Figures

# List of Tables

## Acknowledgment

This study was supported by the Social and Economic Survey Research Institute (SESRI) at Qatar University. Dr. Sana Abusin (LPI of the project) and the research assistant team were involved in the phases of the project, including questionnaire development, analysis, and report writing. Dr. Kien Le designed and selected the samples for the phone survey. John Lee Holmes implemented the operations for the phone, while Anis Miladi, Isam Abdelhameed, and Ayman Al-Kahlout conducted the programming of the instruments. Alaa Al-Shareef managed the project in different phases. We also thank all the participants who spared some of their valuable time to take part in the survey and answer detailed questions. Our thanks also go to the interviewers and supervisors who administered the phone calls interviews. The findings achieved herein are solely the responsibility of the authors and do not necessarily reflect the views of the Social and Economic Survey Research Institute (SESRI) or Qatar University. The authors gratefully acknowledge the support provided for this study.

# Key Findings

The following outcomes or findings are from the analysis of the collected data from both Qataris and expatriates according to the survey sections; the reported results are the most significant ones.

**Key findings of the report**

- The most commonly identified indoor pollutants were air conditioners (43%), cigarette/shisha smoke (43%), and outdoor pollution sources, such as dust and exhaust fumes (47%). The higher the education level of the respondents, the more likely they were to list air conditioners as one of the top sources of indoor air pollution. By contrast, very few Qataris believed that cooking was an indoor pollutant.
- The majority of the respondents (62%) claimed that high humidity was the biggest climate factor influencing indoor air pollution and worsening air quality, particularly among the older respondents. Only 36% of the respondents claimed that high temperature could be a factor for indoor air pollution, and 10% claimed that low temperature was a factor.
- Only 19% of respondents reported having pets, with more Qataris owning pets compared to expatriates. Among those with pets, 62% believed that pets negatively affected indoor air quality.
- The majority of the respondents (73%) said they ventilated their homes daily, while only 4% never opened doors or windows for ventilation. The higher the education level of the respondents, the less their tendency to naturally ventilate.
- Of the respondents who said that they or other family members smoked, 83% believed that smoke contributed to indoor air pollution, 12% said it contributed to some extent, and 5% said it did not contribute at all.
- Incense/bukhoor was more widely recognized as a pollutant by Qataris compared to high-income expatriates. More unemployed respondents perceived incense as the most harmful compared to employed respondents, who seemed to underestimate its harmful effects.
- Regarding incense use in relation to educational background, those with secondary education or less were the most frequent users, with 53% indicating constant use of incense. Postgraduates were more likely to use incense occasionally (44%) and made up the largest group of those who never used it (40%).

- Incense use is more prevalent among Qataris, women and those with larger families. The practice also saw an increase during the post-COVID-19 period, driven largely by cultural reasons and the desire to maintain home freshness.
- Candle use was more common among younger respondents, women and those who were single.
- Female respondents were more likely to experience symptoms related to indoor air pollution, such as frequent headaches, dizziness, itchy eyes, skin irritation, itchy nose, itchy throat, and insomnia. Dry cough was more prevalent among married individuals.
- Overall, 85% of the respondents believed that indoor air quality had worsened over time, suggesting awareness or concern about the impact of indoor air pollution on their health.
- A notable disparity in respiratory health existed across ethnicity, gender, and age. Qataris were more likely to be diagnosed with asthma than were high-income expatriates. Women were more frequently diagnosed with respiratory conditions, such as nasal sinusitis, while men reported fewer respiratory issues overall. Additionally, younger respondents were less likely to be diagnosed with respiratory-related diseases compared to employed respondents, suggesting that the likelihood of such conditions increases with age or employment, possibly due to environmental or occupational factors.
- The findings show that higher-income expatriates (63%) were more likely than Qataris (49%) to believe that both indoor and outdoor air quality had the same effect on their quality of life. However, more Qataris (22%) perceived outdoor air quality as having a greater impact on their lives compared to higher-income expatriates (19%).
- Respondents with higher educational attainment were more aware of the impact of air quality.
- A large portion of respondents believed that technologies such as air purifiers would significantly improve air quality, with higher support among married respondents.
- Female respondents (56%) and married individuals (51%) were more likely to believe that reducing incense use would improve indoor air quality “a lot.”
- About 50% of both Qataris and high-income expatriates believed that reducing the use of sanitizers and chemical cleaners would greatly improve air quality.
- A majority of the respondents believed that frequent cleaning of air conditioner filters would improve air quality.

- Most of the respondents believed that public awareness campaigns could significantly improve indoor air quality. Those with bachelor’s degrees showed the highest level of support.

# Introduction

The climate in the GCC is characterized by high ambient temperature and humidity. These countries are also characterized by large oil reserves and huge factories for their production. The region has witnessed industrial and demographic revolutions and has been hosting international events that have resulted in radical changes in infrastructure. However, despite this great development, the topic of environmental pollution has come to the fore due to heavy dust, noise, and intense carbon emissions that make outdoor environments more polluted than indoors. Nevertheless, indoor exposure can be a greater threat and may cause more harmful health effects than exposure to outdoor air. Indoor concentrations of air pollutants are frequently higher than those typically encountered outdoors, and indoor air pollution causes 3.8 million premature deaths each year globally (Wang et al., 2020). The Qatar Environment and Energy Research Institute reported a 30% decrease in PM2.5 concentrations associated with people staying indoors across Doha (Marhba Qatar, 2020). Nevertheless, no study has been conducted to determine indoor pollution levels during the same period.

During the same period (after COVID-19), some research worldwide demonstrated that while outdoor pollution decreased, indoor pollution increased significantly. This is attributed to certain factors, such as being home for a longer time, crowding of personal spaces, and prolonged time of exposure (US EPA, 2024 online source). We assume that one driver of indoor pollution could be a lack of awareness of indoor pollutants. Indoor pollutants such as tobacco, wood, coal heating and cooking appliances, fireplaces, cleaning supplies paints, and insecticides can release harmful byproducts such as carbon monoxide, which pollute the indoor environment (U.S. Environmental Protection Agency, 1989). In this report, we add to this list of pollutants two of the most used indoor products in GCC—incense and scented candles—because of their connection with traditions, culture, and beliefs.

Although indoor pollution refers to the quality of the air in a home, school, office, or other building environment, in this report, we only cover the household's opinions on indoor quality. We include some of the health symptoms associated with indoor pollution, including eyes, nose, and throat irritation, as well as cancer, heart, and respiratory diseases. Our aim is to raise awareness about indoor pollutants, show the negative health impacts of indoor pollution, and provide strategies to mitigate pollution inside houses.

To the best of our knowledge, this is the first attempt to address the research gap in indoor air quality in Qatar, which is particularly large, especially regarding investigating indoor pollution

public opinions, indoor pollutants, and policy recommendations for better quality. A good understanding of indoor pollution/pollutants and their consequences is necessary to help policy makers and managers design appropriate intervention measures that would improve indoor environment air quality. The study provides useful findings and recommendations to inform policy implications.

# SECTION 1

## Demographic Characteristics

# SECTION 1: Demographic Characteristics

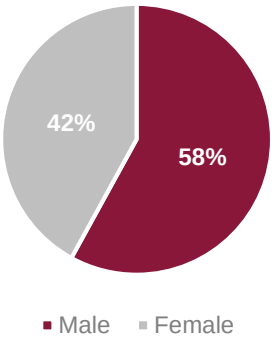
To better understand the respondents' characteristics, an overview of their social demographics is presented in this section.

## Gender of the respondents

Across the entire sample, most of the respondents were male (58%) (see Figure 1). Within the group of Qataris, 48% were male, and 52% were female. Within the group of high-income expatriates, 60% were male and 40% were female.

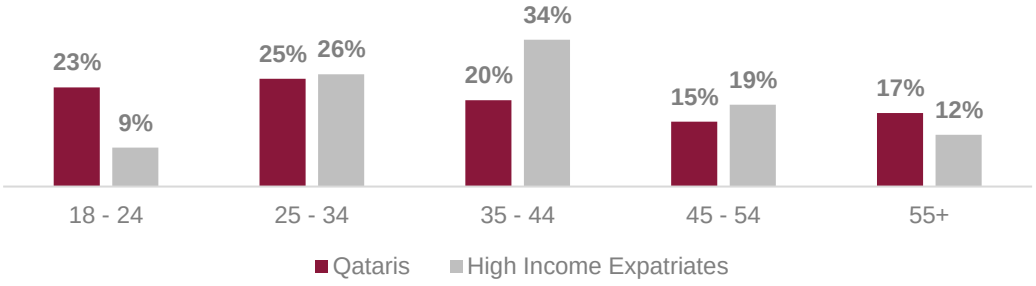
## Age of the respondents

**Figure 1. Distribution of respondents by gender**




Most of the respondents were between 35–44 years old (31%), 26% were between 25–34 years old, 18% were between 45–54 years old, 13% were above 55 years old, and 11% were between 18–24 years old (see Figure 2). Within the group of Qatari nationals, the majority of respondents reported being 25–34 years old (25%), followed by 23% of respondents between 18–24 years old (see Figure 2). Most of the high-income expatriates reported being between 35–44 years old (34%), followed by 26% of respondents between 25–34 years old (see Figure 2).

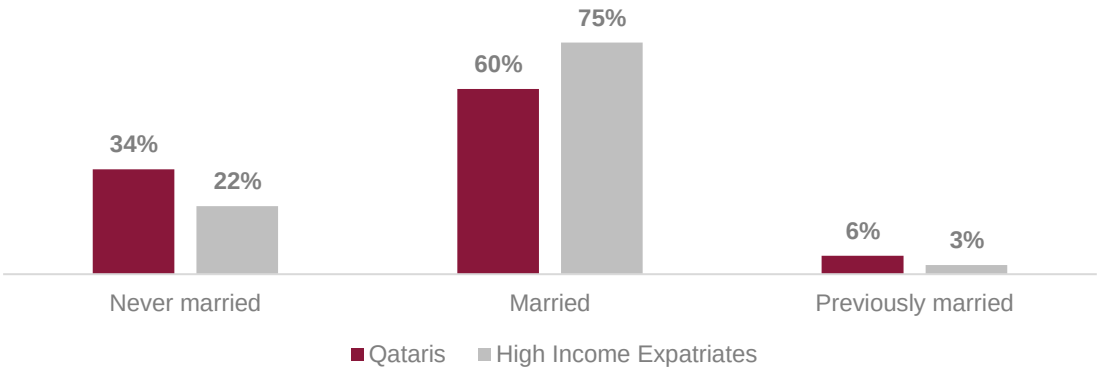
**Figure 2. Distribution of Qataris and high income expatriates by age**



## Marital status

A high percentage of respondents were currently married (72%), 24% were never married, and only 4% were previously married. Subsequently, most of the high-income expatriates (75%) and Qataris (60%) were married. A higher proportion of Qataris reported never being married (34%) compared to high-income expatriates (22%) (see Figure 3).

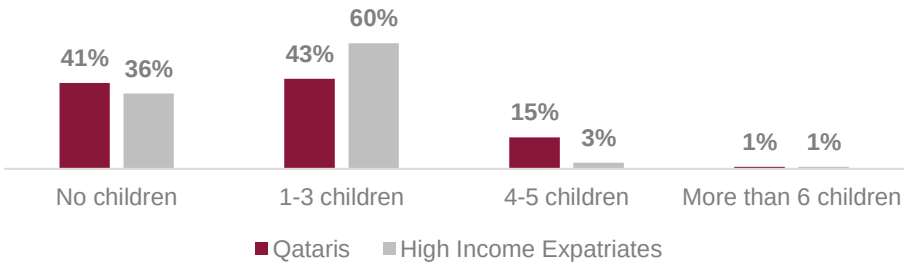
**Figure 3. Distribution of Qataris and high income expatriates by marital status**




## Number of children

Currently married and previously married respondents were asked about the number of their children. The majority (57%) responded that they had 1–3 children, 37% said that they had no children, 5% had 4–5 children, and 1% of respondents had more than 6 children. Within the group of Qataris, most of the respondents reported having 1–3 children (42%), with a similar proportion reporting having no children (41%) (see Figure 4). Within the group of high-income expatriates, almost 60% of respondents reported having 1–3 children, while 36% reported having no children (see Figure 4).

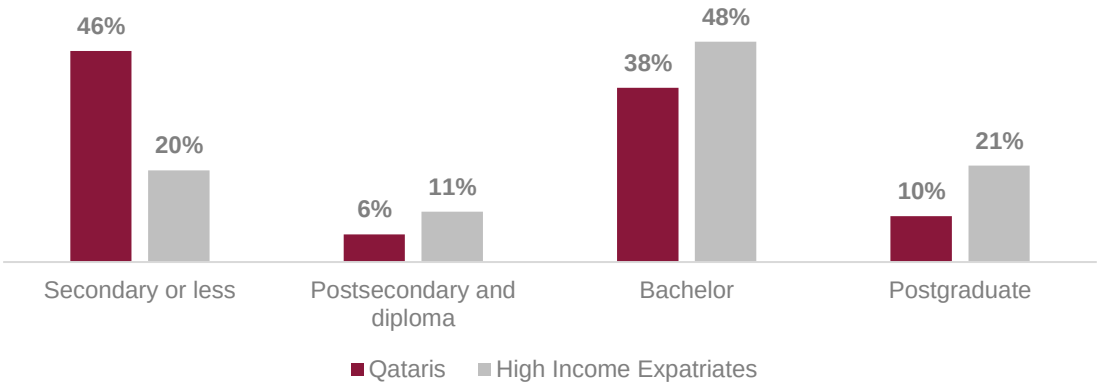
**Figure 4. Distribution of Qataris and high income expatriates by number of children**



## Respondents' educational level

Most of the respondents (46%) had a bachelor's degree, while 25% had a secondary or lower level of education. Around 19% had postgraduate studies, and 10% had postsecondary studies. Within the group of Qataris, 46% of respondents had secondary or less studies, 38% had a bachelor's degree, 10% had postgraduate studies, and 6% had postsecondary studies. In the case of high-income expatriates, the majority (48%) had a bachelor's degree, 21% had postgraduate studies, 20% had secondary or less studies, and 11% had postsecondary studies.

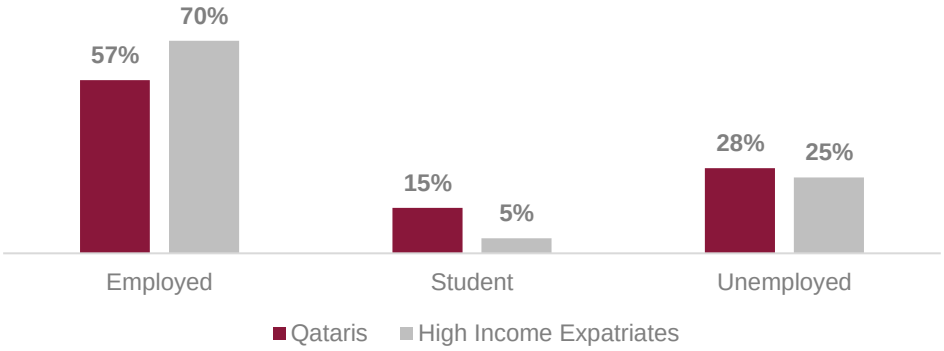
**Figure 5. Distribution of Qataris and high-income expatriates by educational level**




## Respondents' employment status

When asked about their employment status, 68% of respondents declared being employed, compared to 25% who were unemployed. Around 7% of the respondents were students. Within the group of Qatari respondents, 57% were employed, 15% were students, and 28% were unemployed (see Figure 6). Around 70% of high-income expatriates were employed, only 5% were students, and 25% were unemployed (see Figure 6).

**Figure 6. Distribution of Qataris and high income expatriates by employment status**



## Income

The respondents were asked about their family's total monthly income. Within the group of Qataris, more than half of the respondents (57%) declared that their family's total monthly income was above 50,000 QAR, while 43% reported income below 50,000 QAR (see Figure 7). Within the group of high-income expatriates, 49% said that their family's monthly income was below 15,000 QAR, while 51% indicated income above 15,000 QAR (see Figure 8).

**Figure 7. Distribution of Qataris by income**

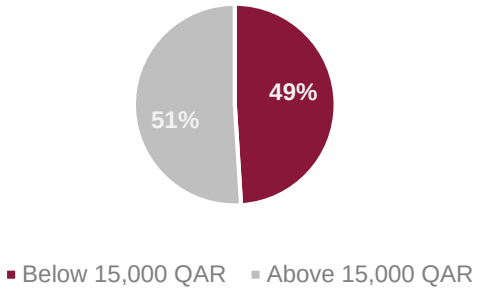
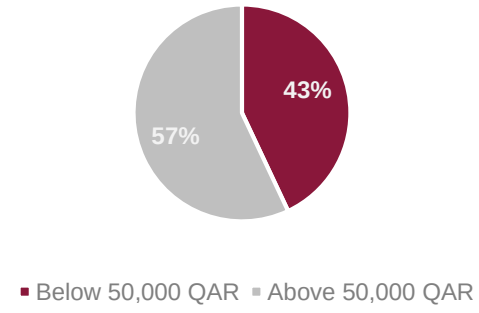



**Figure 8. Distribution of high income expatriates by income**



# SECTION 2

## Awareness of Indoor Air Pollution

# SECTION 2: Awareness of Indoor Air Pollution

While most people know about outdoor air pollution, understanding indoor air pollution might not be as common. The air quality within buildings and structures affects the comfort and health of occupants. Being aware of and properly identifying the sources of indoor air pollution is an important step that can help reduce the risks of indoor health and comfort concerns. This section presents the survey results related to the general public's perception of the most common sources of pollution inside the home, climate factors that affect indoor air quality, and other perceived sources of indoor air pollution, such as having pets, smoking, and using scented candles and bukhoor.

## 2.1 Indoor air pollutant awareness

- ***Scented candles***: Table 1 shows that only 17% of respondents identified the use of scented candles as a common pollutant. In terms of respondent type, more Qataris (25%) than high-income expatriates (15%) believed that scented candles were one of the top sources of indoor air pollution in their homes. Moreover, more women (24%) thought that this was one of the top three most common pollutants, compared to only 12% of males.
- ***Incense/bukhoor:*** Incense, also known as bukhoor, seemed to be more widespread than scented candles, as a higher proportion of respondents (28%) identified it as an indoor pollution source (see Table 1). In line with local cultural practices, the results showed that 47% of Qataris listed bukhoor as a common pollutant in their homes, compared to 23% of high-income expatriates. In addition, more women (34%) than men (23%) believed that the use of incense (bukhoor) was a common source of indoor air pollution. Interestingly, 44% of students identified incense as one of the most common pollutants, compared to 38% of unemployed respondents and 23% of employed respondents. These results reflect the power of culture and traditions within Qataris and the lack of awareness among expatriates.
- ***Air conditioners:*** A high percentage of respondents (43%) perceived the use of air conditioners as one of the three most common indoor pollutants. Age was found to be a significant factor in the use of air conditioners. Around 55% of respondents aged 35–44 years old thought air conditioners were one of the top three pollutants, followed by 26% of respondents between 45–54 years old, 38% of respondents above 55 years old, and 35% of respondents in both categories of 18–24 and 25–34 years old. In addition,

education level was also a significant predictor. A large proportion (55%) of respondents with postgraduate studies identified air conditioners as the most common pollutants, compared to 45% of respondents with bachelor's degrees, 44% of respondents with postsecondary studies and diplomas, and 31% of respondents with secondary studies or less. Hence, the higher the education level of the respondents, the more likely they were to list air conditioners as one of the top three sources of indoor air pollution.

- ***Cooking:*** Around 33% of respondents believed that cooking inside the home was one of the three main indoor pollutants, with a much higher proportion of high-income expatriates (37%) reporting this than Qataris (17%).
- ***Cleansers/sanitizers products:*** The use of cleansers and sanitizers was the second least perceived source of indoor pollution after the scented candles, with only 21% of respondents listing it.
- ***Cigarettes/shisha:*** Smoke emitted from cigarettes and shisha was one of the top three sources listed by a high proportion of respondents (43%), along with outdoor pollution sources (47%) and air conditioners (43%) (see Table 1). Gender was found to be a significant variable, with more males (49%) than females (36%) indicating smoke from cigarettes and shisha in their top three list of indoor pollutants. Marital status also showed significance, with a high proportion of 53% of people who were never married reporting cigarettes and shisha as common pollutants, compared to 41% of married people and 30% of previously married respondents.
- ***Sewage:*** Around 23% of respondents identified toilets and sewage emissions inside the house as one of the top three sources.
- ***Outdoor pollution:*** Outdoor pollution sources were the most listed source of indoor air pollution by 47% of respondents (see Table 1). Despite it being perceived as the most common indoor pollutant, no significance was found when correlated with other socio-demographic variables. This could be related to the preparation and infrastructure work pre- and post-FIFA 2022 (Lygdopoulos, 2023).

**Table 1. The most common sources of indoor air pollution by respondent type**

| Sources | All respondents | Qataris | High income expatriates |
|---|---|---|---|
| Use of scented candles | 17% | 25% | 15% |
| Use of incense, like bukhoor | 28% | 47% | 23% |
| Use of air conditioners | 43% | 38% | 44% |
| Cooking inside the house | 33% | 17% | 37% |
| Use of cleansers and sanitizers | 21% | 21% | 21% |
| Smoke emitted from cigarettes and shisha | 43% | 43% | 44% |
| Sewage emissions inside the house | 23% | 24% | 22% |
| Outdoor pollution sources (dust, exhaust fumes etc.) | 47% | 45% | 47% |
| Other | 2% | 4% | 1% |

## 2.2 Factors accelerate/ reduce indoor pollution

### 2.2.1 Climate

The respondents were asked about their perceptions of several climate factors that could increase the negative effects of indoor air pollution. These factors were high humidity, high temperature, and low temperature. Table 2 presents the proportion of the total respondents, as well as the proportion of Qataris and high-income expatriates who perceived these factors as contributors to indoor pollution.

**Table 2. Climate factors increasing indoor air pollution by respondent type**

| Climate factors | All respondents | Qataris | High income expatriates |
|---|---|---|---|
| High humidity | 62% | 52% | 64% |
| High temperature | 36% | 43% | 34% |
| Low temperature | 10% | 11% | 10% |

The majority of respondents (62%) found high humidity to be the main climate contributor to indoor pollution, with more high-income expatriates (64%) believing that than Qataris (52%) (see Table 2). The high humidity factor was found to be significant when correlated with age, as a great proportion of the respondents above 55 years old (78%) thought that high humidity negatively affected indoor air quality, compared to 56% of respondents between 25–34 years old who believed the same. In addition, the majority of respondents who declared having no children (70%) identified high humidity as a significant contributor to indoor pollution, compared to 51% of people with 4–5 children.

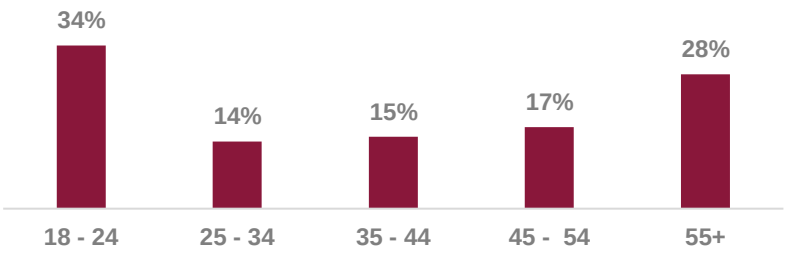
However, fewer respondents (36%) found high temperature to be a factor that could increase indoor air pollution, with more Qataris (43%) holding such a perception than high-income expatriates (34%) (see Table 2). Again, the number of children seemed to be a significant

variable, with more respondents with 4–5 children (39%) and 1–2 children (37%) selecting the high temperature, compared to 29% of respondents with no children. We found that more employed respondents (39%) and students (37%) were more likely to perceive high temperature as a factor to negatively affect indoor pollution than unemployed respondents (25%). Only 10% of respondents perceived low temperature as a factor that could negatively affect indoor air pollution (see Table 2).

### 2.2.2 Pets

Pets' waste can affect indoor air quality, spreading bacteria, mold, and mildew. The respondents were asked if they had pets at home, and only 19% of all respondents reported having pets. The results showed that more Qataris (34%) than high-income expatriates (16%) had pets. In addition, more females (25%) owned pets than males (15%). In terms of age, the extreme groups of younger and older people had pets, with 34% of those aged between 18–24, and 28% of respondents above 55 years old (see Figure 9).

**Figure 9. Distribution of respondents who have pets by age**



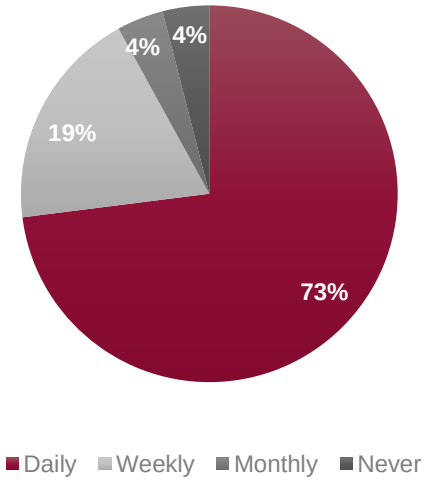

Concerning education level and its correlation with having pets, more respondents with secondary education or less (27%) and postgraduate education (22%) owned pets, compared to 17% of respondents with bachelor's and only 3% of those with postsecondary education. More students (38%) seemed to be interested in having pets than employed (17%) and unemployed (20%) respondents. Of the respondents who had pets, 62% indicated that pets could negatively affect indoor air quality.

### 2.2.3 Windows open for ventilation

The respondents were asked about the frequency of opening doors and/or windows for the natural ventilation of the house. Around 73% of respondents said that they ventilated the house on a daily basis, compared to only 4% who never opened windows or doors (see Figure 10).

This finding needs more investigation to regress those who never opened windows with their locations or nearby infrastructure work during the time of the survey

**Figure 10. Distribution of respondents by frequency of natural ventilation**

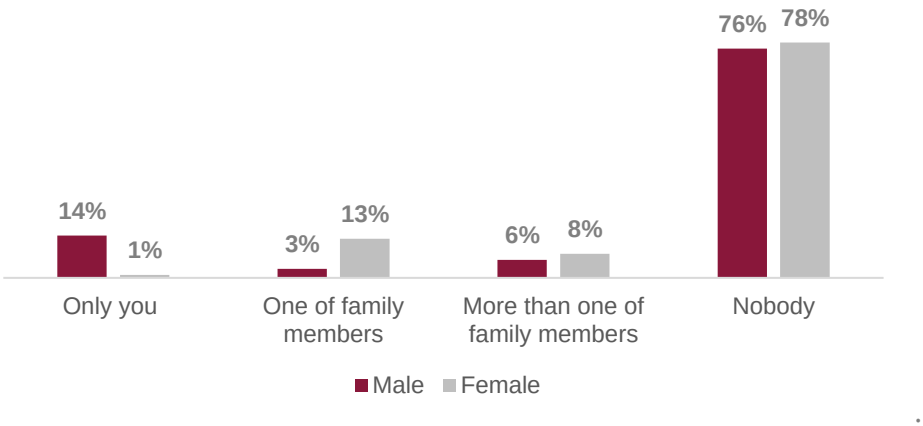



More females (77%) than males (71%) opened doors or windows daily, while more males (21%) than females (15%) naturally ventilated the house weekly. Interestingly, more respondents with a lower educational level, such as those with secondary studies or less (84%), tended to use natural ventilation daily compared to those with postgraduate studies (61%). Around 6% of postgraduates never opened doors or windows, compared to 3% of secondary or lower educational levels who never did.

### 2.2.4 Smoking cigarettes and shisha inside house

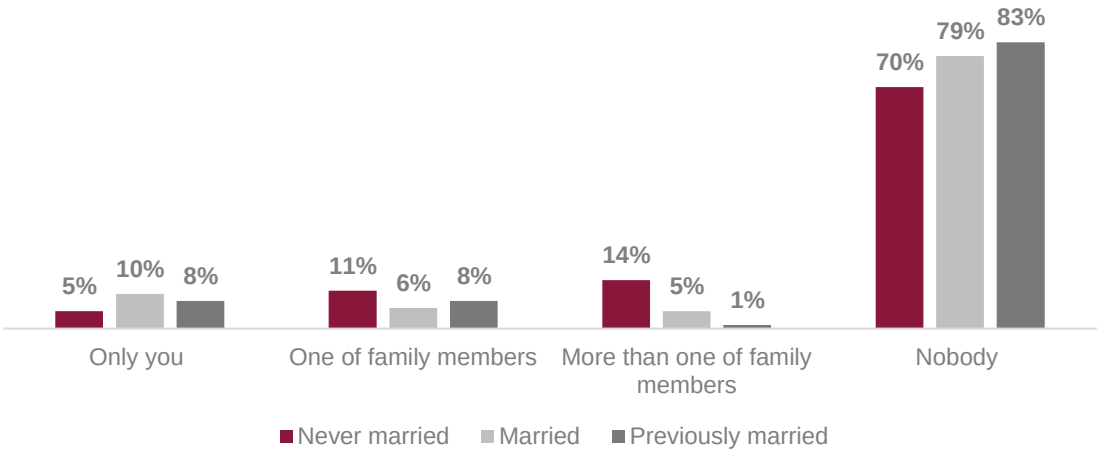
The survey included one question about family members smoking cigarettes or shisha inside the home. The great majority of respondents (77%) said that no family member smoked inside the house, 8% said that they were the only indoor smoker, and slightly smaller proportions reported having at least one family member who smoked inside (7%) or more than one member who smoked indoors (7%). Around 14% of respondents who reported themselves as the only smoker inside the house were males, compared to less than 1% of females (see Figure 11). The negative effects of smoking are well known among the participants.

**Figure 11. Distribution of family members smoking indoors by gender**



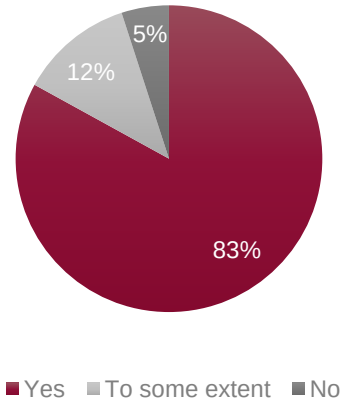

Less never married respondents (5%) reported themselves as indoor smokers, compared to 10% of married people and 8% of previously married respondents. Only 1% of previously married people said that they had more than one family member smoking indoors, compared 13% of never married people reporting that (see Figure 12). No student reported himself as being the only indoor smoker.

**Figure 12. Distribution of family members smoking indoors by marital status**




Of the respondents who said that either themselves or other family members smoked, 83% firmly believed that smoke contributed to indoor air pollution, 12% said it contributed to some extent, and 5% said it did not contribute at all (see Figure 13).

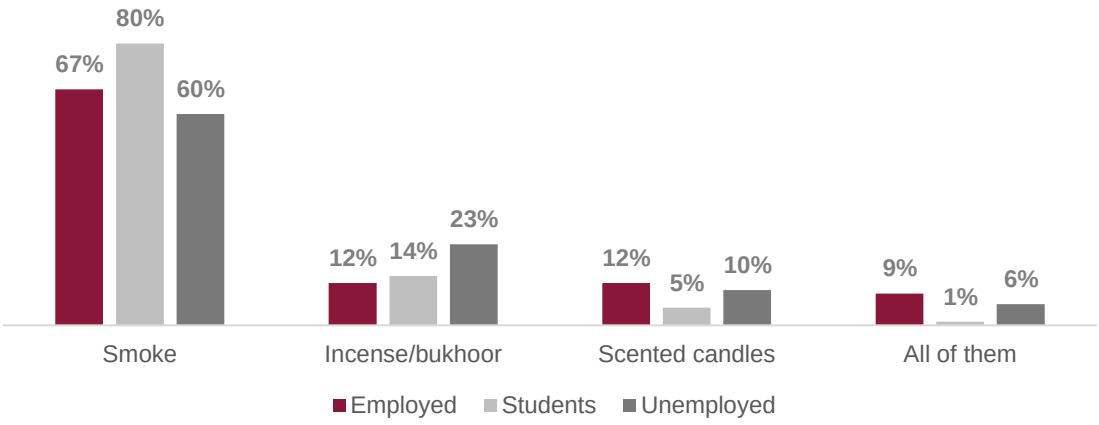
**Figure 13. Distribution of respondents who think smoking contribute to indoor pollution**




## 2.3 The perceived negative effects of indoor pollutants

The respondents were asked to select the indoor air pollution source with the most negative effect in their opinion, having as options 1) smoke, 2) incense/bukhoor, 3) scented candles and 4) all of them. Around 66% of respondents think that smoke has the most negative effect, 15% think that incense/bukhoor, 11% think that scented candles, and 8% think that all of them have a negative effect. More high-income expatriates (68%) than Qataris (57%) selected smoke as the source with the most negative effect, while slightly more Qataris than high-income expatriates believed incense/bukhoor, scented candles, and all of the sources have the most negative impact. Significant values were found with the employment status variable, with more students (80%) perceiving smoke as the source with the most negative effect, compared to employed (67%) and unemployed (60%). More unemployed respondents (23%) than employed respondents (12%) believed that incense/bukhoor has the most negative effect (see Figure 14). The literature indicates that the impact of incense is 3 times more dangerous than smoking; the fact needs to be raised among the community (Lee et al., 2021). The respondents also highly underestimated the effects of scented candles.

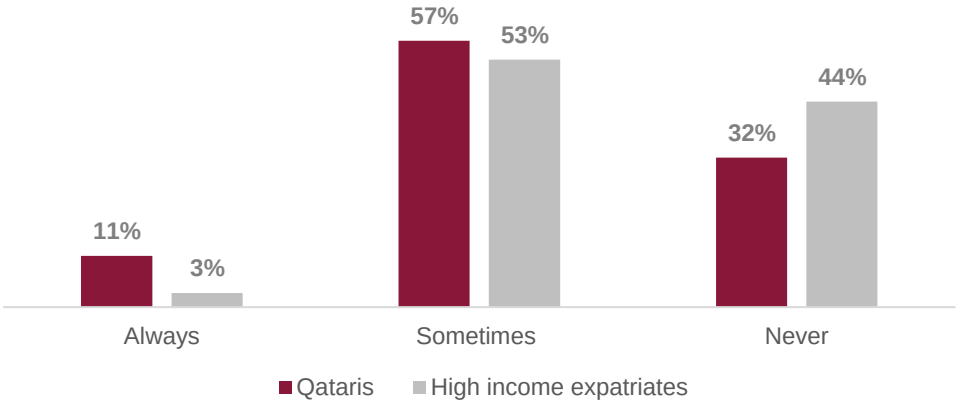
**Figure 14. Distribution of respondents selecting the source with the most negative effect by employment status**




## 2.3.1 Usage of scented candles

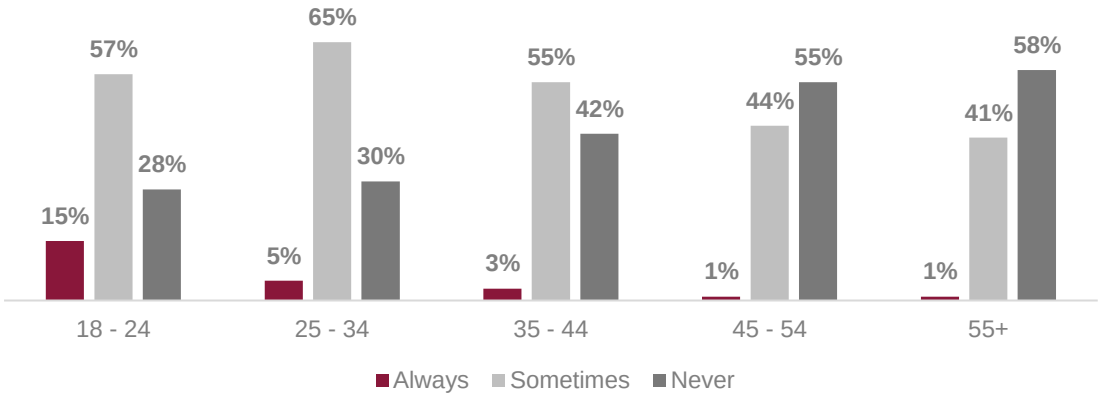
When asked about the use of scented candles in their family, 54% of respondents said that their family members or themselves sometimes used scented candles, 4% said that they did so always, and 42% said that they never used scented candles. More Qataris (11%) than high-income expatriates (3%) always used scented candles, 57% of Qataris and 53% of high-income expatriates said that they sometimes and more high-income expatriates (44%) than Qataris (32%) said that they never used scented candles (see Figure 15).

**Figure 15. Distribution of respondents using scented candles by respondent type**




The results show that more females always (6%) and sometimes (60%) used scented candles than men (3% and 49%, respectively). More men (47%) than women (34%) said that they never used scented candles. Age seems to be an important factor in candle use, with more respondents between 18–24 years old (15%) always using scented candles, and more people aged between 25–34 years old (65%) sometimes using scented candles (see Figure 16).

**Figure 16. Distribution of respondents using scented candles by age**




In addition, more never married respondents (10%) always used candles compared to married (3%) and previously married (4%) respondents. The results also show that more students (20%) always use scented candles, compared to only 3% of employed and 4% of unemployed respondents.

Considering respondents who used scented candles, the majority of them (41%) said they lit up the candles on a monthly basis, 30% said they used candles weekly, 18% used candles many times during the week, 9% used them daily, and 2% used candles more than once per day. Surprisingly, more men used candles daily (9%), weekly (33%), and monthly (44%) than women (7%, 27%, and 37%, respectively). However, more women tended to use candles more than once per day (4%) and more times per week (24%) than men (1% and 13%, respectively). More never married respondents (16%) used candles daily than married (6%) and previously married (0%), more married (33%) people used them weekly, compared to 24% of never married and 23% of previously married respondents, and the great majority of previously married people (62%) used candles monthly, compared to 32% of never married people and 42% of married people. More students (19%) used candles daily than employed (10%) and unemployed (2%) people. Similar proportions of employed (32%) and unemployed (32%) used candles weekly compared to a lower proportion of students (11%).

Around 31% of respondents thought that candle use increased after the COVID-19 pandemic, out of whom 9% believed that this increase was due to individual beliefs, such as yoga and mood enhancement practice, and 16% thought it was due to cultural and traditional practices (see Table 3), with more men (26%) than women (5%) believing so. Around 31% of respondents attributed this increase to home decoration purposes, and 70% reported a desire to maintain home freshness (see Table 3). Maintaining home freshness was the main reason for

93% of respondents with postsecondary studies and diplomas, 68% of respondents with secondary studies or less, 86% of respondents with bachelor's degrees, and only 34% of postgraduates.

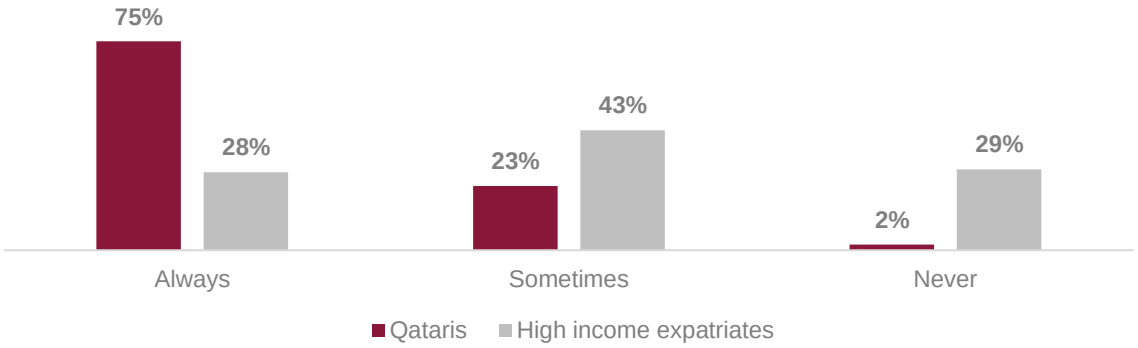
**Table 3. Motives behind the increase of candle usage by respondent type**

| Reasons | All respondents | Qataris | High income respondents |
|---|---|---|---|
| Individual beliefs (e.g. yoga or mood enhancement) | 9% | 19% | 7% |
| Cultural and traditional practices | 16% | 10% | 18% |
| Home decoration | 31% | 31% | 31% |
| Desire to maintain home freshness | 70% | 70% | 69% |

## 2.3.2 Usage of incense/bukhoor

Respondents were also asked to answer whether they themselves or any member of the household use incense/bukhoor. Around 37% of respondents said that they always used it, 39% said that they sometimes used it, and 24% said that they never used it. Predictably, 75% of Qataris said that they always used incense/bukhoor, compared to only 28% of high-income expatriates. More high-income expatriates (43%) than Qataris (23%) said that they used it sometimes, 29% of high-income expatriates said that they never used it, and only 2% of Qataris said they never used it (see Figure 17).

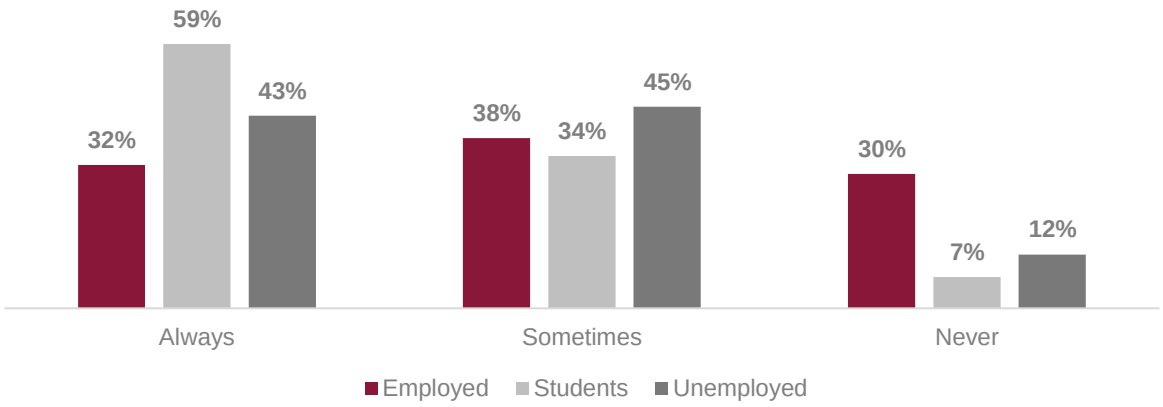
**Figure 17. Distribution of respondents using incense/bukhoor by respondent type**




More females (44%) than males (31%) said that they always used incense, while more males said that they sometimes (42%) or never (26%) used it, compared to women who sometimes (35%) or never (21%) used it. In terms of education, the highest proportion of respondents who always used incense had secondary or less studies (53%), while the highest proportion of respondents who used incense sometimes belonged to postgraduates (44%), who also represented the highest proportion of respondents who never used incense (40%). Similarly, in terms of employment status, more students (59%) than unemployed (43%) and employed

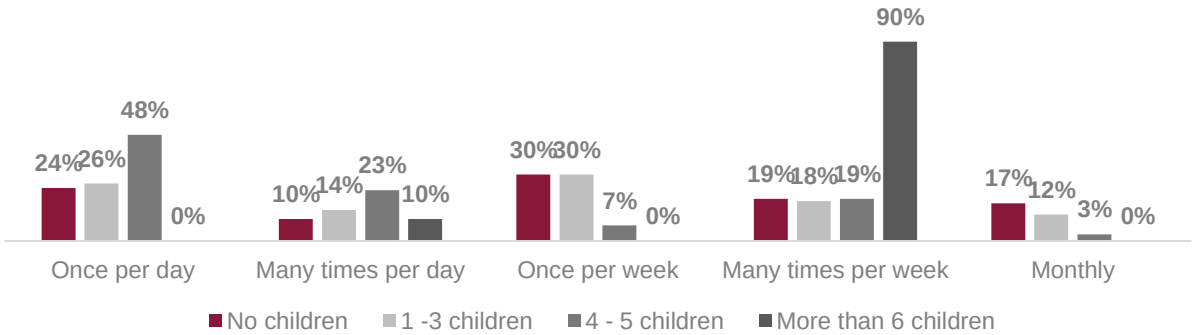
(32%) always used incense, while more unemployed (45%) respondents tended to use incense sometimes, compared to employed (38%) and students (34%) (see Figure 18). A great proportion of employed (30%) said that they never used incense (see Figure 18). The strong relationship between the use of incense in Qataris reflects that it is part of their identity.

**Figure 18. Distribution of respondents using incense/bukhoor by employment status**




When asked about the frequency of using incense/bukhoor, 25% said once a day, 16% many times per day, 27% once a week, 18% many times per week, and 13% said that they use incense monthly. More Qataris use incense once a day (34%) and even many times per day (31%) than high-income expatriates (23% and 11%, respectively). More high-income expatriates (32%) than Qataris (14%) used it once a week. In terms of gender, both males (26%) and females (25%) reported using it once a day, with more females (25%) than males (9%) using it multiple times per day. More male respondents (33%) than females (19%) used it once a week. The number of children affected the use of incense. Around 48% of respondents with 4–5 children use incense once per day, while people with more than 6 children (90%) use it many times per week (see Figure 19).

**Figure 19. Distribution of respondents using incense/bukhoor by number of children**



The highest proportion of respondents who use incense once per day belongs to those with postsecondary studies and diplomas (30%), while the highest proportion who use it many times per day belongs to those with secondary or less studies (29%). The highest proportion of those who burn incense monthly belongs to postgraduates (24%). Around 29% of respondents believed that incense use increased after the COVID-19 pandemic. In the table below, we present the results concerning the motives for the increased use of incense/bukhoor (see Table 4).

**Table 4. Motives behind the increase of incense usage by respondent type**

| Reasons | All respondents | Qataris | High income respondents |
|---|---|---|---|
| Individual beliefs (e.g. healing or health reasons) | 31% | 36% | 29% |
| Cultural and traditional practices | 25% | 33% | 22% |
| Home decoration | 9% | 14% | 8% |
| Diversification of home fragrances | 16% | 19% | 15% |
| Desire to maintain home freshness | 63% | 57% | 66% |

# SECTION 3

# Diseases Caused by Indoor Air Pollution

## SECTION 3: Diseases Caused by Indoor Air Pollution

Indoor air quality (IAQ) is a significant factor in the development, progression, and worsening of respiratory diseases. The World Health Organization estimates that household air pollution accounts for an estimated 4.3 million premature deaths annually (World Health Organization, 2021). Since people spend the majority of their time indoors, especially at home, it is essential to understand how exposure to indoor pollutants, allergens, and infectious agents can have both immediate and long-term health effects, particularly on the respiratory system. Prolonged exposure to these harmful substances can contribute to the development of conditions such as asthma, chronic bronchitis, and other respiratory issues, underscoring the importance of maintaining good IAQ for overall health and well-being.

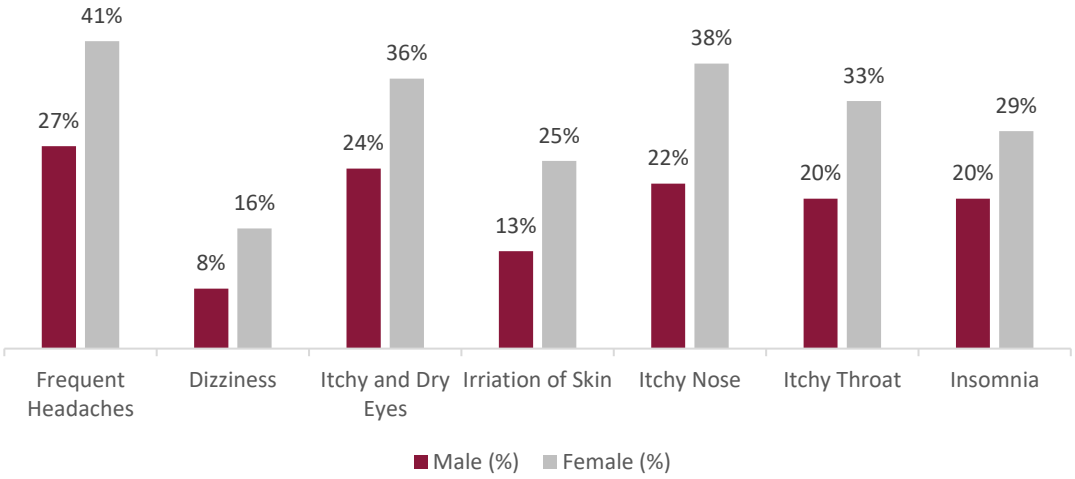
### 3.1 Reported Symptoms of Indoor Air Pollution

To understand the impact of IAQ, we asked respondents about their experiences with symptoms related to indoor air pollution over the last three years. These symptoms include dry cough at night, itchy eyes, and insomnia, among others.

- ***Dry cough at night:*** Overall, 26% of respondents reported experiencing dry cough at night. Of these, 68% were married. Additionally, 81% of respondents with a secondary education degree reported that they had not experienced this symptom. By contrast, those with bachelor's degrees (75%) and postgraduate degrees (69%) reported not experiencing this symptom in the last three years.
- ***Whistling while breathing:*** This symptom was more prevalent among Qataris (16%) than among high-income expatriates (9%). Overwhelmingly, female respondents were more likely to experience symptoms related to indoor air pollution than male respondents, as shown in the symptoms listed below.
  - ***Frequent headaches:*** 41% of female respondents had frequent headaches in comparison to 27% of male respondents.
  - ***Dizziness:*** % of female respondents had experienced dizziness at least once a month in comparison to 8% of male respondents.
  - ***Itchy and dry eyes:*** 36% of female respondents experienced this symptom in comparison to 24% of male respondents.
  - ***Skin irritation:*** 25% of female respondents reported skin irritation or itchiness, compared to 13% of males.

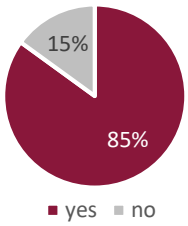
- ***Itchy nose:*** 38% of female respondents experienced this symptom, compared to 22% of males.
- ***Itchy throat:*** 33% of female respondents experienced this symptom in comparison to 20% of males.
- ***Insomnia:*** 29% of female respondents reported this symptom in comparison to 20% of male respondents.

**Figure 20. Symptoms experienced by male and female respondents over the last three years**




Following their responses to the previous questions regarding symptoms, the respondents were asked whether they believed that indoor air pollution had generally increased. An overwhelming 85% of the total respondents agreed, indicating a widespread perception that IAQ had deteriorated (see Figure 21). This high level of agreement suggests that there is a strong awareness or concern among individuals about the impact of indoor air pollution on their health, particularly the symptoms they reported experiencing.

**Figure 21. Respondents' opinion on whether indoor air quality has worsened over time**



## 3.2 Health Conditions

The respondents were further asked if they had been diagnosed with any health conditions, particularly those related to respiratory health. Among Qataris, 12% reported being diagnosed with asthma, compared to 6% of higher-income expatriates, reflecting a noticeable disparity between the two groups. In terms of broader respiratory-related diseases, high-income expatriates appeared to be less affected, with 68% reporting no diagnosis of respiratory-related illnesses, in contrast to 57% of Qataris (see Figures 22 and 23). This difference was statistically significant ($p$ = 0.006), indicating a potential link between socioeconomic status and health outcomes in this context. This also confirmed the significant relationship between Qataris as intensive users of incense and respiratory diseases.

**Figure 22. Percentage of Qataris diagnosed with respiratory diseases**

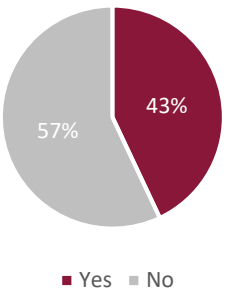
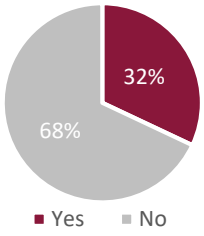



**Figure 23. Percentage of white-collar expatriates diagnosed with respiratory disease**




Gender differences were also observed, with 30% of female respondents reporting a diagnosis of nasal sinusitis, compared to 18% of male respondents. Additionally, more male respondents (71%) reported no diagnosis of respiratory-related diseases, compared to 58% of female respondents, highlighting a potential gender disparity in respiratory health conditions.

Age is another factor that plays a role in respiratory health. The younger population, particularly students, were less likely to be diagnosed with respiratory-related diseases, with only 16% of students reporting a diagnosis. By contrast, 34% of employed respondents and 41% of unemployed respondents reported being diagnosed with such conditions. This suggests that the likelihood of being diagnosed with respiratory diseases may increase with age or employment status, possibly due to environmental or occupational exposure.

# SECTION 4

# Relationship between Indoor Air Pollution and Outdoor Air Pollution

## SECTION 4: Relationship between Indoor Air Pollution and Outdoor Air Pollution

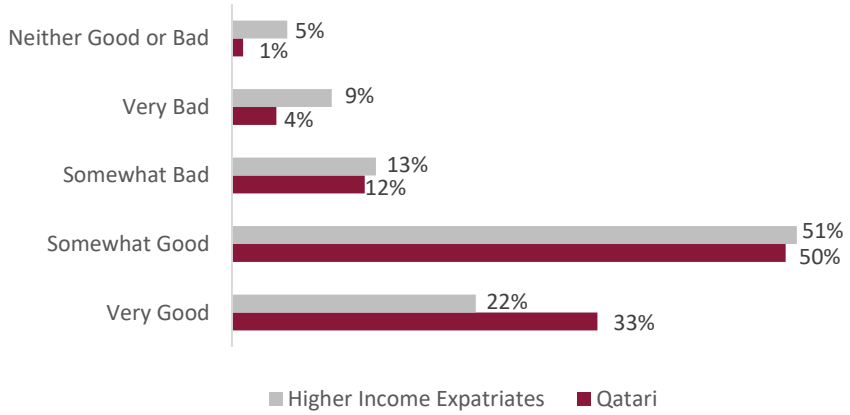
This section focuses on respondents' perceptions of the relationship between indoor and outdoor air pollution. Table 5 presents several statements collected from the respondents to understand their perspectives on the role of indoor and outdoor air pollution in their quality of life. This allows us to explore respondents' understanding of the impact of different types of pollution on their livelihood, and which type of pollution they perceive as more influential on their quality of life. The table shows that more higher-income expatriates (63%) than Qataris (49%) reported that both indoor and outdoor air quality had the same effect on their lives. More Qataris (22%) than higher-income expatriates (19%) saw that outdoor air quality had a greater impact on their quality of life. Notably, a similar percentage of both groups (Qataris: 13%, expatriates: 11%) reported that neither indoor nor outdoor air quality had any effect on their lives. Whereas higher-income expatriates tended to see indoor and outdoor air quality as equally important, a larger proportion of Qataris believed that outdoor air quality had a greater impact on their quality of life. These differences in perception could stem from varying living environments, lifestyle patterns, or other contextual factors that affect air quality in these groups' daily lives.

**Table 5. Respondents' perspective on the impact of indoor vs. outdoor pollution on quality of life**

| Statements | Qataris | Higher-Income Expatriates | Total |
|---|---|---|---|
| Outdoor air quality has a greater impact on my quality of life | 22% | 19% | 19% |
| Indoor air quality has a greater impact on my quality of life | 11% | 7% | 8% |
| Indoor and outdoor air quality have the same effect on my quality of life. | 49% | 63% | 62% |
| Neither indoor air quality nor outdoor air quality has any effect on my quality of life | 13% | 11% | 11% |

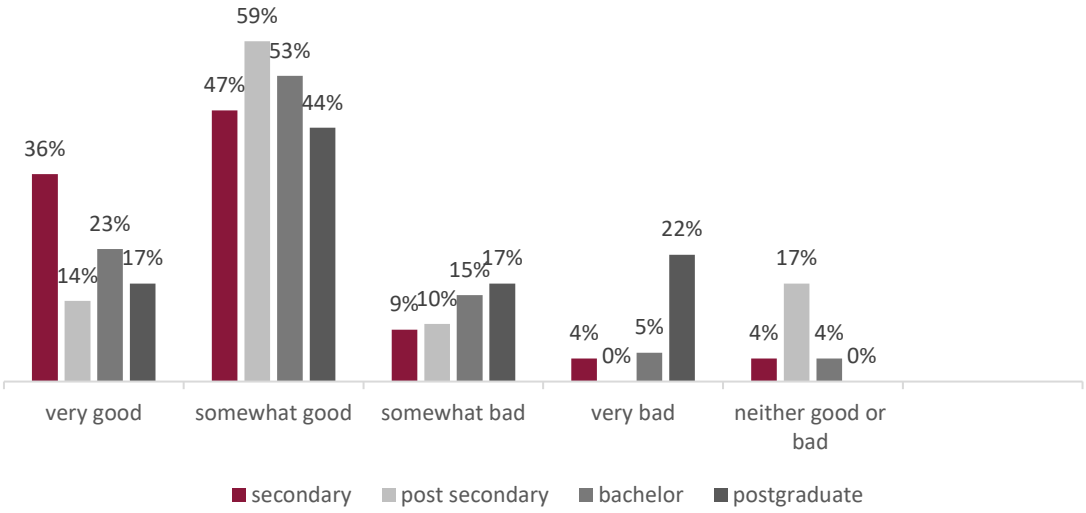
Furthermore, respondents were asked how they would describe air quality in Qatar on a 5-point Likert scale. Generally, Qatari respondents perceived the air quality to be better in comparison to higher-income expatriates, with 33% of the former agreeing that the air quality was very good compared to 22% of the latter. Only 4% of Qatari respondents claimed that the air quality was very bad in comparison to 9% of higher-income expatriates (see Figure 24).

**Figure 24. Qatari vs higher income Expatriates Perception on Air Quality in Qatar**




This significance was also clear in relation to educated levels, as those with higher education (postgraduate degrees) tended to report negative perceptions of air quality ($p$ = 0.00). Overall, 36% of secondary school graduates perceived the air quality to be very good, compared to only 17% of postgraduates. Only 4% of secondary school graduates perceived the air quality to be very poor, in comparison to 22% of postgraduate degree holders. Higher educational attainment is associated with a more critical view of air quality. Finally, respondents with higher educational attainment were more aware of the impacts of air quality, given that none of the respondents answered 'neither good nor bad' to any of the questions given to them (see Figure 25).

**Figure 25. Respondents' perceptions of air quality in Qatar**



# SECTION 5

# Strategies and Actions to Reduce Indoor Air Pollution

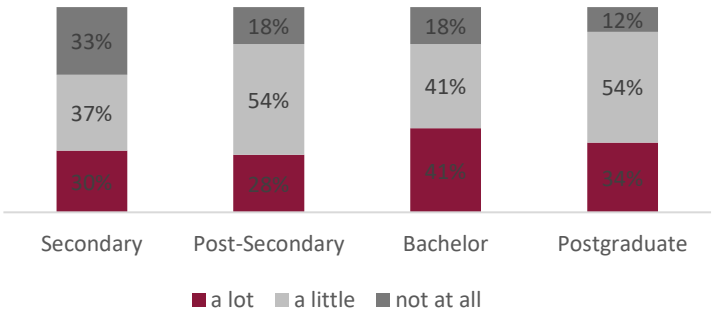
# SECTION 5: Strategies and Actions to Reduce Indoor Air Pollution

## 5.1 Strategies to Alleviate Indoor Air Pollution

There are various methods for improving indoor air quality. According to the WHO, the introduction of cleaner technologies for cooking, heating, and lighting, improving house ventilation, and supportive government policies and economic incentives are various methods that should be implemented worldwide. In this section, we asked respondents on their perception of different strategies that could be implemented to alleviate indoor air pollution, using a three-point scale—'a lot', 'a little,' or 'not at all'—to gauge their general perceptions.

Respondents were asked about their perceptions of the use of technology and indoor air pollution reducers (such as air purifiers) to improve IAQ. There was a significance among the different education levels ($p$ = 0.003). More respondents with a secondary degree (33%) believed that technology would 'not at all' alleviate indoor air pollution. However, this percentage decreases among respondents with postsecondary education, bachelor's degree, and postgraduate degrees to 18%, 18%, and 13%, respectively (see Figure 26). Additionally, there was a significant difference among marital statuses ($p$=0.003). More married respondents (41%) perceived that technologies would improve air quality by 'a lot' in comparison to 24% of respondents who had never been married.

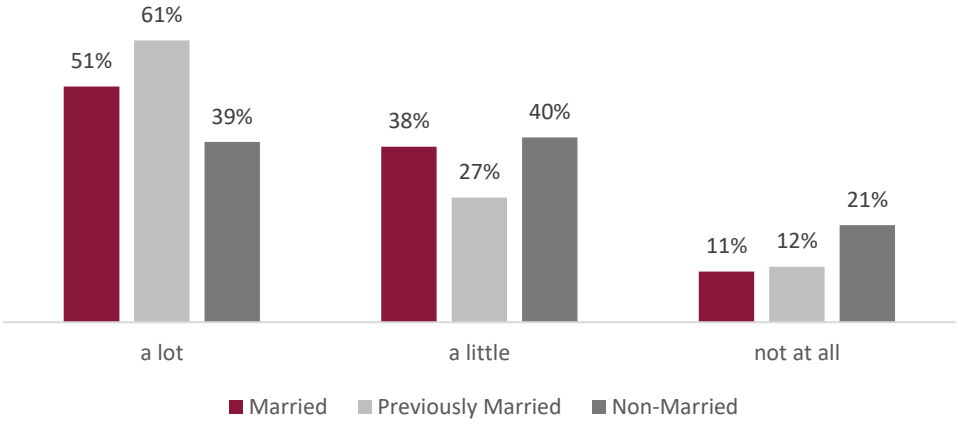
**Figure 26. Respondents' perception of the use of technology to improve IAQ based on education level**




The survey also explored whether respondents believed that reducing the use of incense (bukhoor) would impact IAQ. A greater percentage of male respondents (46%) perceived that reducing incense would improve air quality by "a little," compared to only 29% of female respondents. By contrast, 56% of female respondents believed that a reduction in incense would improve air quality by "a lot," compared to 43% of male respondents. Marital status again

played a significant role in shaping perceptions ($p = 0.04$). A majority of respondents who were married (51%) or previously married (61%) agreed that reducing incense use would improve air quality "a lot," in contrast to 39% of those who had never been married (see Figure 27). Conversely, 21% of non-married respondents perceived that reduced incense use would improve air quality by "a little," compared to 11% of married and 12% of previously married respondents.

**Figure 27. Respondents' perceived impact of reducing the use of incense on IAQ based on marital status**




Respondents were asked whether they perceived that reducing the use of sanitizers and chemical cleaning products would improve indoor air quality. A similar proportion of Qataris (51%) and higher-income expatriates (50%) agreed that such a reduction would have a positive impact by "a lot." However, a notable disparity was observed between the two groups regarding the minimal impact of sanitizers and cleaning products. Among Qataris, 31% perceived that the reduction of sanitizers and cleaning products would improve air quality by "a little," compared to 39% of higher-income expatriates. Additionally, 18% of Qatari respondents perceived that the reduction of sanitizers and cleaning substances would "not at all" improve air quality, compared to 10% of higher-income expatriates.

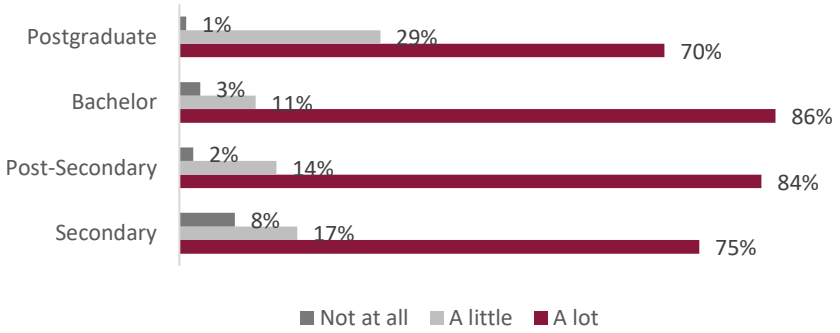
Additionally, there is a disparity between genders in the perceived impact of the use of sanitizers and chemical cleaning substances on indoor air quality. Among female respondents, 60% perceived that reducing the use of sanitizers and chemical cleaning equipment would improve IAQ by "a lot," compared to 47% of male respondents. Meanwhile, 43% of male respondents perceived that it would improve IAQ by "a little," compared to 31% of female respondents.

## 5.2 Preventive Actions to Improve Indoor Air Quality

This section aims to explore respondents' perceptions of various preventative actions that can be taken to reduce indoor pollution and improve air quality. Similar to the previous section, questions were framed using a three-point scale: "a lot," "a little," or "not at all." Overall, there was general agreement that the frequent cleaning of air conditioner filters (79%) and stringent requirements of air filters designed to remove contaminants within indoor spaces (77%) would improve air quality by "a lot." Respondents were also asked for their views on the classification of incense and scented candles as air pollutants by government institutions. Responses varied significantly based on marital status (P = 0.002). Half of the married respondents (50%) perceived that such a classification would improve air quality by "a lot," compared to 41% of those who had never married and 34% of previously married individuals.

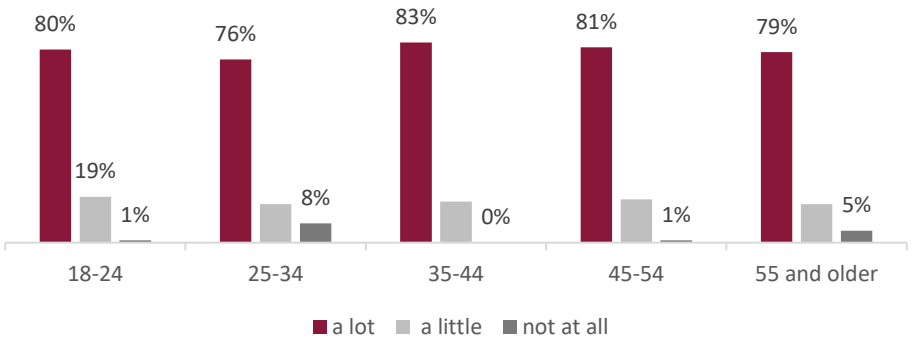
Perceptions of the role of public awareness campaigns in improving air quality were also surveyed. Among higher-income expatriates, 81% perceived that these campaigns improved air quality "a lot," compared to 74% of Qatari respondents**.** Additionally, perceptions of the effectiveness of public awareness campaigns varied depending on the respondents' education level ($p$ = 0.0008). Overall, the majority of respondents across all education levels perceived that public awareness campaigns improved air quality significantly. Respondents holding bachelor's degrees (86%) and postsecondary education (84%) showed the highest level of agreement, followed by respondents with secondary education (75%) and postgraduate degrees (70%). Notably, respondents with secondary education had the highest proportion (8%) who felt that public awareness campaigns did "not at all" improve air quality (see Figure 28). Thus, while respondents with higher education levels (bachelor's and postsecondary) were more likely to perceive public awareness campaigns as highly effective, those with secondary and postgraduate education exhibited more varied opinions, with a larger proportion expressing skepticism or seeing only a limited benefit.

**Figure 28. Perceptions of public awareness campaigns' impact on air quality by education level**



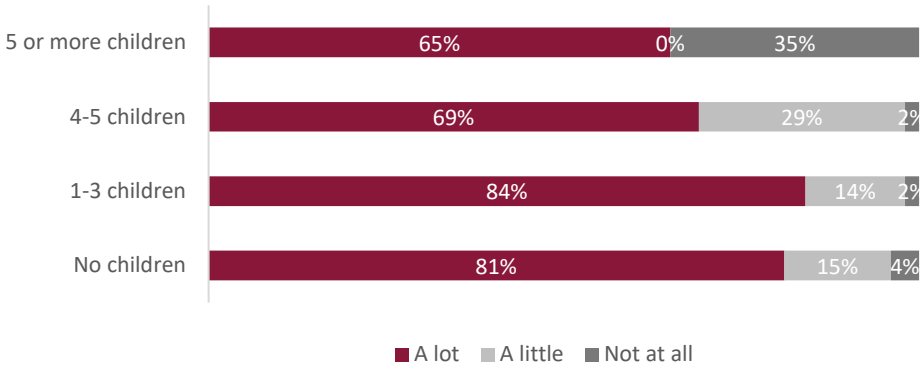

When considering age, there was general agreement among older respondents about the positive impact of public awareness campaigns. For instance, respondents aged 35–44**,** 45–54, and 55 and older were overwhelmingly in favor, with 83%, 81%, and 79%, respectively, stating that these campaigns improved air quality by "a lot." Younger respondents aged 18–24 also largely agreed, with 80% sharing this view. However, respondents aged 25–34 showed the lowest agreement, with only 76% believing that public awareness campaigns improved air quality "a lot." Notably, this group also had the highest proportion (8%) of respondents who felt that public campaigns had no impact on air quality. By contrast, only 5% of those aged 55 and older shared this view, with minimal percentages among other age groups: 1% for both the 18–24 and 45–54 age groups and 0% for the 35–44 age group. These findings indicate significant variations in perceptions of the effectiveness of public awareness campaigns, particularly among younger and middle-aged respondents. Whereas older respondents were generally more confident in campaigns' effectiveness, the 25–34 age group were more skeptical, reflecting a potential need for tailored communication strategies to address their concerns (see Figure 29).

**Figure 29. Perceptions of public awareness campaigns impact on air quality by age group**




Finally, there was a clear relationship between the number of children respondents had and their perceptions of the effectiveness of public awareness campaigns ($p$ = 0.009). Respondents with 1–3 children (84%) or no children at all (81%) perceived public awareness campaigns to be more effective than respondents with 4–5 children (69%) or more (65%). Notably, 35% of respondents with more than five children perceived that public awareness campaigns did "not at all" improve air quality, compared to much lower rates among those with 4–5 children (2%), 1–3 children (2%), and no children (4%) (see Figure 30). This suggests that those with larger families may be more critical or less engaged in such initiatives.

**Figure 30. Perceptions of the impact of public awareness campaigns on air quality by number of children**



## Policy Recommendations

Given the health effects of indoor pollution, numerous strategies have been created to either reduce pollution levels or adapt through innovative technologies. These include environmentally friendly infrastructure, building practices, and energy solutions. The results of this study suggest several initial policy recommendations, as stated below.

- *National standards of IAQ*: Stricter IAQ norms and regulations should be pursued to address the issue of indoor air pollution, and these should be accessible to the general population on various governmental platforms. The IAQ guidelines must be formulated to include traditional, current, and future sources of indoor pollution generated by new technologies or materials used in offices, schools, private residences, and other community spaces.
- *Implementation of Standards*: To promote the application of IAQ guidelines and norms, policy makers should explore avenues for advancing strategies that could include awareness initiatives, formative and educational programs and accessible regulatory frameworks.
- *Comprehensive research*: In Qatar, the scarcity of toxicological data on indoor air pollutants represents an obstacle to developing operative IAQ guidelines. Future studies supported by both governmental and private institutions should be conducted, focusing on the effects of indoor contaminants not only on the general population but also on distinct population segments, such as children and elderly people. Assessing the exposure and identifying the health effects associated with exposure to indoor pollutants will help formulate strategies to decrease the negative effects of indoor living environments on the wellbeing and health of the population. Moreover, dynamic conditions such as climate changes that involve rising temperatures and humidity levels, should be addressed in future research studies as adaptability and responsiveness to these dynamic conditions are key factors in advancing adequate and effective IAQ guidelines.
- *IAQ monitoring:* Given the active nature of indoor environments, IAQ monitoring in real time should be intensified. Frequently measuring and monitoring indoor air quality in real time will help determine the various indoor pollutants that people are exposed to and identify the pollution levels within the indoor space.
- *Source management:* Preventive measures include removing sources of indoor pollution. Consequently, strategic approaches should set a number of limitations in order to protect people. For instance, in the case of tobacco smoke, the designation of certain areas where

smoking is allowed can reduce pollution. Gas stoves can be adjusted to decrease emissions. Use of scented candles, bukhoor, toxic cleaning products, etc., should be reduced, eliminated, or replaced with more natural options.

- *Fostering private sector responsibility*: Governmental programs should support the manufacturing and commercialization of environmentally safe commercial products by offering government-approved labels. For instance, cleaning products could have an approved level of toxicity, and companies could be offered incentives to use non-toxic ingredients.
- *Air cleaners/filtration:* Air cleaners and air filters can help remove harmful particles and allergens from indoor spaces. Technologically advanced air filter systems are widely available. In addition, houseplants have been shown to reduce levels of pollutants in homes and offices.
- *Ventilation:* Home cooling systems and air cleaners do not mechanically bring fresh air into the house. Hence, opening windows and doors when the weather permits, increases the outdoor ventilation rate and helps remove or dilute indoor airborne pollutants coming from indoor sources.
- *Using indoor plants:* Indoor plants can improve air quality and reduce airborne pollution by removing pollutants through phytoremediation and controlling temperature through evaporation and transpiration. Snake plants and Areca Palm are some of the most effective plants for this purpose.
- *Fragrance-free personal care products:* Personal care products such as perfumes and cosmetics that are fragrant are known to emit hazardous compounds and impact indoor air quality. Using fragrance-free alternatives reduces such harmful emissions and enhances air quality.
- *A significant proportion of the respondents reported suffering from sewage and toilet emissions, which raises the need for government intervention about the optimal management of sewage systems in Qatar.*

# SURVEY METHODOLOGY

The survey on Indoor Air Quality took place between January 31 and March 4, 2024. Using a nationally representative wireless telephone sample, SESRI interviewed 665 adults (18 years of age or older), including 308 higher-income expatriate workers and 357 Qatari nationals. The survey was conducted using a Computer Assisted Telephone Interviewing (CATI) system. In this report, we detail the methodological procedures related to data collection, including sampling, questionnaire development, pretesting, field procedures, data cleaning and weighting, and analysis.

## Study population

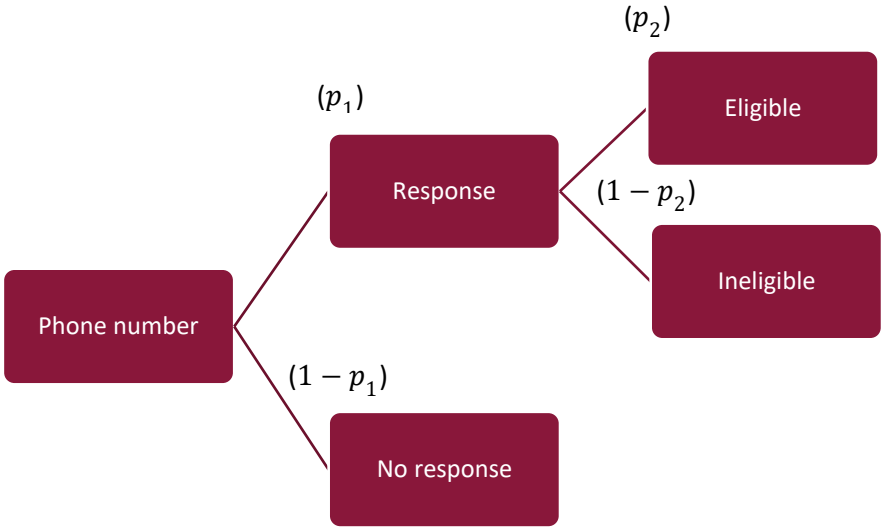
Like other countries in the Arab Gulf region, Qatar's residential population is divided into three distinct groups: citizens, white-collar expatriates, and blue-collar expatriates. The "white-collar" expatriate group encompasses individuals typically engaged in professional, managerial, teaching, or administrative roles, usually in an office, cubicle, or other administrative settings. The "blue-collar" residents consist of labor migrants working in construction, security, customer service, public-facing sales, transportation, household assistance (where they live with a family), or other service-oriented jobs. For this study, the target population was limited to adult Qatari nationals and white-collar expatriates living in Qatar during the survey reference period.

## Sample design

In Qatar, the vast majority (98%) of adults have access to at least one cell phone, irrespective of their work-related status or living arrangements. Accordingly, a wireless sample survey is expected to provide excellent coverage for this target population. Working with local cell phone providers in Qatar, SESRI developed a cell phone frame suitable for the survey. To determine eligibility, screener questions asked if the respondent was a Qatari national and, if not, whether they earned 5,000 QAR or more per month (the white-collar expatriate cutoff). This cutoff is based on data from prior phone and field surveys, which determined that this income level most closely matched the division for the same population when interviewed in person. A prior screener had already ensured that all participants were 18 years of age or older and resided in Qatar during the survey reference period.

In a phone survey, the result (or disposition) from dialing a phone number can be described in two stages. First, a call either receives a response or no-response (e.g., non-working or disconnected numbers, immediate hang up or call refusal) from the dialing. Then, in the second stage, a phone number that does receive a response can be identified as either eligible or ineligible (e.g., blue-collar expatriates, non-resident, under 18 years old) as shown in Figure 31.

**Figure 31. Dialing result (phone number states and probabilities)**




According to Figure 1, there are three possible states for a phone number. A phone number can be (1) an eligible person for the survey, (2) an ineligible person, or (3) a phone number with no-response. Since we do *not* know the state of a phone number prior to the survey (prior to dialing), the sampling process is conducted while the state of the phone number is unknown. Accordingly, a simple random sampling (SRS) can be inefficient and associated with high survey cost as a large number of sampled phone numbers may end up in ineligible or no-response states.

Based on the sampling literature originally developed to target rare populations (e.g., racial or ethnic minorities, low-income households), SESRI has developed a sampling process to address this issue. First, using previous phone surveys, in which the states of the phone numbers have been identified after dialing, we apply two-stage (or nested) logistic regressions corresponding to Figure 1. In the first stage regression, the dependent variable is response or no-response, and in the second stage regression, the dependent variable is eligible or ineligible. For both regressions, the independent variables are derived from auxiliary information. Following these regressions, the probabilities $p_1$ and $p_2$ in Figure 1 can be calculated as follows:

$$p_i = \frac{e^{x_i\beta_i}}{1+e^{x_i\beta_i}}$$

where $i$ is 1 or 2, $x_i$ is a vector of independent variables, and $\beta_i$ is a vector of estimated coefficients from the nested logistic regressions.

The probability for each state is the product of these two probabilities; that is, $p_1 p_2$ for eligible, $p_1(1-p_2)$ for ineligible, and $1-p_1$ for non-response. Since the independent variables are derived from the auxiliary information, these probabilities can be extrapolated to all phone numbers in the frame. In other words, for every phone number in the frame, we can calculate its probability of belonging to state 1, 2, or 3.

Next, using these probabilities, we divide the frame into five strata in descending order of probability. The first stratum includes phone numbers most likely to be eligible while the last stratum consists of phone numbers least likely to be eligible (most likely including ineligibles and no-responses).

Finally, we construct a disproportionate stratified sample from these strata. The disproportionate allocation is important to achieve efficiency whereby a higher sampling fraction is applied to the stratum with a higher probability of eligibility. With this allocation, we can reduce the survey cost because the sample is more likely to contain eligible phone numbers. In fact, we can achieve an optimal allocation of the sample into these strata by solving the optimization problem in which the objective function is the variance of an estimated mean $Var(\bar{Y})$ and the constraint is the survey cost. The optimal sampling fraction derived from this optimization is:

$$f_h \propto \sqrt{\frac{P_h}{P_h(c-1)+1}}$$

where $P_h$ is the proportion of the eligible phone numbers in stratum $h$, and $c$ is the ratio of data collection costs for eligible phone numbers relative to ineligible phone numbers. Further details of this optimization problem and its solution can be found in Kalton (2009), Chen and Kalton (2010), and Barron et al (2015).

## Questionnaire development

Following a review of the literature, including the relatively few studies from the Arabian Gulf region, the research team designed a survey instrument that accounted for both the research requirements and the mode of implementation. When conducting a survey by phone, factors such as cognitive load, attention span, and human memory must be taken into account. Accordingly, the survey instrument was kept to a reasonable length, with questions and response options designed to minimize or mitigate potential recency effects.

The final survey instrument included questions about demographic characteristics (e.g., education, gender, employment, age, nationality, and income), respondent awareness of indoor pollution sources, the types of pollutants found in respondents' homes, the frequency of use of potential pollutant agents, and any health-related symptoms associated with indoor pollution.

Respondents were also asked to indicate their level of agreement with various strategies and policies intended to alleviate indoor pollution.

The questions were initially developed in English and then translated into Arabic by professional translators. The translation was carefully checked by researchers fluent in both languages. Next, the questionnaire was tested internally at SESRI. This step allowed the project team to gauge whether respondents could understand and answer the questions and to identify any concerns that might affect responses. The adjusted questionnaire was then programmed into a CATI (Computer Assisted Telephone Interview) system using BLAISE, a powerful and flexible software issued by Statistics Netherlands.

After debugging the programmed instrument and making any necessary revisions based on SESRI's internal testing, a pretest using a small probability sample was conducted. The purpose was to verify that the questions were understood as intended, that respondents were engaged with the questionnaire, and that the survey length was acceptable. The pretest helped the researchers refine question wording, response categories, introductions, transitions, and interviewer instructions, as well as shorten the overall interview length.

## Survey Administration

The survey was administered using a Computer Assisted Telephone Interviewing (CATI) system. This technology automates skip logic, randomization, callback management, and error checking to reduce mistakes and record data accurately and efficiently. Interviewers are trained on the effective use of the CATI system. SESRI is strongly committed to equipping interviewers with proper interviewing techniques, field procedures, and an understanding of the fundamentals of academic survey research. This comprehensive training ensures the highest quality of data collection. We achieve this through continuous interviewer training, robust support during field production, strict adherence to quality through monitoring protocols, and real-time evaluation of interviewing activities using advanced technology. Every interviewer receives general training on standard, fully structured academic interviewing protocols, hands-on training on the effective use of the CATI system, and project-specific preparation before each survey. These sessions delve into academic survey research interviewing fundamentals, standard protocols for assigning case dispositions, and practical phone interview exercises.

Throughout the data collection phase, SESRI's call center implements a stringent monitoring protocol. This includes supervisory oversight in the calling lab, audio and video monitoring, and statistical analysis of interviewer behavior using both survey data and paradata (such as time per question, movement within the questionnaire, path and branching behavior, and disposition selection). These measures help ensure that questions are asked correctly and that responses are accurately recorded by interviewers.

The phone numbers in the sample were released for interviewing in batches to ensure that the complete call procedures were followed for all numbers. For every phone number in the sample, respondents were called multiple times during different times of the day and on different days of the week to maximize the chances of making contact. For phone numbers with a break-off or a soft refusal, dedicated interviewers attempted to convert them to

completed interviews. The following table shows the disposition of all dialed phone numbers during this survey.

**Table 6. Calling dispositions**

| Disposition | Freq. |
|---|---|
| Completed | 665 |
| Not completed | 5285 |
| Eligible | 1632 |
| Ineligible | 2960 |
| Unknown eligibility | 693 |
| Raw response rate (RR1) | 22.2% |
| Adjusted response rate (RR2) | 25.6% |

On the basis of Table 6, the response rates were calculated using a standardized coding and interpretation procedure for different calling dispositions, as set by the American Association for Public Opinion Research (AAPOR 2023). Completed responses included those who finished the entire survey questionnaire. Those who did not complete the survey interview were divided into three categories: eligible numbers ("eligible"), ineligible numbers ("ineligibles"), and numbers with unknown eligibility ("unknowns"). Eligibles included Qatari nationals and white-collar expatriates who refused to participate in the study and those who agreed to an appointment but the appointment was not fulfilled upon follow-up. Partial interviews (i.e., respondents who completed part of the interview) were also counted as eligibles. For this study, ineligibles consisted primarily of blue-collar expatriates and individuals under 18 years old. Unknowns consisted of phone numbers with no answer. Those who immediately refused to participate, and whose eligibility could not be determined by the interviewer, were also included in this category.

We report two response rates in the last two rows of Table 6. First, the raw response rate is the ratio of the number of completed interviews to the total sample size after excluding ineligibles: RR1=C/(C+E+UE) where C is the number of completions, E is the number of eligible responses, and UE is the number of unknown eligibility. Second, the adjusted response rate is RR2=C/(C+E+eUE) where e is the estimated proportion of eligibilities which is given by this expression e=(C+E)/(C+E+IE) where IE is the number of ineligibles.

With the numbers of completed interviews presented in Table 6, the maximum sampling error for a percentage is approximately 5%. This calculation of the sampling error takes into account the design effects. One possible interpretation of sampling errors is: if the survey were conducted 100 times using the exact same procedures, the resulting estimates would include the "true population value" within their margins of error in about 95 of those 100 surveys. Note that sampling errors can be calculated in this survey since the sample is based on a sampling scheme with known probabilities.

## Calculation of data weights

Following data collection, we calculate a weight for each completed response. There are three components in this calculation: (1) the base weights reflecting the sample selection probability, (2) the adjustment factors to account for the non-response, and (3) the calibration to align the survey results with known population parameters. Additionally, we employ weight trimming, since highly variable weights can introduce undesirable variability in statistical estimates.

First, the base weights are the inverse of the selection probability for each sampled unit. Because we used disproportionate sampling (as described in the sample design), these selection probabilities are needed to ensure unbiasedness in the analysis. Formally,

$$W\_base=1/p$$

where W_base is the base weight for the phone number, p is its probability of selection.
Second, assuming that responding and non-responding units are essentially similar with respect to key survey variables and the subject of the investigation, the base weights can be adjusted for non-response by this formula:

$$W=\alpha W\_base$$

where $\propto$ is called the adjustment factor for non-response, which is derived from the estimated propensity of a sampled unit to respond to the survey.

Third, calibration is used to align the weighted survey results with population parameters. This adjustment can help reduce effects of non-response and under-coverage in the sampling frame. SESRI uses a "raking" method in the calibration to adjust the weights of the completed responses, ensuring that the proportions of the adjusted weights for specific characteristics (such as marital status, gender, and age groups) match the corresponding proportions in the population.

## Data Management

After data collection, all individual interviews were merged and saved into a single BLAISE data file. In compliance with the standards set by Qatar University's Institutional Review Board (IRB) and best practices in academic survey research, we removed all identifying information, such as telephone numbers, from the dataset to preserve confidentiality. We then cleaned, coded, and converted this anonymized dataset into the STATA (Statistical Software for Data Science) format. Having weighted the final responses to adjust for the probability of selection and non-response as detailed above, we undertook univariate, bivariate, and multivariate analyses.

# References

AAPOR Standard Definitions 10th edition (2023) https://aapor.org/wp-content/uploads/2023/05/Standards-Definitions-10th-edition.pdf

Barron, M. et al. 2015. Using auxiliary sample frame information for optimum sampling of rare population. Journal of Official Statistics.

Chen, S. and G. Kalton. 2010. Geographic oversampling for race/ethnicity using data from the 2010 US population census. Journal of Survey Statistics and Methodology.

Elliott, M. et al. 2013. Using indirect estimates based on name and census tract to improve the efficiency of sampling matched ethnic couples from marriage license data. Public Opinion Quarterly.

Goodman, N., & Nematollahi, N. (2022). Fragranced Consumer Products as Sources. In Handbook of Indoor Air Quality (pp. 129–161). Springer Nature Singapore. https://doi.org/10.1007/978-981-16-7680-2_14

Kalton, G. 2009. Methods for oversampling rare subpopulations in social surveys. Survey Methodology.

Kim, J., et al. 2014. Surname Sampling: Reevaluating Kim Sampling in Korea and the United States. Field Method.

Lee, W., Vo, T., Wee, Y., Chiang, C., Chi, C., Chen, L., Hsu, F., Fang, L., Lee, H., Guo, E., Cheng, C., & Lee, T. (2021). The Adverse Impact of Incense Smoke on Human Health: From Mechanisms to Implications. *Journal of inflammation research*, *14*, 5451–5472. https://doi.org/10.2147/JIR.S332771

Lygdopoulos, S. J. (2023). The Beautiful Game Blackened by its Carbon Footprint? The 2022 FIFA World Cup in Qatar. *Essex Student Journal*, *14*(S1).

Patricia A. Gwartney, The Telephone Interviewer's Handbook: How to Conduct Standardized Conversations. Jossey-Bass, 2007)

Potter, F. (1990). A Study of Procedures to Identify and Trim Extreme Sampling Weights. Proceedings of the Section on Survey Research Methods, American Statistical Association, 1990, 225-230.

Sanchez, N. et al. 2009. Health care utilization, barriers to care, and hormone usage among male to female transgender persons in New York City. Medical Journal of Public Health.

Selvan, N., Balasubramani, G., & Pradeep John, P. (2023). Systemic Review on Indoor Plants as an Alternative Technique for Reducing Indoor Air Pollutants. Journal of Xidian University, 17(11), 1074–1083. https://doi.org/10.37896/jxu17.11/092.

Substantial Improvement in Qatar's Air Quality as People Stay Indoors - Marhaba Qatar. Accessed September 8, 2022. https://www.marhaba.qa/substantial-improvement-in-qatars-air-quality-as-people-stay-indoors.

U.S. Environmental Protection Agency. 1989. Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C. Washington, DC. Indoor Air and Coronavirus (COVID-19) | US EPA online source-2024.

Varedian M. and G. Forsman (2003), "Comparing propensity score weighting with other weighting methods: A case study on Web data" In Proceedings of the Section on Survey Statistics, American Statistical Association; 2003, CD-ROM

Waksberg, J. et al. 1997. Geographic-based oversampling in demographic surveys of the United States. Survey Methodology.

Wang et al., 2020, C. Wang, P.W. Horby, F.G. Hayden, G.F. Gao-A novel coronavirus outbreak of global health concern.Lancet, 395 (2020), pp. 470-473

World Health Organization. (n.d.). *International classification of diseases for mortality and morbidity statistics (11th Revision)*. World Health Organization. https://www.who.int/publications/i/item/9789240034228

Wu, T., MüllerT., Wang, N., Byron, J., Langer, S., Williams, J., & Licina, D. (2024). Indoor Emission, Oxidation, and New Particle Formation of Personal Care Product Related Volatile Organic Compounds. Environmental Science & Technology Letters.

# APPENDICES

## Questionnaire

# INDOOR AIR POLLUTION IN QATAR

## QUESTIONNAIRE

2023

Social and Economic Survey Research Institute (SESRI)
Qatar University, P.O. 2713
Doha, Qatar
Tel: + (974) 403 3020
Fax: + (974) 403 3021
Email: sesri@qu.edu.qa

**[PROGRAMMER: THIS SECTION IS FOR BOTH QATARI AND WHITE-COLLAR EXPATRIATES]**

## INTRODUCTION

{Q: STUDYINTRO}
Many indoor and outdoor air pollutant sources affect indoor air quality. However, while information about outdoor air pollutants is available, information on indoor air pollutant sources remains scarce. The study aims to raise awareness about common potential air pollutants and to provide strategies to mitigate pollutant concentrations in indoor environments.

{Q: INTRO}
*Good morning/afternoon/evening,*
*Qatar University's Social and Economic Survey Research Institute is conducting a survey about indoor air quality in Qatar. You have been selected at random to be part of our sample. Your assistance will help all residents of Qatar to better understand how we can improve our living spaces.*
*My name is ___ and if you have no questions, we can get started!*

*INTERVIEWER, AS NEEDED:*
*Any information obtained here will be treated strictly confidentially, and your name will not be printed or used in any documents. The results from the analysis of these data will be presented only in summary statistics in which no individual can be identified. Please note that your participation is voluntary, you can skip any question you do not want to answer, and you can also stop the interview at any time you want.*
{Q: REINTRO}
PROGRAMMER, IF COMPLETING AN INTERVIEW ALREADY STARTED:
*Good morning/afternoon/evening, Qatar University's Social and Economic Survey Research Institute is conducting a survey regarding Qatar's indoor air quality. We started this survey with you but were unable to complete it at the time. Would this be a good time to talk?*

**PROGRAMMER: PLEASE RECORD LANGUAGE OF INTERVIEW FROM BLAISE / NOTE: ALL QUESTIONS HAVE DON'T KNOW/REFUSE OPTIONS EVEN WHEN OMITTED IN SPECIFICATIONS BELOW**

{Q: SAFE}
For your safety, if you are currently doing anything that would require your full attention, such as driving or operating heavy equipment, then I'll need to call you back at a time convenient for you.
*INTERVIEWER, IF RESPONDENT SEEMS TO BE IN SITUATION WHERE CANNOT HEAR CLEARLY OR SPEAK WITHOUT INFLUENCE FROM OTHERS, ASK:*
Are you able to answer questions without distraction and in conditions that comfortable to you?

1 GO ON
2 R CALLBACK
8 DON'T KNOW
9 REFUSED

{Q: CONFIRM}
Second, I need to confirm that you are at least 18 years of age and live in the State of Qatar.
[IF NECESSARY SAY: Your answers are confidential, and we don't use anybody's name.]

1 R IS RESIDENT ADULT, PROCEED
2 R IS NOT ADULT
3 R IS NOT QATAR RESIDENT

IF ANSWER>1 SKIP TO INELIG
IF ANSWER = DON'T KNOW / REFUSED SKIP {Q: SALREF}

PROGRAMMER: CONFIDENTIALITY ON SEPARATE TAB, ALWAYS AVAILABLE
{Q: CONFDNTL}

Before we begin, let me reassure you that the survey is voluntary and results from the survey will be presented as statistical summaries in which no individual can be identified, and you may choose not to answer any question at any time. If you have no further questions, let's get started!

IF NECESSARY: We are calling from Qatar University. This is an important study we conduct on a regular basis to track public opinion.

IF ASKED: The survey will take about 15 minutes depending on your answers and you can complete it in several parts if you need to leave at any time. All of your answers will be saved and we'll resume right where you left off at a time that is convenient for you.

IF NECESSARY: SOCIAL UTILITY MESSAGE:
The Social and Economic Survey Research Institute is a research unit of Qatar University providing scientifically valid survey research in Qatar and the region. We are subject to oversight by an institutional review board and comply with the standards of the survey research profession worldwide. We do not report any individual answers, and strictly protect your confidentiality. In addition, we randomly select respondents so that everyone has an equal chance of selection. Your participation is very important to provide the perspective of other people just like you. By answering a few questions you can make this study more representative and therefore have more impact.

1 GO ON
2 R CALLBACK

## DEMOGRAPHICS PROFILE

**PROGRAMMER: RETRIEVE RESPSAMPLE FROM THE SAMPLE. INITIALIZE RESPTYPE=0.**

{Q: CITIZEN}

Are you Qatari or a non-Qatari?

1 YES, QATARI CITIZEN
2 NO, NOT QATARI CITIZEN
3 HAS TEMPORARY QATARI "MISSION" PASSPORT
9 REFUSED

{Q: CHECKCIT}

***IF CITIZEN = 1 AND RESPSAMPLE < > 1 ASK***

INTERVIEWER: FOR CLARIFICATION PURPOSE, ASK: Do you have a Qatari passport?

1 HAVE QATARI PASSPORT
2 DON'T HAVE QATARI PASSPORT
3 HAS TEMPORARY QATARI "MISSION" PASSPORT
8 DON'T KNOW
9 REFUSED

***IF CITIZEN OR CHECKCIT=1, SET RESPTYPE=1***
***IF CITIZEN OR CHECKCIT=1, SKIP TO GENDER***

{Q: INCO2}

Do you yourself - or if you have a spouse or immediate family with you here in Qatar - do all of you together make more than 5,000 QAR per months with your monthly salary?

1 LESS THAN 5,000 QATARI RIYALS PER MONTH OR
2 5,000 QATARI RIYALS OR MORE PER MONTH?
9 REFUSED

***IF INCO2=1, SET RESPTYPE=3***
***IF INCO2=1, SKIP TO INELIG***
***IF INCO2=2, SET RESPTYPE=2***
***IF ANSWER = REFUSED SKIP {Q: SALREF}***
(Resptype=1: Qataris; Resptype=2: Higher income expats; Resptype=3: Ineligible)

{Q: NATIONALITY}

***IF CHECKCIT>1, ASK***

What is your nationality [PROGRAMMER: USE DIGITAL NUMBER FOR COUNTRY] Would you please tell me the country code of your phone that you use?

ENTER NUMBER FROM YOUR COUNTRY CODE LIST. IF YOU CANNOT FIND IT ENTER '9997' AND WRITE OUT THE COUNTRY NAME. CONFIRM SPELLING WITH RESPONDENT.

| | | | | | |
|---|---|---|---|---|---|
| 20 | EGYPT | 967 | YEMEN | 98 | IRAN |
| 91 | INDIA | 216 | TUNISIA | 880 | BANGLADESH |
| 963 | SYRIA | 249 | SUDAN | 1 | UNITED STATES |
| 962 | JORDAN | 92 | PAKISTAN | 101 | CANADA |
| 63 | PHILIPPINES | 966 | SAUDI ARABIA | 9997 | NOT ON PAPER LIST |
| 961 | LEBANON | 94 | SRI LANKA | 9998 | DON'T KNOW |
| 970 | GAZA STRIP/WEST BANK | 44 | UNITED KINGDOM | 9999 | REFUSED |

{Q: NATIONCONF}

***IF NATIONALITY > 0 & < 9998, ASK***

INTERVIEWER: IS THE COUNTRY NAME DISPLAYED CORRECT?
READ IT BACK TO THE RESPONDENT AND CONFIRM. AFTER CONFIRMING SELECT 1 TO CONTINUE. IF NOT CORRECT GO BACK AND SELECT THE CORRECT COUNTRY FROM YOUR LIST.

{Q: GENDER}

**[ENTER REPONDENT'S GENDER]**

IF UNCERTAIN, SAY: The computer requires you to tell me your gender.

3 MALE
5 FEMALE

{Q: AGE1}

In what year were you born?

_____

8. DON'T KNOW
9. REFUSED

{Q: AGE2}

**If AGE1=8 OR 9, ASK**

What is your age range?

1. 18 – 24 years
2. 25 - 34 years
3. 35 - 44 years
4. 45 - 54 years
5. 55 - 64 years

6. 65 years or more
8. DON'T KNOW
9. REFUSED

{Q: EDU}

What is the highest level of education you completed?
INTERVIEWER: PROBE FROM RESPONSE, READ ONLY IF NECESSARY

1. PRIMARY (1-6)
2. PREPARATORY (7-9)
3. SECONDARY (10-12)
4. POST SECONDARY VOCATIONAL TRAINING
5. DIPLOMA (LESS THAN 2 YEARS PROGRAM)
6. BACHELOR'S DEGREE (4 YEAR PROGRAM)
7. MASTER'S DEGREE OR PROFESSIONAL DEGREE (J.D., M.D., etc.)
8. DOCTORATE DEGREE (Ph.D., Ed. D)
9. NEVER ATTENDED SCHOOL
10. OTHER (SPECIFY)

98. DON'T KNOW
99 REFUSED

{Q: MARITAL}

What is your current marital status?

1. Married
2. Separated
3. Divorced
4. Widowed
5. Never married
8. DON'T KNOW
9. REFUSED

{Q: CHILD}

***IF MARITAL< 5, ASK***

How many children under 12 years old do you have?
1. Specify the number _____
2. Don't have kids
8. DON'T KNOW
9. REFUSED

{Q: WORK}

What is your current employment status?
[INTERVIEWER: PAUSE AND READ IF NECESSARY. PROBE FROM RESPONSE]
[INTERVIEWER: IF SAYS 'I OWN A BUSINESS OR AM SELF-EMPLOYED', ASK: "Is that full time or part time?"]

1 FULL-TIME EMPLOYED
2 PART-TIME EMPLOYED
3 UNEMPLOYED, SEEKING WORK
4 UNEMPLOYED, NOT SEEKING WORK
5 STUDENT
6 HOMEMAKER OR HOUSEWIFE
7 RETIRED
8 UNABLE TO WORK
9 OTHER (SPECIFY)
98 DON'T KNOW

99 REFUSED

## Section 1: Awareness of Indoor Air Pollution

Q: {INDOPOLLU}

**IF RESPONSE=2, 8 and 9 END SURVEY**

Most people know about outdoor air pollution; do you think there is also pollution inside houses (indoor air pollution) in Qatar?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

{INDOSOURCES}

**[PROGRAMMER: ONLY THREE CHOICES ARE POSSIBLE]**
**IF INDOPOLLU=1, ASK**

There are various sources of indoor air pollution. I'll read a list of possible sources. Please tell me which are the three most common sources in your home?

1. Use of scented candles
2. Use of incense, like bukhoor
3. Use of air conditioners
4. Cooking inside the house
5. Use of cleansers and sanitizers
6. Smoke emitted from cigarettes and shisha
7. Sewage emissions inside the house
8. Outdoor pollution sources (dust, exhaust fumes etc.)
9. OTHER [SPECIFY]
98. DON'T KNOW
**99.** REFUSED

Q: {POLSEVERE}

**[PROGRAMMER: THE RESPONDENT CAN CHOOSE MORE THAN ONE OPTION]**

INTERVIEWER: READ THE OPTIONS, THE RESPONDENT CAN CHOOSE MORE THAN ONE OPTION

Which of the following climate factors do you think could increase the negative effects of indoor air pollution?

1. High humidity
2. High temperature
3. Low temperature
8. DON'T KNOW
9. REFUSED

Q: {PETS}

Do you have any pets living indoor?

1. YES
2. NO

Q: {PETSPOL}

***IF PETS = 1, ASK***

Do you think that having pets indoor can negatively affect the quality of the indoor air?

1. YES
2. NO
8. DON'T KNOW

9. REFUSED

Q: {OPENFREQ}

How often do you open windows or doors for natural ventilation?

1. Daily
2. Weekly
3. Monthly
4. Never
8. DON'T KNOW
9. REFUSED

Q: {INSMOKE}

Do you or anyone of the household members smoke cigarettes or shisha inside the home?

1. Only you
2. One of your family members
3. More than one of your family members
4. Nobody is smoking inside the home
8. DON'T KNOW
9. REFUSED

Q: {IAQSMOKE}

**IF INSMOKE=1, 2, 3, ASK**

In your opinion, do you think that smoke contributes to indoor air pollution?

1. Yes
2. To some extent
3. No
8. DON'T KNOW
9. REFUSED

Q: {NEGEFFECT}

In your opinion, which of the following sources has the most negative effect?

1. Smoke
2. Incense (bukhoor)
3. Scented candles
4. ALL OF THE ABOVE
98. DON'T KNOW
99. REFUSED

Q: {USESCENT}

Do you or any member of your household use scented candles?

1. Always
2. Sometimes
3. Never
8. DON'T KNOW
9. REFUSED

Q: {SCENTFREQ}

**[PROGRAMMER: SELECT ONLY ONE CHOICE]**

**IF USESCENT=1, 2 ASK**

How frequently do you use scented candles?

1. Once a day
2. Many times during the day
3. Once a week
4. Many times during the week
5. Monthly
8. DON'T KNOW

9. REFUSED

**IF USESCENT=3, SKIP**

Q: {SCENTUSAGE}

Do you think that candle usage has recently increased, especially after the Covid-19 pandemic?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

**IF SCENTUSAGE = 1, ASK**
**PROGRAMMER: MULTIPLE CHOICES ARE POSSIBLE**

Q: {SCENTUSAGE1}

Which reasons do you think explain this increase in candle usage:
INTERVIEWER: READ ITEMS IN PARENTHESES ONLY IF NECESSARY
MULTIPLE CHOICES ARE POSSIBLE

1. Individual beliefs (E.G. YOGA OR MOOD ENHANCEMENT)
2. Cultural and traditional practices
3. Home decoration
4. Desire to maintain home freshness

8. DON'T KNOW
9. REFUSED

Q: {USEINCENSE}

Do you or any member of your household use incense (bukhoor)?

1. Always
2. Sometimes
3. Never
8. DON'T KNOW
9. REFUSED

Q: {INCENSEFREQU}

**[PROGRAMMER: SELECT ONLY ONE CHOICE]**
**IF USEINCENSE=1, 2 ASK**

How frequently do you use incense (bukhoor)?

1. Once a day
2. Many times during the day
3. Once a week
4. Many times during the week
5. Monthly
8. DON'T KNOW
9. REFUSED

**IF USEINCENSE=3, SKIP**

Q: {INCENUSAGE}

Do you think that incense (bukhoor) usage increased during the Covid-19 pandemic?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

Q: {INCENREASON}

IF ***INCENUSAGE=1, ASK***
**PROGRAMMER: MULTIPLE CHOICES ARE POSSIBLE**

INTERVIEWER: READ ITEMS IN PARENTHESES ONLY IF NECESSARY
MULTIPLE CHOICES ARE POSSIBLE

Which reasons do you think explain this increase in incense (bukhoor) usage:

1. Individual beliefs (E.G. HEALING OR HEALTH REASON)
2. Cultural and traditional practices
3. Home decoration
4. Diversification of home fragrances
5. Desire to maintain home freshness
8. DON'T KNOW
9. REFUSED

## Section 2: Diseases caused by indoor air pollution

Q: {INTRO_POLLUTION2}

Indoor air pollution can cause many types of diseases. In this section, we would like to know if you have experienced any of these symptoms.

Q: {GENSYMPTOMS}

**[PROGRAMMER: MULTIPLE CHOICE possible, and RANDOMIZE ITEMS 1 THROUGH 12]** INTERVIEWER: READ THE OPTIONS, RESPONDENT CAN CHOOSE MORE THAN ONE

Have you experienced any of the following symptoms in the last three years?

1. Difficulty breathing (more than once a month)
2. Dry cough at night
3. Whistling while breathing
4. Frequent headaches
5. Dizziness (more than once a month)
6. Itchy and dry eyes
7. Irritation or itchiness of the skin
8. Itchy nose
9. Itchy throat
10. General body fatigue
11. Insomnia
12. OTHER SYMPTOMS (SPECIFY)
13. NONE OF THE ABOVE
98. DON'T KNOW
99. REFUSED

Q: {SYMINCREASE}

**IF GENSYMPTOMS=1-12, ASK**

Based on your answer, do you believe that indoor air pollution has increased and exacerbated any of those symptoms?

1. YES
2. NO
8. DON'T KNOW
9. REFUSED

Q: {DISEASES}

**[PROGRAMMER: MULTIPLE CHOICE POSSIBLE, AND RANDOMIZE ORDER]** INTERVIEWER: READ THE OPTIONS, THE RESPONDENT CAN CHOOSE MORE THAN ONE OPTION

Have you been diagnosed with any of the following health conditions?

1. Asthma
2. Chronic bronchitis
3. Nasal sinusitis
4. Acute pneumonia
5. Lung cancer
6. Stroke
7. Chronic heart failure
8. Chronic pulmonary embolism
9. OTHER SYMPTOMS (SPECIFY)
10. NONE OF THE ABOVE

98. DON'T KNOW
99. REFUSED

**Section 3: Relationship between Indoor Air Pollution and Outdoor Air Pollution**

Q: {INTRORELATIONSHIP}

Now, we will read some statements about the relationship between indoor and outdoor air pollution.

Q: {AIRIMPACT}

Which statement best describes your point of view regarding the impact of indoor and outdoor air quality on your quality of life in Qatar?

1. Outdoor air quality has a greater impact on my quality of life
2. Indoor air quality has a greater impact on my quality of life
3. Indoor and outdoor air quality have the same effect on my quality of life.
4. Neither indoor air quality nor outdoor air quality has any effect on my quality of life

98. DON'T KNOW
99. REFUSED

Q: {AIRQSCALE4}

Overall, would you describe the air quality in Qatar as very good, somewhat good, somewhat bad, or very bad?

1. Very good
2. Somewhat good
3. Somewhat bad
4. Very bad
5. SEVERE HEALTH HAZARD
6. NEITHER GOOD NOR BAD – NEUTRAL (VOLUNTEERED)

8. DON'T KNOW
9. REFUSED

## Section 4: Strategies and Actions to reduce indoor air pollution

Q: {STRATEGIES}

**[PROGRAMMER: ALLOW THREE CHOICES ONLY]**

In the following statements, I will read to you some strategies and we would like to know if it might improve air quality a lot, a little or not at all:

| Items | Varnames |
|---|---|
| 1. Cultivating plants that reduce indoor air pollution | {STRATEGIES1} |
| 2. Using technology and indoor air pollution reducers | {STRATEGIES2} |
| 3. Minimizing the use of incense (bukhoor) as much as possible | {STRATEGIES3} |
| 4. Minimizing the use of scented candles | {STRATEGIES4} |

| | |
|---|---|
| 5. Reducing the use of sanitizers and chemical cleaning substances | {STRATEGIES5} |

INTERVIEWER, REPEAT AS NECESSARY: Do you think it might improve indoor air quality . . .

**1.** A lot,
**2.** A little
**3.** Not at all.
8. DON'T KNOW
9. REFUSED

{ACTIONS}

In the following statements, I will read to you some preventive actions and we would like to know if it might improve air quality a lot, a little or not at all:

| Items | Varnames |
|---|---|
| 1. Frequent cleaning of indoor air conditioner filters | {ACTION1} |
| 2. Increased use of home air quality monitors at home | {ACTION2} |
| 3. Classification of incense and scented candles as indoor air pollutants by government institutions. | {ACTION3} |
| 4. Stringent requirements for air filters designed to remove contaminants | {ACTION4} |
| 5. Public awareness campaigns informing on methods to develop and maintain a cleaner living space | {ACTION5} |

INTERVIEWER, REPEAT AS NECESSARY: Do you think it might improve indoor air quality . . .

**1.** A lot,
**2.** A little
**3.** Not at all.
8. DON'T KNOW
9. REFUSED

## DEMOGRAPHICS: PHONE USAGE

In this section, I would like to ask you some demographics for statistical purposes.

{Q: SHARECELL}

First, are you the only user of this cell phone number?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

{Q: NCELL}

How many cell phone numbers do you have?
INTERVIEWER, IF ASKED "WHY DO YOU NEED THIS?", SAY:
People who have more phones have a higher chance of being selected randomly and our statistics need to account for that. So this is for technical purposes only.

8 DON'T KNOW/CAN'T TELL
9 REFUSED

INTERVIEWER: ENTER 10 IF RESPONDENT REPORTS MORE THAN 10
PROGRAMMER: THE ANSWER SHOULD BE FROM 0 TO 10

{Q: NPROV}

***IF NCELL >1, ASK***

| |
|---|
| Of these cell phone numbers how many are with OOREDOO and how many are with VODAFONE? |

_____ OOREDOO _____ VODAFONE
8 DON'T KNOW/CAN'T TELL
9 REFUSED

INTERVIEWER: ENTER 10 IF RESPONDENT REPORTS MORE THAN 10
PROGRAMMER: THE ANSWER SHOULD BE FROM 0 TO 10

**DEMOGRAPHICS: INCOME**

{Q: hhinco1}

***IF RESPTYPE=1, ASK***

We have only 2 more questions related to the total monthly income of your family. First, is it less than QR 50,000 or QR 50,000 or more?

1 LESS THAN QR 50,000
2 QR 50,000 OR MORE
8 DON'T KNOW
9 REFUSED

{Q: hhinco1A}

Second, is it less than QR 30,000 or QR 30,000 or more?

1 LESS THAN QR 30,000
2 QR 30,000 OR MORE
8 DON'T KNOW
9 REFUSED

{Q: hhinco1B}

***IF RESPTYPE=1 & HHINCO1 =2, ASK***

Second, is it less than QR 70,000 or QR 70,000 or more?

1 LESS THAN QR 70,000
2 QR 70,000 OR MORE
8 DON'T KNOW
9 REFUSED

{Q: hhinco2}

***IF RESPTYPE=2, ASK***

We have only 2 more questions related to the total monthly income of your family in Qatar. First, is it less than QR 15,000 or QR 15,000 or more?

1 LESS THAN QR 15,000
2 QR 15,000 OR MORE
8 DON'T KNOW
9 REFUSED

{Q: hhinco2A}

***IF RESPTYPE=2 & HHINCO2 =1, ASK***

Second, is it less than QR 10,000 or QR 10,000 or more?

1 LESS THAN QR 10,000
2 QR 10,000 OR MORE
8 DON'T KNOW
9 REFUSED

{Q: hhinco2B}

***IF RESPTYPE=2 & HHINCO2 =2, ASK***

Second, is it less than QR 25,000 or QR 25,000 or more?

1 LESS THAN QR 25,000
2 QR 25,000 OR MORE
8 DON'T KNOW
9 REFUSED

**INTERVIEW EXIT**

{Q: THANKYOU}

Those are all the questions I have for you. Before I say good-bye, are there any other comments you'd like to make?

1 YES [OPEN-END]
2 NO

Thank you very much for participating. We appreciate the time you have taken to complete this interview.

[READ IF NECESSARY:] If you have any questions on the purpose of this study, you can call my supervisor here at SESRI. We're at 4403- 3030 – just mention the air quality survey.

Again, thank you and goodbye.

{Q: SALREF}

***PROGRAMMER: IF CONFIRM OR CHECKCIT OR INCO1 OR INCO2 = DK/REF & RESPTYPE=0 ASK:***

Thank you for your time. Unfortunately, we need the answer to this question in order to proceed with the survey. Would you reconsider answering the question given the importance of the information to Business community and public? All answers to this and all questions are presented as grouped data and no individual's information is revealed.

1 YES [PROGRAMMER: GO BACK TO INCO1 OR INCO2]
2 NO [GO TO INELIG]

{Q: INELIG}

***PROGRAMMER: IF*** CONFIRM < > 1 ***OR Resptype=0 ASK:***

Thank you very much for your time. Our questions would not apply to you but we appreciate your willingness to participate. Have a nice day.

**[ITEMS FOR INTERVIEWER]**

{Q: R_LANG}:

THE INTERVIEW WAS CONDUCTED IN…

1. ARABIC
2. ENGLISH

{Q: IV_QAID}

***IF(R_LANG = 1) ASK:***

INTERVIEWER: CHOOSE THE BEST ANSWER:

1. THE RESPONDENT DIRECTLY INDICATED THEY THOUGHT I WAS QATARI
2. THE RESPONDENT IMPLIED THEY THOUGHT I WAS QATARI
3. THE RESPONDENT IMPLIED THEY THOUGHT I WAS NON-QATARI
4. THE RESPONDENT DIRECTLY INDICATED THEY THOUGHT I WAS NON-QATARI
5. THE RESPONDENT GAVE NO INDICATION ABOUT MY NATIONAL IDENTITY

{Q: IVCOM}

IV: PLEASE NOTE ANY PROBLEMS DURING THE INTERVIEW THAT WOULD AFFECT THE QUALITY OF THE DATA.

{Q: IVID}

IV: PLEASE PUT YOUR INTERVIEWER ID (NOT YOUR STATION NUMBER) HERE

www.sesri.qu.edu.qa • sesri@qu.edu.qa • 4403 3020 • sesri_qu • sesri_qu