Assessing Public Awareness and Practices Related to Environmental Health and Disease Prevention in Saudi Arabia: A Survey-Based Study

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Abstract:

To assess the level of public awareness, attitudes, and practices (KAP) regarding environmental health and disease prevention among residents of Saudi Arabia, and to identify associated sociodemographic factors. A cross-sectional, survey-based study was conducted involving 1,169 participants aged 18 years and older from both urban and rural areas. Data were collected using a structured questionnaire and analyzed using SPSS. Most participants (94.2%) exhibited a moderate level of environmental health awareness. Only 1.5% scored in the high category. Positive attitudes were widespread, with over 85% believing in their personal role in improving environmental conditions. However, only 15.8% consistently practiced recycling, and 11.5% never took protective measures against pollution. Education and occupation were significantly associated with awareness ($p < 0.001$), while age, gender, and residency were not. The study reveals a population that is moderately informed and highly receptive to environmental health initiatives, yet limited by inconsistent practices and knowledge gaps. Tailored educational programs and clinician-led interventions are recommended to enhance public environmental literacy and promote sustainable behaviors.

1. Introduction

Environmental health is a vital part of public health, reflecting the deep connection between human well-being, the environment, and preventing diseases [1]. Saudi Arabia is undergoing major socio-economic changes as part of its Vision 2030 initiative, which seeks to diversify the economy and reduce reliance on oil [2]. While this vision brings exciting opportunities, it also introduces challenges such as environmental degradation, air and water pollution, waste management issues, and the effects of climate change. Rapid urbanization, industrial growth, and increased vehicle emissions are contributing to declining air quality, while water scarcity remains a critical concern [2].

Over the past decade, public awareness of environmental health in Saudi Arabia has grown significantly. The rise of social media and mobile technology has played a key role in spreading information about environmental issues, helping to shape public conversations. Research shows that people, especially in urban areas with higher pollution levels, are increasingly recognizing the link between environmental factors and health outcomes [3].

However, despite this progress, significant gaps remain. Surveys across different regions of Saudi Arabia reveal that while many people are aware of air and water pollution as problems, there is often limited understanding of how these hazards directly impact health. For example, knowledge about the health risks of exposure to fine particulate matter (PM10 and PM2.5) is still lacking, and misconceptions about preventive measures are common [4]. Additionally, educational campaigns by government and non-governmental organizations can be inconsistent and sometimes fail to reach underserved communities, particularly in rural areas [2].

The importance of environmental health awareness and practices in Saudi Arabia goes beyond immediate health concerns—it is also central to broader disease prevention efforts [5]. Research shows that exposure to environmental pollutants is linked to a range of health problems, including respiratory and cardiovascular diseases, and even certain types of cancer [7, 8]. Recognizing the strong connection between environmental health and disease prevalence underscores the need for comprehensive public health initiatives. These should include environmental health education, community involvement, and strong monitoring systems to protect and improve public health [5].

This paper will provide empirical data on public awareness, which can inform health policies and educational programs aimed at mitigating health risks associated with environmental factors. Understanding the public's practices related to environmental health can aid in identifying areas requiring targeted interventions. The study also contributes to the broader discourse on public health in Saudi Arabia and emphasizes the importance of integrating environmental health education into public health strategies. Despite the acknowledged impact of environmental factors on public health, there is a paucity of data regarding the public's awareness and behavior concerning these issues in Saudi Arabia. The lack of understanding can lead to inadequate disease prevention measures, further exacerbating health challenges.

The aim of this study is to assess the level of public awareness and practices related to environmental health and disease prevention among the population of Saudi Arabia.

2. Methodology
Research Design

A cross-sectional, survey-based research was conducted to assess public awareness and practices related to environmental health and disease prevention in Saudi Arabia.

Study Population
The target population for this study included residents of Saudi Arabia aged 18 years and above, representing both urban and rural areas.

Inclusion Criteria
Eligible participants must be residents of Saudi Arabia, aged 18 years and older. Additionally, individuals from both urban and rural settings were included to provide a comprehensive understanding of various socio-economic and cultural contexts.

Exclusion Criteria
Participants who are non-residents or who have lived in Saudi Arabia for less than six months were excluded. Furthermore, individuals with cognitive impairments or those who cannot provide informed consent were also be excluded.

Sample Size
The sample size was calculated to ensure statistical reliability and generalizability of the findings. Using a confidence level of 95% and a margin of error of 5%, the required sample size was determined based on the estimated population of Saudi Arabia. Assuming a conservative response distribution of 50% to account for maximum variability, the sample size was calculated using the formula for estimating proportions in a large population. The target sample size was increased to 1,000 participants to allow for more robust subgroup analyses and enhance the validity of the study's findings.

Sampling

A stratified random sampling technique was used to ensure representation from various regions, age groups, genders, and educational backgrounds. The sample size was determined using statistical software, based on a confidence level of 95% and a margin of error of 5% to generalize to the population of Saudi Arabia.

Data Collection Tool

Data were collected using a structured questionnaire designed to measure public awareness, attitudes, and practices related to environmental health and disease prevention. The questionnaire was divided into four main sections:

1. Demographic Information: Age, gender, education level, occupation, and region of residence.
2. Awareness of Environmental Health Issues: Questions assessing knowledge of air and water pollution, waste management, climate change, and their health impacts.
3. Practices and Behaviors: Questions exploring daily habits, such as waste disposal, water conservation, and use of protective measures against pollution.
4. Attitudes and Perceptions: Questions evaluating public attitudes toward environmental health policies and their willingness to adopt preventive measures.

The questionnaire was developed in both Arabic and English to ensure accessibility and clarity for all participants. It underwent pilot testing with a small group of individuals to assess its reliability and validity, and necessary adjustments were made based on feedback.

To assess participants' overall awareness, attitudes, and practices related to environmental health, a total score was computed by summing individual responses across all sections of the questionnaire. The maximum attainable score was 56 points, reflecting cumulative performance across knowledge, attitude, and practice domains. Participants' total scores were subsequently categorized into three levels of awareness and engagement as follows:

- **Low**: Scores ranging from 0 to 20, indicating limited awareness, poor environmental health practices, and negative or indifferent attitudes.
- **Moderate**: Scores between 21 and 40, reflecting average awareness, partially consistent practices, and generally positive attitudes toward environmental health.
- **High**: Scores from 41 to 56, denoting strong awareness, regular engagement in environmentally responsible practices, and proactive attitudes.

This classification enabled a comprehensive evaluation of participants' environmental health literacy and behaviors, facilitating further analysis in relation to sociodemographic variables.

Data Collection Methods

Data were collected through a combination of online and offline methods to maximize reach and inclusivity. The online survey was distributed via social media platforms, email, and community forums, targeting a wide audience across Saudi Arabia. For offline data collection, trained researchers conducted face-to-face interviews in public spaces such as malls, parks, and primary healthcare centers. Additionally, collaboration with hospitals, clinics, and educational institutions facilitated the distribution of the survey to patients, students, and staff.

3. Data Analysis

Data were analyzed using statistical software, including SPSS version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the sociodemographic and clinical characteristics of the study population. Bivariate analysis using chi-square tests or t-tests assessed associations between awareness and practice with sociodemographic characters of participants.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the relevant authority in Saudi Arabia. Consent was obtained from all participants before data collection, ensuring they understand the purpose and procedures of the study. Confidentiality was maintained by using unique identifiers for participants, and data was securely stored.

Results

A total of 1,169 participants were surveyed. The age distribution showed that the largest proportion of participants fell within the 35–44-year age group (30.6%), followed by those aged 45–54 years (22.0%) and 25–34 years (21.0%). Smaller proportions were recorded for the 18–24 years (13.3%), 55–64 years (8.4%), and those above 65 years (4.8%). In terms of gender, the majority were male (67.2%), while females constituted 32.8% of the sample.

Regarding educational attainment, most participants held a Bachelor's degree (68.7%), followed by those with secondary education (20.6%). A smaller portion had attained postgraduate degrees (5.1%), primary school education (3.7%), or had no formal education (1.9%). Occupational status revealed that 30.1% were employed, 27.2% self-employed, and 20.5% unemployed. Students accounted for 13.3% of the sample, while 8.6% were retired and only 0.3% identified as housewives. In terms of

residency, participants were predominantly from urban areas (45.1%), followed by those residing in suburban (37.0%) and rural areas (18.0%) **Table (1)**.

Most participants demonstrated some level of awareness regarding air pollution and its health implications. Specifically, 42.5% were somewhat knowledgeable, 17.6% were very knowledgeable, while 27.5% were not knowledgeable, and 12.4% were not at all knowledgeable. In terms of awareness of water pollution in their communities, 32.4% reported hearing about it occasionally, 28.5% very often, 26.9% rarely, and 12.1% had never heard about it. Understanding of the concept of climate change was moderate, with 32.9% stating they understood it somewhat well, 21.0% stating very well, while 27.2% and 18.9% responded not really and not at all, respectively. A significant majority (51.0%) agreed and 37.6% strongly agreed that environmental health policies are important for their communities. Only a small portion disagreed (4.4%) or strongly disagreed (0.4%). When asked about their personal role in improving environmental health, nearly half (49.2%) strongly agreed that they could make a difference through their actions, while 36.6% agreed. Only 4.0% disagreed and 0.9% strongly disagreed with this statement. Support for local government initiatives aimed at environmental health was also high, with 39.7% agreeing and 38.9% strongly agreeing. Meanwhile, 15.4% were neutral, and only a minority expressed disagreement (6.0% combined). Similarly, willingness to adopt changes in lifestyle to protect the environment was affirmed by 41.8% who agreed and another 41.8% who strongly agreed, indicating a strong commitment toward environmental responsibility. Only 5.1% expressed disagreement, and 11.3% were neutral. Regarding recycling at home, 40.4% of participants reported doing so often, while 15.8% did it always. Meanwhile, 25.0% recycled occasionally, 13.6% rarely, and 5.2% never engaged in recycling activities. In terms of waste disposal, nearly half (49.1%) stated that they disposed of their waste by throwing it in the trash with some sorting, while 33.8% reported properly sorting and recycling their waste. Less sustainable practices included burning waste (11.6%), dumping in public areas (5.3%), and other methods (0.2%). Water conservation practices were reported positively, with 33.9% indicating they conserved water sometimes, and 31.0% doing so always. However, 24.1% stated they rarely conserved water, and 11.0% admitted they did not conserve water at all. Finally, regarding protective measures against pollution (e.g., wearing masks on polluted days or using air purifiers), 26.1% practiced such measures often, 19.9% always, and 19.4% occasionally. Meanwhile, 23.0% reported doing so rarely, and 11.5% never took such measures **Table (2)**.

Specifically, 94.2% (n = 1101) of respondents fell within the moderate range, while only 4.4% (n = 51) had a low score. A mere 1.5% (n = 17) of participants achieved a high KAP score. The mean total score was 28.43 ± 4.5, with scores ranging between 7 and 41 **Table (3)**.

There was no statistically significant association between participants' awareness levels and their age (p = 0.414) or gender (p = 0.586). Most age groups exhibited a moderate level of awareness, with the highest proportion of high awareness observed in the 35–44-year group (2.5%) and those over 65 years (3.6%). Both males and females had a similar distribution of moderate awareness (94.7% and 93.2%, respectively), with slightly higher high awareness among females (1.8%) than males (1.3%). A highly significant association was found between education level and awareness (p < 0.001). The highest proportion of high awareness was among postgraduates (10%), followed by those with secondary education (1.7%). Participants with no formal education or only primary education exhibited no high awareness at all, with the majority in these groups falling within the moderate awareness category. Similarly, a statistically significant association was observed between occupational status and awareness levels (p < 0.001). The self-employed group had the highest proportion of participants with high awareness (2.8%), followed by the employed group (1.7%). No participants from the unemployed or student categories had high awareness, and these groups had relatively higher proportions of low awareness (7.1% and 8.4%, respectively). Although urban residents showed a slightly higher proportion of high awareness (2.1%) compared to suburban (1.2%) and rural (0.5%) residents, the association between residency and awareness levels did not reach statistical significance (p = 0.082) **Table (4)**.

Table 1: Sociodemographic characteristics of the included participants (n=1169).

Parameter		Frequency	Percentage
Age	**18-24 years**	155	13.3
	25-34 years	245	21.0
	35-44 years	358	30.6
	45-54 years	257	22.0

	55-64 years	98	8.4
	>65 years	56	4.8
Gender	Male	786	67.2
	Female	383	32.8
Education	No formal education	22	1.9
	Primary school	43	3.7
	Secondary school	241	20.6
	Bachelor's degree	803	68.7
	Postgraduate	60	5.1
Occupation	Unemployed	240	20.5
	Employed	352	30.1
	Self-employed	318	27.2
	Housewife	4	.3
	Retired	100	8.6
	Student	155	13.3
Residency	Suburban	432	37.0
	Rural	210	18.0
	Urban	527	45.1

Table 2: *Knowledge, attitude and practice of environmental health among the participants (n=1169).*

Parameter		Frequency	Percentage
Knowledge			
Knowledge about air pollution and its health impacts	Very knowledgeable	206	17.6
	Somewhat knowledgeable	497	42.5
	Not knowledgeable	321	27.5
	Not at all knowledgeable	145	12.4
I hear about water pollution in my community:	Very often	333	28.5
	Occasionally	379	32.4
	Rarely	315	26.9
	Never	142	12.1
I understand the concept of climate change:	Yes, very well	245	21.0
	Yes, somewhat	385	32.9
	No, not really	318	27.2
	No, not at all	221	18.9
Attitude			
I believe that environmental health policies are important for my community	Strongly agree	439	37.6
	Agree	596	51.0
	Neutral	78	6.7
	Disagree	51	4.4
	Strongly disagree	5	0.4
I feel that I can make a difference in improving environmental health through my actions	Strongly agree	575	49.2
	Agree	428	36.6
	Neutral	109	9.3
	Disagree	47	4.0
	Strongly disagree	10	0.9
I would support local government initiatives aimed at improving environmental health	Strongly agree	455	38.9
	Agree	464	39.7
	Neutral	180	15.4
	Disagree	50	4.3
	Strongly disagree	20	1.7
I am willing to adopt changes in my lifestyle to protect the environment	Strongly agree	489	41.8
	Agree	489	41.8
	Neutral	132	11.3
	Disagree	50	4.3
	Strongly disagree	9	0.8
Practice			
I recycle materials (paper, plastic, etc.) at home:	Always	185	15.8
	Often	472	40.4
	Occasionally	292	25.0

	Rarely	159	13.6
	Never	61	5.2
I typically dispose of my waste:	Properly sorted and recycled	395	33.8
	Thrown in the trash with some sorting	574	49.1
	Burned	136	11.6
	Dumped in public areas	62	5.3
	Other	2	0.2
I conserve water in your daily life (e.g., shorter showers, fixing leaks):	Yes, always	362	31.0
	Sometimes	396	33.9
	Rarely	282	24.1
	No, I do not	129	11.0
I take protective measures against pollution (e.g., wearing masks on polluted days, using air purifiers):	Always	233	19.9
	Often	305	26.1
	Occasionally	227	19.4
	Rarely	269	23.0
	Never	135	11.5

Table 3: *Total knowledge, attitude, and practice scores.*

	Frequency	Percent
High	17	1.5
Moderate	1101	94.2
Low	51	4.4
Mean score	28.43±4.5 (7-41)	

Table 4: *Association between participants' awareness and their sociodemographic characteristics.*

Parameter		Awareness			P-value
		High	Moderate	Low	
Age	18-24 years	0	145 (93.5%)	10 (6.4%)	0.414
	25-34 years	2 (0.8%)	232 (94.7%)	11 (4.5%)	
	35-44 years	9 (2.5%)	333 (93%)	16 (4.5%)	
	45-54 years	3 (1.2%)	245 (95.3%)	9 (3.5%)	
	55-64 years	1 (1%)	94 (95.9%)	3 (3.1%)	
	>65 years	2 (3.6%)	52 (92.9%)	2 (3.6%)	
Gender	Male	10 (1.3%)	744 (94.7%)	32 (4.1%)	0.586
	Female	7 (1.8%)	357 (93.2%)	19 (5%)	
Education	No formal education	0	22 (100%)	0	<0.001
	Primary school	0	42 (97.7%)	1 (2.3%)	
	Secondary school	4 (1.7%)	223 (92.5%)	14 (5.8%)	
	Bachelor's degree	7 (0.9%)	762 (94.9%)	34 (4.2%)	
	Postgraduate	6 (10%)	52 (86.7%)	2 (3.3%)	
Occupation	Unemployed	0	223 (92.9%)	17 (7.1%)	<0.001
	Employed	6 (1.7%)	333 (94.6%)	13 (3.7%)	
	Self-employed	9 (2.8%)	304 (95.6%)	5 (1.6%)	
	Housewife	1 (25%)	3 (75%)	0	
	Retired	1 (1%)	96 (96%)	3 (3%)	
	Student	0	142 (91.6%)	13 (8.4%)	
Residency	Suburban	5 (1.2%)	413 (95.6%)	14 (3.2%)	0.082
	Rural	1 (0.5%)	194 (92.4%)	15 (7.1%)	
	Urban	11 (2.1%)	494 (93.7%)	22 (4.2%)	

4. Discussion

The present study aimed to assess the knowledge, attitudes, and practices of participants concerning environmental health and to explore how these elements are influenced by various sociodemographic factors. The findings revealed a predominantly moderate level of awareness and engagement across the population, with nuanced differences based on education and occupation. This study demonstrated that regarding knowledge, nearly half of the respondents (42.5%) were somewhat knowledgeable about air pollution and its health implications, while only a small proportion (17.6%) identified as very knowledgeable. Notably, 39.9% of participants

reported limited or no knowledge on the topic, indicating a significant gap that warrants targeted educational interventions. Similar patterns emerged with respect to understanding climate change, where just over half reported some level of understanding, and nearly half indicated a limited or complete lack of understanding. **Chin et al.** reported that perceptions of air pollution were found to be influenced by individuals' perceived susceptibility to its health effects [6]. For instance, participants with children were more inclined to view the air as heavily polluted. This may reflect an instinctive parental response, recognizing the long-term health consequences of local air pollution, which tend to be more significant for children [7], thereby amplifying the perception of it as a health concern [8].Encouragingly, we also found that participants demonstrated a largely positive attitude toward environmental health. A substantial majority agreed (51.0%) or strongly agreed (37.6%) that environmental health policies are essential to their communities. This positive outlook extended to personal responsibility, with 85.8% believing they could make a difference through individual actions. Likewise, strong support was evident for governmental initiatives and behavioral change, with 83.6% expressing willingness to adopt lifestyle changes to protect the environment. Earlier research has emphasized the significance of public awareness concerning environmental health threats [9, 10]. Enhancing risk comprehension is vital, as environmental challenges—such as substandard recreational water quality—can profoundly affect both public health and overall well-being [11, 12]. Some public health communicators observed that the general public today appears more informed about environmental health issues compared to the past [13]. Nevertheless, this awareness is likely limited to individuals who actively seek out such information. Notably, nearly a quarter of respondents indicated that they consult health care professionals for environmental health insights [6]. This is significant, as physicians and other medical practitioners serve a crucial role in conveying environmental health risks [14], making it essential for them to be well-versed in effective risk communication strategies.This study reported that the vast majority (94.2%) fell within the moderate range of knowledge, attitude, and practice regrading environmental health, while only 4.4% (n = 51) had a low score. A mere 1.5% (n = 17) of participants achieved a high KAP score. **Shin et al.** revealed that 66.0% of U.S. adults were aware of government environmental public health efforts and concerns about health risks from pollutants. Over half of respondents (57.8%) reported concerns, while 40% felt none of the health impacts were

related to environmental issues [10]. **Chin et al.** conducted a study conducted in Malaysia's Klang Valley and Iskandar conurbations aimed to understand urban Malaysians' perception and attitudes towards air pollution. Over 60% of respondents were positive about air quality, with motor vehicles being the primary source of pollution. Private transport was the preferred mode of transportation. Participants agreed that protection actions should not involve individual effort. However, certain segments were more willing to personally pay for environmental protection [6].Additionally, **Evans et al.,** implemented a survey of 555 women aged 18-35 in Northern Manhattan, New York City, found high awareness of environmental risks to children's health, with over 95% identifying lead, pests, pesticides, tobacco smoke, and drugs as harmful. Over 95% reported taking protective actions to reduce these risks. However, the reported levels varied greatly, suggesting room for an educational campaign to teach women new ways to protect their families. The survey respondents and CCCEH scientists emphasized the importance of incorporating community concerns into environmental campaigns [15].This study reported a highly significant association was found between education level and awareness (p < 0.001). High awareness was most common among postgraduates (10%), followed by those with secondary education (1.7%). Participants with no formal or only primary education showed no high awareness, with most falling in the moderate category. Similarly, occupational status was significantly associated with awareness (p < 0.001). The self-employed had the highest proportion of high awareness (2.8%), followed by the employed (1.7%). No high awareness was reported among the unemployed or students, who showed higher levels of low awareness (7.1% and 8.4%, respectively). A study conducted in Saudi Arabia by **Almulhim et al.** revealed that individuals with higher education levels demonstrated greater awareness of environmental health hazards compared to those with lower educational attainment [16]. This finding is consistent with research from the United States, where 58% of the general public was found to have knowledge of environmental risks [10]. Collectively, these findings highlight the importance of expanding educational initiatives that are tailored to the awareness levels and specific needs of various population groups, to ensure comprehensive understanding of environmental health threats. Incorporating environmental health topics into school science curricula and medical education could foster early awareness. Additionally, strategies such as communication

campaigns, multilingual outreach, and clinical screenings may help strengthen communities' capacity to recognize and address environmental risks [17].

Strengths and limitations

This study possesses several methodological strengths that contribute to its reliability and applicability. One of its most notable strengths lies in the large and diverse sample size, which included 1,169 participants from various regions, educational backgrounds, occupational statuses, and residential settings. Such diversity enhances the generalizability of the findings to the broader Saudi population. Additionally, the use of both online and offline data collection methods allowed for broader participation, including individuals with limited internet access or digital literacy. Furthermore, the study addresses a relevant and timely public health issue aligned with Saudi Arabia's Vision 2030 goals, offering practical insights for policymakers and health educators.Despite its strengths, this study is not without limitations. As a cross-sectional study, it captures participants' knowledge, attitudes, and practices at a single point in time, limiting the ability to establish causality or track changes over time. The reliance on self-reported data also introduces potential biases, particularly social desirability bias, where participants may overstate environmentally friendly behaviors or underreport harmful practices.

5. Conclusion

This study reveals that while the majority of Saudi participants demonstrate moderate awareness and generally positive attitudes toward environmental health, there remain notable gaps in knowledge and inconsistency in environmentally responsible practices. Education and occupational status emerged as significant predictors of awareness, highlighting the need for tailored educational interventions. With most individuals expressing willingness to support environmental initiatives and adopt behavioral changes, public health stakeholders are well-positioned to implement targeted strategies that translate this receptiveness into sustainable actions. Future programs should focus on strengthening environmental literacy, particularly among underserved populations, and integrating environmental health promotion into broader disease prevention efforts.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.

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