

Views of South Asian Physicians on Climate Related Health Effects: A Multinational Cross-Sectional Pilot Study

Tehzeeb Zulfiqar^{1*} , Hina Jawaid², Abdul Jalil Khan³, N. Waseem Ahmed⁴ , Asif Rehman⁵ , Muhammad Hassam Khan³, Kinley Bhutti⁶, Md. Ferdous Rahman⁷ , Saadia Mustafa¹, Husnulmaab Ali³, Tariq Aziz²

¹Health Services Academy, Islamabad, Pakistan

²University of Health Sciences, Lahore, Pakistan

³Khyber Medical University, Peshawar, Pakistan

⁴Department of Diabetes, Gem Hospital & Research Centre, Chennai, Tamilnado, India

⁵Peshawar Medical College, Peshawar, Pakistan

⁶PARO General Hospital, Paro, Bhutan

⁷International Centre for Diarrheal Disease Research, Dhaka, Bangladesh

Email: *tehzeeb.zulfiqar@hsa.edu.pk

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Abstract

Background: South Asian populations are vulnerable to poor health outcomes associated with climate due to the region's complex topography, poverty, lack of education, and population density. Physicians, being highly trusted members of society, can help mitigate climate change effects in their countries. **Objectives:** The present study assessed perceptions of physicians from four South Asian countries (Bangladesh, Bhutan, India, and Pakistan). We hypothesized that physicians from these countries will be aware and knowledgeable about health effects of climate change. **Methods:** We conducted a cross-sectional online survey of physicians between March and July 2022. Data of 201 physicians was analyzed using the Kruskal-Wallis test and Dunn's post hoc method. **Results:** Physicians from four South Asian countries were attuned to the health risks associated with climate change. A majority of physicians (86.6%) believed that climate change would make health conditions in their countries more severe or frequent (Bangladesh 83.3%; Bhutan 70%; India 91% and Pakistan 90.8%). The most common health effect related to climate change was illnesses related to reduced outdoor air quality (54.3%). Common barriers to discuss climate change with patients from all four countries were physicians' lack of knowledge (strongly agree, 13.8%; agree 47.7%) in how to approach the issue with patients, lack of time (strongly agree, 12%; agree, 48%) and their perception that patients were

not interested in knowing about climate change (strongly agree, 8.6%; agree, 42.6%). More than half (56.2%) of the physicians reported no training (Bangladesh, 51.7%; Bhutan, 80%; India, 44.6%; Pakistan, 63.1%) and approximately 30% reported less than 20 hours of training (Bangladesh, 28.3%; Bhutan, 15.0%; India, 39.3%; Pakistan, 27.7%) in climate-change-related health effects. Conclusion: While additional large-scale research is needed to understand the trends observed in our pilot study, our findings identify the need to introduce interventions to improve physicians' knowledge of the health impacts of climate crisis.

Keywords

Climate Change, Health, Physicians, South Asia

1. Introduction

Climate change is a “public health emergency of the 21st century” (Xie et al., 2018). The 2022 Lancet Countdown report on “health and climate change” showed a grim picture of the deteriorating situation of health impacts related to climate change (Romanello et al., 2022). The worsening of climate related health effects in 2021-2022 were evident from the extreme weather events such as severe floods and droughts, wildfires, rising sea levels, and record high temperatures reported from countries across all continents. These intense weather events resulted in huge loss of lives, displacements, and enormous economic loss to individuals and countries (Romanello et al., 2022). The annual heat-related deaths in people older than 65 years increased by 68% in 2017-2021 compared to 2000-2004 (Romanello et al., 2022). An estimated 250,000 additional deaths are predicted to occur between 2030 and 2050 due to climate change related health conditions (World Health Organization, 2018). A positive finding from the Lancet Countdown report was the highest commitment from countries across the globe to adopt measures to achieve the goal of the Paris Agreement of low-carbon or net zero-carbon emissions by 2050 (World Health Organization, 2021). Despite these commitments, there are little practical measures adopted by the most countries to mitigate climate change.

Climate change has catastrophic effects on human health and well-being, especially for the most vulnerable population, such as, young children, pregnant women, older adults, people with chronic illnesses and disabilities, outdoor workers, and people with fewer resources (Lehmkuhl, 2019). Increasing number of extreme weather events have direct and indirect effects on mental, social and physical health of population, which reduces their capacity to work, resulting in huge economic losses to the countries (Romanello et al., 2022). The main categories of climate change related health impacts include increase in morbidity and mortality from extreme temperatures; poor air quality from smog and smoke; more frequent extreme weather and climatic events; higher vector-borne

illnesses; increase in water-borne diseases; decrease in food safety, nutrition, and distribution; and higher mental health conditions including anxiety, depression, and substance use (Lehmkuhl, 2019). Climate change also adversely impacts the economic development of countries, and may push the countries to poverty, instability and war (Martinich & Crimmins, 2019). With the global temperatures projected to rise more than 1.5 degrees Celsius by the middle of the 21st century (Ma et al., 2022), these adverse health outcomes are predicted to become more frequent and overburden the health systems. The effects will be higher for countries with insufficient climate change adaptations and poorly functioning health systems in many regions of South America, Asia, and Africa (Romanello et al., 2022).

Climate change is a significant threat to the human survival and stability of the South Asian region. In the past two decades, more than half of the South Asian population (approximately 750 million people) were affected by one or more climate-related disasters such as cyclones, floods, extreme monsoon rainfalls, food and water insecurity, and extreme heat from rising temperatures (Sen et al., 2017, Agarwal et al., 2021). The Global Climate Risk Index (GCRI) 2021, ranked Bangladesh and India 7th, and Pakistan 8th out of 180 countries, indicating the extent to which these countries have been affected by the impact of climate related disasters (Eckstein et al., 2021). There are some regional variations, for example, Bhutan ranked 105 on the GCRI 2021, which shows that climate change has not adversely affected all countries in the region. However, without serious measures to lower carbon emissions through multisectoral actions and community involvement globally, this situation may change in the future.

With the increasing frequency of adverse climate events, there is an increase in research outlining the substantial effects of climate on human health (Watts et al., 2019, Pörtner et al., 2022). There is also a growing body of evidence that suggests that the health services are overburdened with the increasing number of patients presenting with climate-related health conditions and emergencies (Crowley et al., 2016, Sen et al., 2017, Romanello et al., 2022). As a result, health professionals have an extraordinary responsibility to educate their patients and communities in the global efforts to reduce emissions and protect themselves from climate-related health effects (World Health Organization, 2018). However, evidence is scarce on the awareness of physicians about the health relevance of climate change, and their commitment to engage with patients and communities to address these issues. Previously published literature showed that most health professionals are aware that climate change is happening and is caused by human activity. Health professionals also believed that climate change was the cause of the increase in the incidence of common health diseases in their countries. However, a majority of physicians reported that time constraint and insufficient knowledge about the linkages between climate and poor health outcomes was a barrier to educating their patients (Sarfaty et al., 2014, Sheffield et al., 2014, Wei et al., 2014, Sarfaty et al., 2016a, 2016b, Ryan et al., 2020, Kotcher et

al., 2021, Scheerens et al., 2021, Sambath et al., 2022). Such evidence is not well reported from South Asia.

To the best of our knowledge, only one Indian study explored knowledge, attitude, practice of diverse group of health workers (community health workers, doctors, nurses, paramedical staff, hospital administrators) related to climate change and health outcomes. Higher proportion of doctors was able to identify relationship of acute health conditions with climate change. However, indirect, or delayed health effects of climate change such as allergies and mental health were less often reported as climate-related health outcomes. Health professionals were also unaware of their role in raising patient's awareness on climate related health outcomes. Only one third of doctors participated in an activity such as health campaign to educate people about climate related health effects (Sambath et al., 2022). Evidence identifying gaps in understanding, and awareness of health relevance of climate change among practicing clinicians at primary care clinics and hospitals is not available from other South Asian countries.

To fill the literature gap, we conducted a multi-country cross-sectional online pilot study. The choice of countries for this research was based on the interest expressed by the researchers from Bangladesh, Bhutan, India, and Pakistan, on the World Organization of Family Doctors (WONCA) forum. We hypothesized that as South Asian region is severely impacted by climate change, the physicians from participating countries will have a higher understanding and awareness about the health effects of climate change. Considering the vulnerability of south Asian region to climate change, such evidence is valuable to develop regional and national interventions aimed to equip health professionals and health system to mitigate climate related adverse health outcomes.

2. Geography and Climate of the Participating Countries

Figure 1 shows map of the South Asia. A brief introduction of the geography and climate of participating countries is given below.

India is the largest South Asian country by area, with a population of around 1.2 billion people. It is situated at a latitude of $20.593684^{\circ}\text{N}$, and a longitude of 78.96288°E . Indian coast line is surrounded by the Indian Ocean, the Arabian Sea, and the Bay of Bengal. India shares land borders with Pakistan, China, Nepal, Bhutan, Bangladesh and Myanmar. India comprises of an extraordinary variety of climatic regions, ranging from tropical in the south to temperate and alpine in the Himalayan north, where elevated regions receive sustained winter snowfall (Spate & Learmonth, 2017).

Pakistan is the 2nd largest South Asian country by area, with a population of almost 243 million people. It is located at a latitude of 32.98983°N and longitude of $70.605583^{\circ}\text{E}$. It's coastline is bounded by the Arabian Sea and Gulf of Oman. It shares land borders with India, Afghanistan, Iran, and China. Pakistan climate varies from tropical to temperate (Spate & Learmonth, 2017).

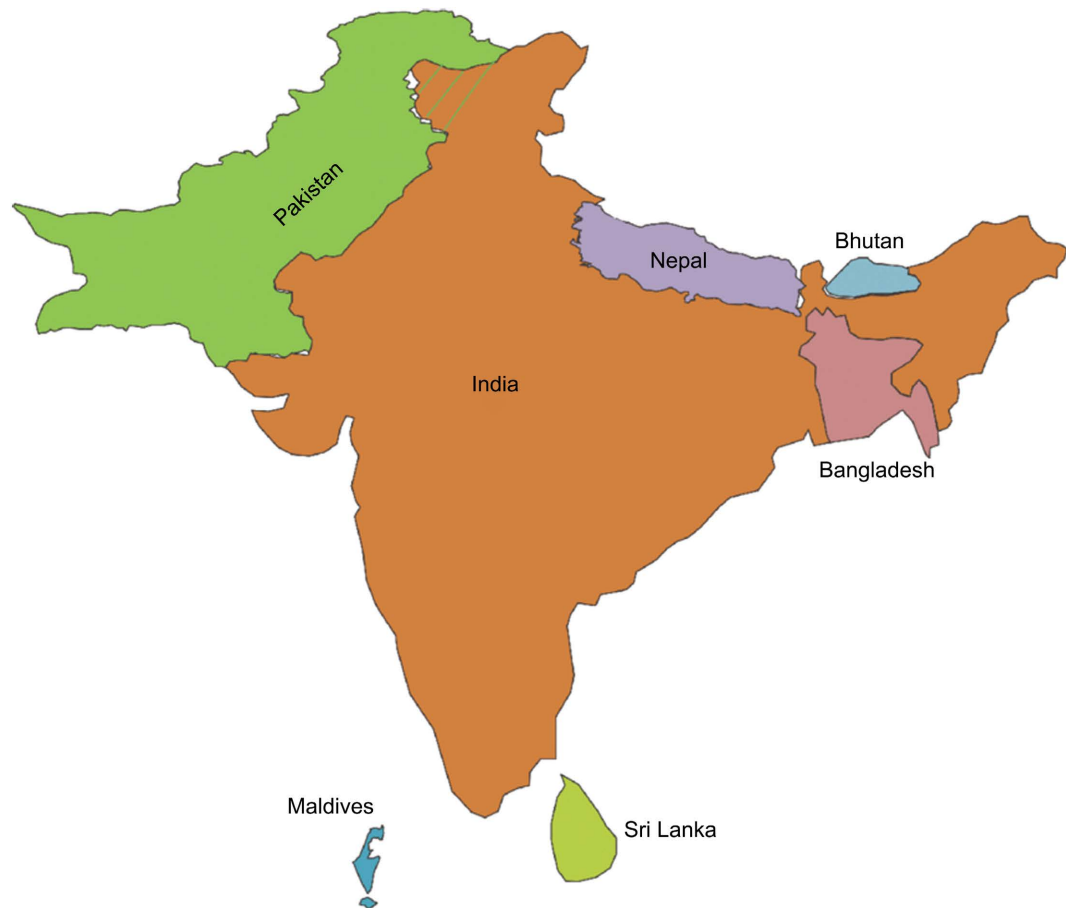


Figure 1. Map of South Asian countries.

Bangladesh is located at latitude of $23.684994^{\circ}\text{N}$ and longitude $90.356331^{\circ}\text{E}$. It is among the most densely populated countries, with over 165 million people. Bangladesh shares land borders with India and Myanmar. It has a coastline along the Bay of Bengal. Bangladesh's climate is tropical, with a mild winter from October to March and a hot, humid summer from March to June (Rashid, 2019).

Kingdom of Bhutan is a landlocked mountainous South Asian country with a latitude of 27.500°N and longitude of 90.500°E . It has a population of around 727,145 people. It is situated in the Eastern Himalayas, between China and India. Bhutan's climate varies with elevation, from subtropical in the south to temperate in the highlands and polar-type climate with year-round snow in the north. Southern Bhutan has hot humid summers and cool winters; central and eastern Bhutan are temperate and drier than the west with warm summers and cool winters (Fraser et al., 2001).

The commonest feature of South Asian weather is the monsoon season. Monsoon begins in June and lasts till September. Shift in monsoon pattern, such as early or late rains, heavier than normal rainfalls and flash floods are considered as a significant indicator of climate change in South Asia (Singh et al., 2021).

3. Methodology

Institutional review committees of participating countries approved the research (Figure 2). The ethical consideration of the study were guided by World Medical Association Declaration of Helsinki (1964-updated 2014 (General Assembly of the World Medical Association, 2014), and the International Ethical Guidelines for Biomedical Research Involving Human Subjects (International Organizations of Medical Sciences, 2017).

We conducted a cross-sectional online pilot study using online Google forms, which is a freely available cloud-based data management tool for online surveys (Vasantha Raju & Harinarayana, 2016). As the study was conducted during SARS-CoV 2 pandemic, digital research was considered as the most appropriate methodology (Favilla & Pita, 2020).

The questionnaire was developed by adopting questions from previous research of health professional's opinions on health implications of climate change (Sarfaty et al., 2014, Sarfaty et al., 2016a, 2016b, Kotcher et al., 2021). As the medium of instruction for medical education in all these countries is English, we developed the questionnaire in English. The questionnaire inquired about the demographic characteristics of physicians, their views on health relevance of climate change, their trainings on climate-related health effects, and common barriers of physicians to educate patients on climate related health outcome in their countries.

The questionnaire was first pilot tested with eight physicians and academics (two from each country) working in public and private health sectors. The physicians who participated in pilot-testing were excluded from the final research. The piloting was conducted online, using Google forms. The purpose of pilot-testing was to check the questionnaire for language, ease of understanding, consistency, and length of time taken to complete. The overall feedback from the physicians involved in the pilot-testing was positive. Based on the physician's feedback, we rephrased the wording of some questions and removed ambiguous

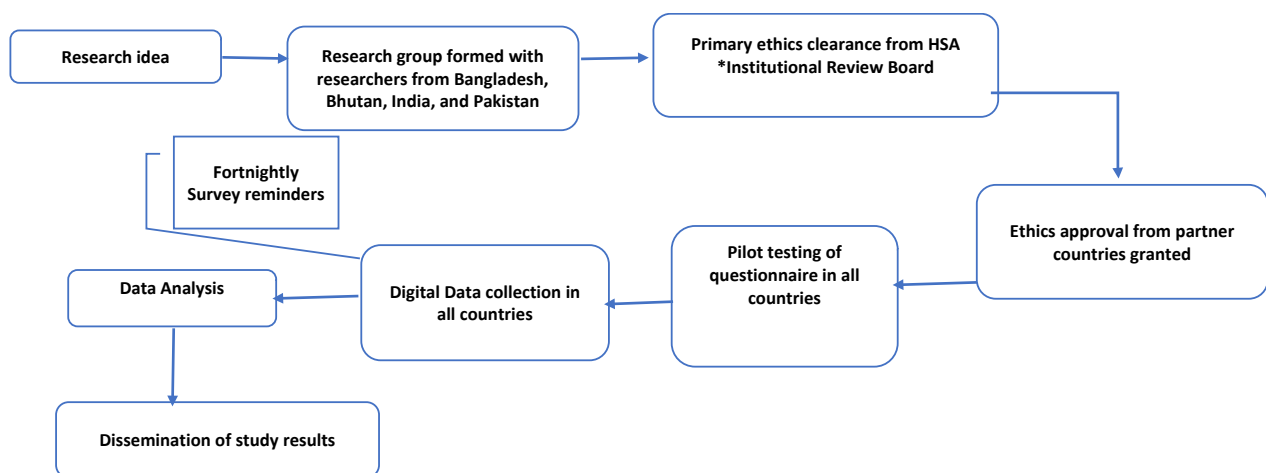


Figure 2. Schematic showing the research methodology. *HSA—Health Services Academy.

and repetitive questions. Once the research team was satisfied with the quality, language, flow, and ease of understanding of the questionnaire, the final edited version was uploaded to Google forms, and an online survey link was created.

Researchers from participating countries invited primary care physicians from their respective countries by sharing the study information and online survey link to the institutional e-mails of potential participants. The researchers also contacted physicians from their respective countries on social media channels, such as WhatsApp messages, Facebook, Twitter, and LinkedIn accounts. Physicians with a minimum of primary undergraduate medical education (Bachelor of Surgery and Bachelor of Medicine) working in primary and secondary care clinics and hospitals were eligible for the study.

After sharing the study information and survey links on the online forums, the researchers sent fortnightly reminders for four months to invite participants to the online survey. Survey participation was voluntary. We offered no incentives to the participants. Each participant was able to take the survey once. The Google forms were accessible to only one researcher in the research team, to ensure the anonymity of the participants.

Data collection was carried out from April-July 2022. We aimed to recruit as many primary care physicians as possible within the data collection period. Due to the very low response rate from the primary care physicians, we expanded the invitations to physicians from other specialties in the third month of data collection. Data collection ended on 31st July 2022.

4. Data Analysis

Questionnaires were checked for completion. Questionnaires with a minimum completion of 80% of responses were analyzed.

The data were analyzed using SPSS statistical software version 28. We ran descriptive statistics on all variables. Data were not weighted. Responses were segmented by country.

We used descriptive statistics to summarize physicians' demographic data by country and their Likert scale responses.

We conducted the Kruskal-Wallis test to identify the significant differences between the countries. For a variable with a P value of <0.05 , we used Dunn's post hoc method of adjustment for multiple comparisons between the countries. We established the threshold for statistical significance at a p -value < 0.05 . For variables with P value > 0.05 we did not conduct further analysis as there was no significant difference between the countries.

5. Results

Despite several online recruitment attempts, we were able to collect data from 211 physicians, out of which 201 were analyzed (60 from Bangladesh, 20 from Bhutan, 56 from India, and 65 from Pakistan) (Table 1). We did not include ten questionnaires due to more than 20% of missing responses including their country of practice.

Table 1. Sociodemographic characteristics of participants by country.

Characteristics	Bangladesh		Bhutan		India		Pakistan		Total	
	n	%	n	%	n	%	n	%	n	%
Total Participants	60	29.5	20	10.0	56	28.0	65	32.5	201	
Male	29	48.3	16	80.0	31	55.4	21	32.3	97	48.2
Female	31	51.7	04	20.0	25	44.6	44	67.7	104	52.8
Primary work location										
Urban/Suburban	41	68.3	19	95.0	40	71.4	46	71.8	146	72.6
Rural	10	16.6	01	5.0	11	19.6	12	18.7	34	34.0
Multiple practice sites (rural/urban)	09	15.0	00	00	05	8.9	07	10.9	21	10.4
Specialties										
Family medicine/General Practice	07	11.6	09	45.0	38	67.8	54	83.1	108	53.7
Hospital based specialty (Gynae/Obs/Paedriatics/dermatology)	48	80.0	06	30.0	14	25.0	11	16.9	79	39.3
Others (teaching, administration etc.)	03	5.0	00	00	02	3.6	00	00	5	2.5
No specialization	02	3.3	05	25.0	02	3.6	00	00	9	4.5
Primary work setting										
Clinic	21	35.0	01	5.0	25	44.6	39	60.0	86	42.8
Hospital	34	56.7	19	95.0	22	39.3	20	30.8	95	47.3
Administration	03	5.0	00	0.0	09	16.1	00	0.0	12	5.9
Non-clinical work place (teaching, working for non-government organization, etc.)	02	3.3	00	0.0	00	0.9	06	9.2	8	4.0

Note: Not all categories add to the total number of participants, due to missing information.

More than half of our respondents were females. Approximately three quarter (72.6%) of respondents had primary work location in urban and semi-urban areas (Table 1). More than half of the respondents (53.7%) were family physicians or general practitioners; majority of them from Pakistan (83.1%), followed by India (67.8%) and Bhutan (45%). Physicians with hospital-based specialty were the second largest group (39.3%), with highest proportion from Bangladesh (80%). A majority (90%) of physicians from all four countries were actively practicing at clinic (42.8%) or secondary hospital (47.8).

Physicians' perception of climate change and its health effects

The majority (86.6%) of physicians from all four countries were certain that climate change was happening, with the highest percentage (91.7%) from Bangladesh (Figure 3). Most (84.6) physicians considered climate change important to them personally; highest proportion reported from India (92.8%). Approximately two-third (65.7%) were very worried about climate change, majority of them from Bangladesh (78.3%). About 90% (47.7% strongly agree; 42.3% agree) physicians believed that it is their responsibility to inform their patients about climate change.

Physicians' self-assessed knowledge and trainings in climate change related health conditions

The majority (78.3%) of physicians reported moderate or modest knowledge about climate-change-related health effects (Figure 4). Only one in five physicians

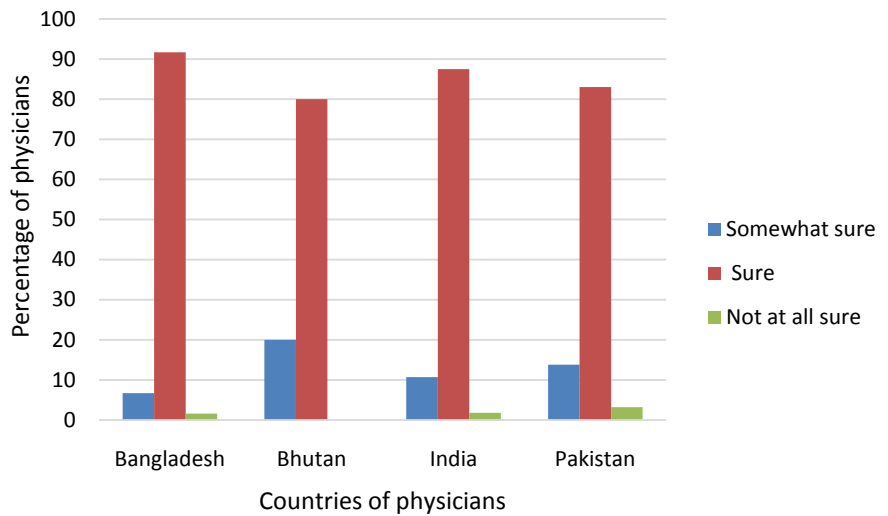


Figure 3. Country wise percentage of Physicians who perceived that climate change is happening.

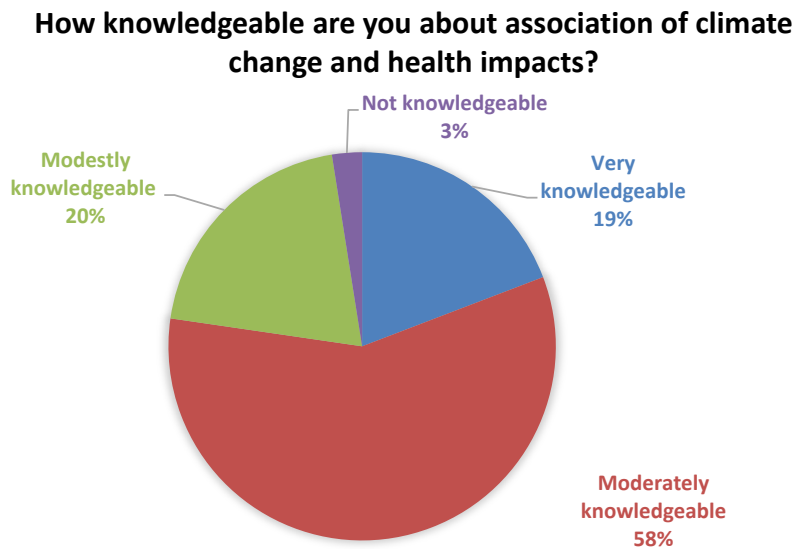


Figure 4. Percentage of physicians who felt very, moderately or modestly knowledgeable about health effects of climate crisis.

from Bangladesh, Pakistan, and India thought they are very knowledgeable about the relationship of climate change with health (**Figure 5**). More than half (56.2%) of the physicians reported no training (Bangladesh, 51.7%; Bhutan, 80%; India, 44.6%; Pakistan, 63.1%) and approximately 30% reported less than 20 hours of training (Bangladesh, 28.3%; Bhutan, 15.0%; India, 39.3; Pakistan, 27.7%) in climate-change-related health effects. Approximately two-thirds of physicians (28.4% strongly agree, 42.3% agree) agreed that climate change should be integrated into undergraduate medical education (**Table 2**). However, approximately one-fifth physicians disagreed (8% disagreed, 12.4% strongly disagreed) with integrating climate change into undergraduate medical education

Physicians’ views of health effects of climate change in their countries

Table 2. Physicians' views about the importance of climate change, and their responsibility, self-assessed knowledge, and training needs by countries of practice.

	Total	Bangladesh	Bhutan	India	Pakistan	<i>P</i> value	Dunn's Pair wise comparison					
	n (%)	n (%)	n (%)	n (%)	n (%)		1 - 2	1 - 3	1 - 4	2 - 3	2 - 4	3 - 4
How sure are you that climate change is happening?												
Sure	174 (86.6)	55 (91.7)	16 (80)	49 (87.5)	54 (83.0)	0.78						
Somewhat sure	23 (11.4)	4 (6.7)	4 (20)	6 (10.7)	9 (13.8)							
Not at all sure	4 (2.0)	1 (1.7)	-	1 (1.8)	2 (3.1)							
How important is the issue of climate change to you personally?												
Very important	170 (84.6)	51 (85.0)	17 (85)	52 (92.8)	50 (76.9)	0.03*	0.15	0.12	0.42	0.01*	0.37	0.09*
Somewhat important	37 (18.4)	8 (13.3)	2 (10.0)	14 (7.1)	13 (20.0)							
Not important	4 (2.0)	1 (1.7)	1 (5)	-	2 (3.1)							
Do you believe that primary health professionals have a responsibility to bring health effects of climate change to the attention of the public?												
Strongly agree	96 (47.7)	31 (51.7)	5 (25)	35 (62.5)	25 (38.5)	0.00**	0.03*	0.20	0.18	0.00**	0.21	0.00**
Agree	85 (42.3)	23 (38.3)	11 (55)	18 (32.1)	33 (50.8)							
Neutral	17 (8.5)	8 (8.3)	4 (20)	3 (5.4)	5 (7.7)							
Disagree	1 (0.5)	1 (1.7)	-	-	-							
Strongly disagree	2 (1.0)	-	-	-	2 (3.1)							
How worried are you about climate change?												
Very worried	132 (65.7)	47 (78.3)	10 (50.0)	39 (69.6)	36 (55.4)	0.12						
Somewhat worried	64 (31.8)	13 (21.7)	10 (50.0)	16 (28.6)	25 (38.5)							
Not worried at all	5 (2.5)	-	-	1 (1.8)	4 (6.2)							
How knowledgeable are you about association of climate change and health impacts?												
Very knowledgeable	38 (19.2)	12 (20.0)	1 (5.0)	10 (23.2)	15 (23.1)	0.39						
Moderately knowledgeable	115 (58.1)	37 (61.7)	13 (65.0)	32 (57.1)	33 (50.8)							
Modestly knowledgeable	40 (20.2)	11 (18.3)	6 (30)	10 (17.9)	13 (20.0)							
Not knowledgeable	5 (2.5)	-	-	1 (1.8)	4 (6.2)							
How many hours of trainings have you received on climate change and health?												
0 - 20 hours	60 (29.8)	17 (28.3)	3 (15.0)	22 (39.3)	18 (27.7)	0.04*	0.05*	0.32	0.33	0.00**	0.20	0.05*
20 - 100 hours	22 (11.0)	11 (18.3)	1 (5.0)	7 (12.5)	3 (4.6)							
101 + hours	6 (3.0)	1 (1.7)	-	2 (3.4)	3 (4.6)							
None	113 (56.2)	31 (51.7)	16 (80.0)	25 (44.6)	41 (63.1)							
Should climate change and its health impacts should be integrated into undergraduate medical education?												
Strongly agree	57 (28.4)	13 (21.7)	4 (20)	21 (37.5)	19 (29.2)	0.83						
Agree	85 (42.3)	29 (48.3)	9 (45)	18 (32.1)	29 (44.6)							
Neutral	18 (8.9)	6 (10.0)	6 (30)	3 (5.4)	3 (4.6)							
Disagree	16 (8.0)	4 (6.7)	-	11 (1.8)	1 (1.5)							
Strongly disagree	25 (12.4)	8 (13.3)	1 (5)	3 (23.2)	13 (20)							

*Refer to significance at 5% and ** refers to significance at 1% with Kruskal Wallis test.

Physicians' awareness of the effects of climate change on health conditions in their countries was high. A majority (86.6%) believed that the health conditions will become more frequent and severe with changing climate in the future. This belief was highest (91%) among physicians from India and Pakistan.

How knowledgeable are you about association of climate change and health impacts?

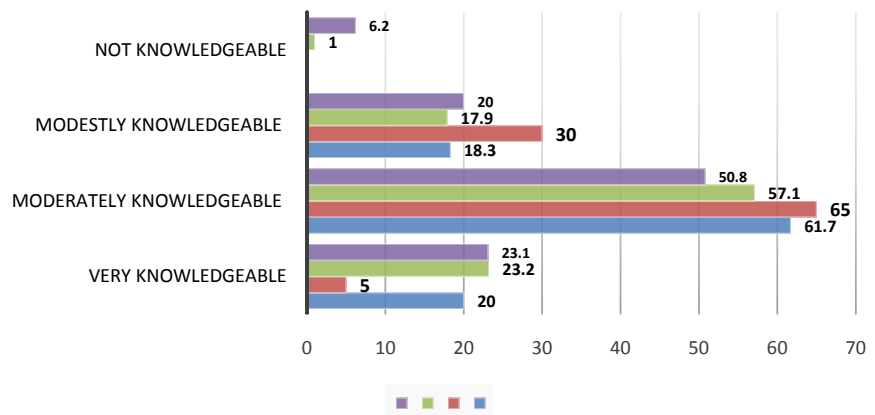


Figure 5. Percentage of physicians who felt very, moderately or modestly knowledgeable about health effects of climate crisis by countries of origin.

There was a consensus among physicians from all four participating countries that climate change has adversely affected health conditions in their countries. Physicians reported that climate change moderately affected physical and mental health harm from forest or bushfires (44.9%), disrupted health care services for people with chronic conditions during extreme weather events (39.5%) and resulted in violence, conflicts, or dislocations (36.5%) in their countries. The health conditions greatly affected according to the physicians were illnesses related to reduced outdoor air quality (54.3%), water and food-borne diseases (49.8%), vector-borne diseases (46.7%), heat-related conditions, such as stroke, cardiorespiratory illnesses (46%), drought-related physical or mental harm (43.7%), increased poverty due to economic hardships (43%), hunger and malnutrition due to rising food prices (42.5%), anxiety, depression and mental health conditions (40.1%), and loss of housing displaced due to extreme weather (37.3%).

In contrast to the views of physicians from Bangladesh, Pakistan, and India, Bhutanese physicians reported that climate had little effect on heat-related effects (45%), mental health conditions (50%), physical or mental harms from droughts (50%), illness due to reduced outdoor air quality (45%), disruption to health care services for people with chronic conditions during extreme weather events (55%), increased poverty due to economic hardships (45%) and violence and conflict (40%) (**Table 3**).

Barriers to discuss climate change related health issues with patients

Common barriers to discuss climate change with patients from all four countries were physicians' lack of knowledge (strongly agree, 13.8%; agree 47.7%) in how to approach the issue with patients, lack of time (strongly agree, 12%; agree, 48%) and their perception that patients are not interested in knowing about climate

Table 3. Physicians' views on the climate related health outcomes in their countries of practice.

	Total n (%)	Bangladesh n (%)	Bhutan n (%)	India n (%)	Pakistan n (%)	P value	Dunn's Pair wise comparison					
							1 - 2	1 - 3	1 - 4	2 - 3	2 - 4	3 - 4
Will climate change make health conditions in your country? n = 201												
More frequent or severe	174 (86.6)	50 (83.3)	14 (70.0)	51 (91.1)	59 (90.8)	0.06						
Less frequent or severe	21 (10.4)	10 (16.7)	3 (15.0)	2 (3.6)	6 (9.2)							
Will remain the same	3 (1.5)	-	3 (15.0)	-	-							
Do not know	3 (1.5)	-	-	3 (5.4)	-							
How much do you think has climate change affected the following in your country												
Physical or mental harm from forest fires or bush fires (n = 198)												
A little	40 (20.2)	10 (16.7)	6 (30.0)	9 (16.7)	15 (23.4)	0.07						
Moderately	89 (44.9)	22 (36.7)	11 (55.0)	24 (44.4)	32 (50.0)							
Great deal	53 (26.8)	23 (38.3)	1 (5.0)	17 (31.5)	12 (18.8)							
Not at all	14 (7.1)	4 (6.7)	2 (10.0)	3 (5.6)	5 (7.8)							
Don't know	2 (1.0)	1 (1.7)	-	1 (1.9)	-							
Heat related effects (heat stroke, heat exhaustion, cardio-respiratory illnesses) (n = 200)												
A little	22 (11.0)	6 (10.0)	9 (45.0)	4 (7.1)	3 (4.7)	0.02	0.00**	0.60	0.63	0.00**	0.00**	0.94
Moderately	82 (41.0)	20 (33.3)	8 (40.0)	24 (42.9)	30 (46.9)							
Great deal	92 (46.0)	33 (55.0)	1 (5.0)	28 (50)	30 (46.9)							
Not at all	3 (1.5)	-	2 (10.0)	-	1 (1.6)							
Don't know	1 (0.5)	1 (1.7)	-	-	-							
Vector-borne infectious diseases (Malaria, dengue, etc.) (n = 199)												
A little	17 (8.5)	4 (6.7)	3 (15.0)	8 (14.3)	2 (3.2)	0.83						
Moderately	88 (44.2)	27 (45.0)	13 (65.0)	17 (30.4)	31 (49.2)							
Great deal	93 (46.7)	29 (48.3)	4 (20.0)	31 (55.4)	29 (46.0)							
Not at all	1 (0.5)	-	-	-	1 (1.6)							
Don't know	-	-	-	-	-							
Water and food-borne diseases (Salmonella, Giardiasis, etc.) (n = 199)												
A little	16 (8.0)	2 (3.3)	5 (25.0)	6 (10.9)	3 (4.7)	0.00**	0.00**	0.33	0.80	0.00**	0.00**	0.45
Moderately	81 (40.7)	23 (38.3)	11 (55.0)	21 (38.2)	26 (40.6)							
Great deal	99 (49.8)	35 (58.3)	4 (20.0)	27 (49.1)	33 (51.6)							
Not at all	3 (1.5)	-	-	1 (1.8)	2 (3.1)							
Anxiety, depression, or other mental health conditions (n = 197)												
A little	40 (20.3)	10 (16.7)	10 (50.0)	13 (24.1)	7 (11.1)	0.00**	0.00**	0.82	0.98	0.00**	0.00**	0.80
Moderately	74 (37.6)	22 (36.7)	8 (40.0)	15 (27.8)	29 (46.0)							
Great deal	79 (40.1)	27 (45.0)	2 (10.0)	24 (44.4)	26 (41.3)							
Not at all	2 (1.0)	-	-	1 (1.9)	1 (1.6)							
Don't know	2 (1.0)	(1.7)	-	1 (1.9)	-							

Continued**Physical or mental harm from droughts (n = 199)**

A little	35 (17.7)	8 (13.3)	10 (50.0)	8 (14.5)	9 (14.1)								
Moderately	63 (31.6)	19 (31.7)	4 (20.0)	13 (23.6)	27 (42.2)								
Great deal	87 (43.7)	31 (51.7)	2 (10.0)	28 (50.9)	26 (40.6)	0.04*	0.03*	0.40	0.35	0.00**	0.15	0.08	
Not at all	9 (4.5)	1 (1.7)	4 (20.0)	3 (5.5)	1 (1.6)								
Don't know	5 (2.5)	1 (1.7)	-	3 (5.5)	1 (1.6)								

Illness due to reduced outdoor air quality (n = 197)

A little	16 (8.1)	2 (3.3)	9 (45.0)	3 (5.6)	2 (3.2)								
Moderately	68 (34.5)	19 (31.7)	6 (30.0)	17 (31.5)	26 (41.3)								
Great deal	107 (54.3)	39 (65.0)	2 (10.0)	33 (61.1)	33 (52.4)	0.00**	0.00**	0.86	0.48	0.00**	0.00	0.61	
Not at all	4 (2.0)	-	3 (15.0)	-	1 (1.6)								
Don't know	2 (1.0)	-	-	1 (1.9)	1 (1.6)								

Loss of housing for residents displaced by extreme weather events (n = 201)

A little	37 (18.4)	5 (8.3)	6 (30.0)	12 (21.4)	14 (22.2)								
Moderately	74 (36.8)	23 (38.3)	8 (40.0)	14 (25.0)	29 (46.0)								
Great deal	75 (37.3)	30 (50.0)	1 (5.0)	25 (44.6)	19 (30.2)	0.04*	0.14	0.65	0.01*	0.26	0.76	0.04*	
Not at all	9 (4.5)	1 (1.7)	5 (25.0)	2 (3.6)	1 (1.6)								
Don't know	6 (3.0)	1 (1.7)	0 (0.0)	5 (5.4)	0 (0.0)								

Disruptions to health care services for people with chronic conditions during extreme weather events (n = 200)

A little	36 (18.0)	5 (8.3)	11 (55.0)	12 (21.4)	8 (12.5)								
Moderately	79 (39.5)	23 (38.3)	5 (25.0)	17 (30.4)	34 (53.1)								
Great deal	75 (37.5)	30 (50.0)	2 (10.0)	23 (41.1)	20 (31.3)	0.00**	0.00**	0.32	0.07	0.05	0.01*	0.46	
Not at all	6 (3.0)	-	2 (10.0)	2 (3.6)	2 (3.1)								
Don't know	4 (2.0)	2 (3.3)	-	2 (3.6)	-								

Hunger and malnutrition due to rising food prices (n = 200)

A little	36 (18.0)	5 (8.3)	12 (60.0)	10 (18.2)	9 (13.8)								
Moderately	70 (35.0)	23 (38.3)	4 (20.0)	18 (32.7)	25 (38.5)								
Great deal	85 (42.5)	32 (53.3)	1 (5.0)	23 (41.8)	29 (44.6)	0.00**	0.00**	0.61	0.54	0.00**	0.00**	0.93	
Not at all	6 (3.0)	-	3 (15.0)	2 (3.6)	1 (1.5)								
Don't know	3 (1.5)	-	-	2 (3.6)	1 (1.5)								

Increased poverty due to economic hardships, resulting in health problems (n = 200)

A little	30 (15.0)	5 (8.3)	9 (45.0)	10 (18.2)	6 (9.2)								
Moderately	73 (36.5)	25 (41.7)	6 (30.0)	18 (32.7)	24 (36.9)								
Great deal	86 (43.0)	29 (48.3)	1 (5.0)	24 (43.6)	32 (49.2)	0.09							
Not at all	8 (4.0)	1 (1.7)	4 (20.0)	1 (1.8)	2 (3.1)								
Don't know	3 (1.5)	-	-	2 (3.6)	1 (1.5)								

Continued

Violence, conflicts and/or resulting in dislocations (n = 200)

A little	39 (19.5)	9 (15.0)	8 (40.0)	12 (21.4)	10 (15.6)	
Moderately	73 (36.5)	23 (38.3)	4 (20.0)	16 (28.6)	30 (46.9)	
Great deal	67 (33.5)	24 (40.0)	1 (5.0)	19 (33.9)	23 (35.9)	0.62
Not at all	15 (7.5)	2 (3.3)	7 (35.0)	5 (8.9)	1 (1.6)	
Don't know	6 (3.0)	2 (3.3)	-	4 (7.1)	-	

*Refer to significance at 5% and ** refers to significance at 1% with Kruskal Wallis test.

change (strongly agree, 8.6%; agree, 42.6%). Most physicians disagreed (disagree, 29.8%; strongly disagree, 14.7%) with the statement that addressing climate change related issues with their patients will not make any difference in patients' overall health (**Table 4**).

6. Discussion

Our study adds to the existing literature on physicians' views of climate-related health outcomes in a multi-country cross-sectional pilot study from four low-and-middle income South Asian countries. The small sample of physicians, especially from Bhutan, calls for caution in the generalizability of results and makes it difficult to interpret the variations in opinions of physicians from all four countries. However, it seems appropriate to conclude that there was a consensus among physicians from all four countries that climate change has adversely affected health in their countries. Physicians were worried about the increasing frequency and severity of climate-related health conditions in their countries. A majority of physicians believed that it was their responsibility to educate their patients on climate-related health conditions, however, -reported moderate or modest knowledge on the topic. More than half reported no training on climate-related health effects. Most physicians from all four countries suggested integration of the climate change into undergraduate medical education. Insufficient knowledge, time constraints, and lack of patient interest were common barriers to discuss climate-related health issues with patients. As climate change intensifies globally, there is an urgent need to upscale global awareness and action across all sectors to alleviate the adverse effects of the climate crisis, particularly in high-risk regions such as South Asia.

A majority of physicians in our study were concerned about climate change and the threat it posed to the health of the people of their countries. Our findings align with previous global and regional evidence, which showed that most health professionals believe in climate change because of their personal and professional experiences of climate-related events (Wei et al., 2014, Hathaway & Maibach, 2018, Sambath et al., 2022). Evidence shows that the proportion of health professionals who believed that climate change was happening increased over time in the past two decades (Sarfaty et al., 2014). A slightly higher proportion of physicians

Table 4. Barriers faced by physicians to discuss climate change related health issues with patients.

	Total n (%)	Bangladesh 1 n (%)	Bhutan 2 n (%)	India 3 n (%)	Pakistan 4 n (%)	P value	Dunn's Pair wise comparison					
							1 - 2	1 - 3	1 - 4	2 - 3	2 - 4	3 - 4
What barriers prevent you from addressing climate change related health issues with patients												
1) I do not believe that climate change is happening (n = 200)												
Strongly agree	6 (3.0)	3 (5)	-	2 (3.6)	1 (1.5)	0.33						
Agree	23 (11.5)	7 (11.7)	1 (5)	5 (9.1)	10 (15.4)							
Neutral	26 (13.0)	8 (13.3)	3 (15)	3 (5.5)	12 (18.5)							
Disagree	69 (34.5)	20 (33.3)	11 (55)	19 (34.5)	19 (29.2)							
Strongly disagree	76 (38.0)	22 (36.7)	5 (25)	26 (47.3)	23 (35.4)							
2) My patients are not interested to know about climate change (n = 197)												
Strongly agree	17 (8.6)	7 (11.9)	-	4 (7.4)	6 (9.2)	0.16						
Agree	84 (42.6)	27 (45.8)	9 (47.4)	21 (38.9)	27 (41.5)							
Neutral	46 (23.4)	15 (25.4)	3 (15.8)	9 (16.7)	19 (29.2)							
Disagree	41 (20.8)	9 (15.3)	6 (31.6)	15 (27.8)	11 (16.9)							
Strongly disagree	9 (4.6)	1 (1.7)	1 (5.3)	5 (9.3)	2 (3.1)							
Lack of time (n = 200)												
Strongly agree	24 (12.0)	7 (11.9)	4 (20.0)	4 (7.1)	9 (13.8)	0.18						
Agree	96 (48.0)	33 (55.9)	7 (35.0)	24 (42.9)	32 (49.2)							
Neutral	44 (22.0)	11 (18.6)	4 (20.0)	14 (25.0)	15 (23.1)							
Disagree	25 (12.5)	7 (11.9)	3 (15.0)	9 (16.1)	6 (9.2)							
Strongly disagree	11 (5.5)	1 (1.7)	2 (10.0)	5 (8.9)	3 (4.6)							
3) Lack of knowledge in how to approach the issue with my patients (n = 195)												
Strongly agree	27 (13.8)	6 (10.7)	2 (10.0)	7 (13.0)	12 (18.5)	0.10						
Agree	93 (47.7)	29 (51.8)	8 (40.0)	22 (40.7)	34 (52.3)							
Neutral	35 (18.0)	10 (17.9)	5 (25.0)	8 (14.8)	12 (18.5)							
Disagree	32 (16.4)	10 (17.9)	5 (25.0)	12 (22.2)	5 (7.7)							
Strongly disagree	8 (4.1)	1 (1.8)	-	5 (9.3)	2 (3.1)							
4) Addressing these issues with my patients will not make any difference in their overall health (n = 198)												
Strongly agree	18 (9.1)	9 (15.3)	0 (0.0)	3 (5.6)	6 (9.2)	0.01*	0.04*	0.00**	0.16	0.74	0.29	0.05*
Agree	46 (23.2)	17 (28.8)	4 (20.0)	9 (16.7)	16 (24.6)							
Neutral	46 (23.2)	14 (23.7)	5 (25.0)	10 (18.5)	17 (26.2)							
Disagree	59 (29.8)	14 (23.7)	9 (45.0)	20 (37.0)	16 (24.6)							
Strongly disagree	29 (14.7)	5 (8.5)	2 (10.0)	12 (22.2)	10 (15.4)							

(84.2%) in our study revealed that climate change was important to them personally, compared to 74.7% of physicians in another multi-country study (Kotcher et al., 2021). The increase in percentage of physicians who consider climate

change important in our study could be due to their recent experience with climate-related events. The extreme weather conditions in recent years in South Asia which resulted in large-scale damage to the health infrastructure, and displaced health staff (Ashraf et al., 2022, Beyeler & Salas, 2022), may have raised awareness among health professionals and governments that the health system is unprepared to manage climate-related health events. However, such evidence is not available. Another reason for the concern of health professionals about climate change and their surety that climate change is happening may also be because most of them worked in urban settings. A large proportion of patients present to urban settings with climate-related health conditions such as air quality-related respiratory diseases. Long-term investments in training health professionals and health system preparedness are needed to mitigate worsening climate-related health conditions.

Although physicians in our study felt that they have a primary role to educate their patients about climate change, only 19% reported being very knowledgeable about the association of climate-related health outcomes. An equal number reported modest knowledge of the topic. These results add to a body of literature that reports that a large proportion of health professionals have insufficient knowledge about the topic (Sarfaty et al., 2014, Sheffield et al., 2014, Wei et al., 2014, Sarfaty et al., 2016a, 2016b, Ryan et al., 2020, Kotcher et al., 2021, Scheerens et al., 2021, Sambath et al., 2022). Confirming the findings of previous research, our study also revealed that health professionals supported the integration of climate change and its health impacts in undergraduate medical education (Sheffield et al., 2014, Wei et al., 2014, Ryan et al., 2020, Scheerens et al., 2021, Sambath et al., 2022). More than half of the physicians in our study did not receive any training on climate-related health effects, which may be a barrier for them to recognize and manage these health conditions. Integration of climate change in the undergraduate and postgraduate medical curriculum and continued medical education will improve physicians' knowledge and help them educate their patients and the public about the relationship between climate and health. Introducing webinars, videos, podcasts, and tele-mentoring series for practicing physicians, are also measures that have shown to be successful in improving the knowledge and practices of busy physicians (Katzman et al., 2022).

Time constraints, insufficient knowledge, and lack of patient interest are commonly reported barriers to discuss climate-related issues among health workers in previous research also (Kotcher et al., 2021). Previous evidence suggests that short consultation times, an increasing number of chronic health conditions, and the number of preventive health topics that a health professional can cover in a single consultation, leave little time to discuss the effects of climate change on health with the patients (Boland & Temte 2019). Strategies such as recruiting and training volunteers and allied health workforce in triaging patients' for climate-related talks may help reduce the burden on physicians. Other strategies such as tailored training for improving the communication skills of physicians, developing resources for the self-education of patients, and engaging

social media for health messages are effective strategies suggested in previous evidence to address these barriers (Kotcher et al., 2021, Sambath et al., 2022).

Consistent with previous research, physicians in our study also identified that climate change affected heat-related conditions such as strokes, heat exhaustion, vector-borne diseases, water, and foodborne disease, mental health conditions, physical and mental harm from droughts, illnesses due to poor outdoor air quality, loss of housing and displacements, hunger and malnutrition, and increased poverty to a great deal (Sarfaty et al., 2014, Sarfaty et al., 2016a, 2016b, Boland & Temte, 2019, Sambath et al., 2022). However, our study results were in contrast to the finding of the Indian study, which reported that a lower percentage of physicians considered malnutrition, violence, and social conflict as climate-related health issues (Sambath et al., 2022). The results of our study are encouraging as it shows that physicians are aware of the direct and indirect effects of climate change. Such awareness among health professionals has recently played a critical role in promoting preventive behaviors among patients during COVID-19 pandemic (Romanello et al., 2022). Health messages from physicians on eating less red meat and more fruits and vegetables, walking, or cycling instead of driving are simple day-to-day strategies to improve the physical and mental health of the patients as well as reduce global warming, and environmental pollution (Dupraz & Burnand, 2021).

South Asian countries do not have well developed family medicine specialty (Qureshi et al., 2018). There are limited or no opportunities for undergraduate or post graduate trainings in family medicine (Ahmed, 2021). The results of the present study, make a strong case for policy makers within South Asian countries to prioritize strengthening and promotion of family medicine or primary care within the region. Formal structured post graduate training programs in family medicine must be initiated along with incorporation of family medicine in undergraduate curriculum with a focus on climate related health conditions. Such strategies will form basis of robust primary care health system and “health for all” concept of universal health coverage in the low middle income countries of the region.

7. Strength and Limitation of the Study

To the best of our knowledge, this is the first multi-country study that explores the views of South Asian physicians about the health impacts of the climate change. Our study results identify the need for further large-scale mixed-method research to understand the motivations and challenges faced by South Asian physicians to assess climate change and its health effects.

There are many limitations of our study. The cross-sectional study design limited our ability to infer any associations among the variables. The small sample size was also a limitation as it restricts the generalizability of our results to all physicians in these countries. Close ended questions were other limitation, which may have led to missing some information that was not covered in the questionnaire.

Social desirability bias may have also led to higher responses to some questions, such as feeling responsible to educate patients on climate-related health effects. Qualitative research will help in developing comprehensive understanding of the trends reported in the present study.

We advise caution in the interpretation and comparison of country-wise results in our study, particularly in the case of Bhutanese physicians due to their small sample size. Bhutan has zero carbon emissions compared to the rest of the South Asian countries which have a protective effect on climate related outcomes. However, we have identified significant trends among the physicians from four South Asian countries, which will help develop tailored regional and national trainings in clinical practice, advocacy and communication, and public health practice.

We used social media to invite physicians for this research. Our initial plan was to only invite primary care physicians to the research. However, due to the low response rate we expanded our research to other specialties also. The physicians from Pakistan, India, and Bhutan were predominately family physicians, however, 80% of physicians from Bangladesh had hospital-based specialties. Due to the small sample size, we were unable to test associations of specialty or primary workplace on the knowledge of physicians. However, results from other studies identify that physician knowledge and practice differ by specialty and those who specialize in preventive medicine are more knowledgeable than those practicing in hospital-based specialties such as paediatrics, general surgery, etc. (Boland & Temte, 2019).

8. Conclusion

Our study contributes to the growing body of research identifying physicians' concern on adverse effects of climate change on human health and their belief that they must play crucial leadership role in patient's education. However, they face barriers at several levels, the most critical ones in the clinical setting are their inadequate knowledge, time constraints, and their inability to communicate with the patients effectively about the linkage of climate change with their health.

Our results suggest that South Asian physicians need collective measures to assist them in developing competent and socially acceptable solutions to lower the future effects of climate change on health. Ideally, physicians must be well-informed and skilled to identify the root causes and the impact of climate on health. However, as medical education is disease-focused, therefore, the link between diseases and climate change are not highlighted in the medical curriculum. Educating undergraduate medical graduates and physicians in family medicine to recognise climate-related health condition at primary care clinical settings is critical.

Climate change is a universal phenomenon and is not restricted at borders or national boundaries. Given the wide ranging direct and indirect effects of cli-

mate on health, agriculture, economy, and development, it is important to devise regional and national preventive strategies and actions. National and regional collaborative action plans and dialogue are needed to develop sustainable and long-term solutions to climate change, including developing family medicine speciality and encouraging them to lead the change at primary care level.

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Ethical Approval and Consent to Participate

We obtained the primary ethical clearance for the research from the Institutional Ethical Review Committee of the Health Services Academy, Islamabad, Pakistan. Ethics approval from participating countries was obtained by submitting the primary ethical clearance to their respective institutional review boards.

Participants indicated their informed consent by clicking on a consent statement provided in the survey link after reading full details of the study, its purpose, what was expected of them and how they might terminate involvement. They were promised confidentiality.

Data Availability

Anonymised data underlying this article will be shared upon request to the corresponding author.

Conflicts of Interest

Authors declare they have no conflicting or competing interests.

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