

Survey of International Members of the American Thoracic Society on Climate Change and Health

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Abstract

The American Thoracic Society (ATS), in collaboration with George Mason University, surveyed international members of the society to assess perceptions, clinical experiences, and preferred policy responses related to global climate change. A recruitment email was sent by the ATS President in October 2015 to 5,013 international members. Subsequently, four reminder emails were sent to nonrespondents. Responses were received from 489 members in 68 countries; the response rate was 9.8%. Half of respondents reported working in countries in Asia (25%) or Europe (25%), with the remainder in South America (18%), North America (Canada and Mexico) (18%), Australia or New Zealand (9%), and Africa (6%). Survey estimate confidence intervals were $\pm 5\%$ or smaller. A high percentage of international ATS survey respondents judged that climate change is happening (96%), that it is driven by human activity

(70%), and that it is relevant to patient care (“a great deal”/“a moderate amount”) (80%). A majority of respondents also indicated they are already observing health impacts of climate change among their patients; most commonly as increases in chronic disease severity from air pollution (88%), allergic symptoms from exposure to plants or mold (72%), and severe weather injuries (69%). An even larger majority anticipated seeing these climate-related health impacts in the next two decades. Respondents further indicated that physicians and physician organizations should play an active role in educating patients, the public, and policy makers on the human health effects of climate change. International ATS respondents, like their counterparts in the U.S., observed that human health is already adversely affected by climate change, and support responses to address this situation.

Keywords: international health; climate change; medical education; environmental health; climate and health

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In 2014, the American Thoracic Society (ATS) published, in *AnnalsATS*, the results of a survey of the U.S. members of the ATS that demonstrated that a large majority of respondents agreed that climate change is occurring, that it is driven by human activity, that it is having a direct impact on patient health today, and that it will have a greater impact in the foreseeable future. The survey showed that physicians in many areas of the country have concluded that

their patients are affected by conditions attributable to climate change, especially respiratory disease onset and exacerbation as a result of increased ambient air pollution, heat stress, wildfires, and spread of pollens and molds. Survey participants indicated that physicians should take on leadership roles to make their workplaces environmentally sustainable, and take responsibility to educate their patients and the public about the health impacts of

climate change. They support education on the topic for medical students and continuing education for graduate physicians, and would like to see their professional associations adopt policies and pursue advocacy on the issue.

In order to understand the views of physicians globally, the ATS conducted a similar assessment of the views and experiences of ATS international members. The ATS Environmental

Health Policy Committee, in collaboration with the Program on Climate and Health within the George Mason University Center for Climate Change Communication (Mason 4C), launched such a survey in October 2015.

Methods

Survey Instrument

A description of the survey instrument may be found in the publication that describes the survey of U.S. members with a copy of the survey instrument in the online supplement (1). Several questions were adjusted for an international audience; most notably, the question that inquired about the most trusted sources of information was adapted to include more international authorities. The demographic questions were also adjusted. Other wording changes were more minor, for example: “What state do you practice in?” (U.S. survey) became “What country to you practice in?” Also, some of the race/ethnicity questions were modified (e.g., the term “African American” used in the U.S. survey was not used in the international survey). The survey again invited respondents to provide clinical anecdotes about their own patients. There were 36 questions and several additional open-ended questions. Based on pilot testing, responders took an average of 6 to 8 minutes to complete the survey. The survey was approved by the George Mason University Institutional Review Board (Project 624642-2) as an amendment to the earlier study. The distribution of the survey was conducted online using Qualtrics software.

Contact Procedures

In October 2015, surveys were distributed by email to 5,013 international ATS members. International members comprise approximately one-third of the entire ATS membership. A letter of invitation came from the current President of the organization. The link to the survey was in the letter and in three subsequent reminders. Only individuals who had not yet responded received reminders. The invitation outlined the importance of gaining the views of international ATS members on climate change, and offered two incentives. For every responder, \$1 was to be donated to the ATS Foundation

to support international health programs. As a second incentive, responders were entered into a raffle to win free registration for the ATS International Conference in San Francisco in May 2016. Three reminders were sent at intervals of 1 week or more.

Analysis

Descriptive statistics were obtained using Stata (version 13.1; Stata, College Station, TX) statistical software. Data were unweighted. Confidence intervals (CIs) for proportions were calculated for the responses to each question using an online CI calculator by entering the sample size for each survey item and the observed proportion of affirmative responses (2). Open-ended comments were edited for grammar, spelling, and to abbreviate the length of statements without altering the meaning. All statistics and open-ended comments are found in the online supplement.

Results

Sample

All recipients of the survey were international ATS members. The majority of participants (84%) were between 31 and

65 years of age. More men than women completed the survey (64% vs. 23%). Most respondents were physicians holding an M.D. or equivalent degree (70%); 34% held a Ph.D. Less than 1% held a nondoctoral clinical degree.

The participants practiced pulmonary medicine (52%), critical care (10%), scientific research (14%), primary care, family medicine, internal medicine or other specialties of internal medicine (6%), pediatrics (5%), sleep medicine (3%), environmental/occupational medicine (3%), surgical specialties or subspecialties (1%), and other types of practice (2%). Five percent did not see patients (2% were retired). The primary work settings were hospital-based (45%), academic (38%), outpatient (11%), other clinical (2%), or nonclinical (4%).

Response Rate

Of the 5,013 e-mailed surveys, 1,576 (31.4%) were opened by the recipients. A total of 474 respondents consented to participate in the survey. The response rate among all invitation recipients was 9.8%; the response rate was 31% among those who opened the e-mail. The responders represented 68 countries. Half reported working in countries in Asia (24%) or Europe (25%), with the remainder in South America (18%),

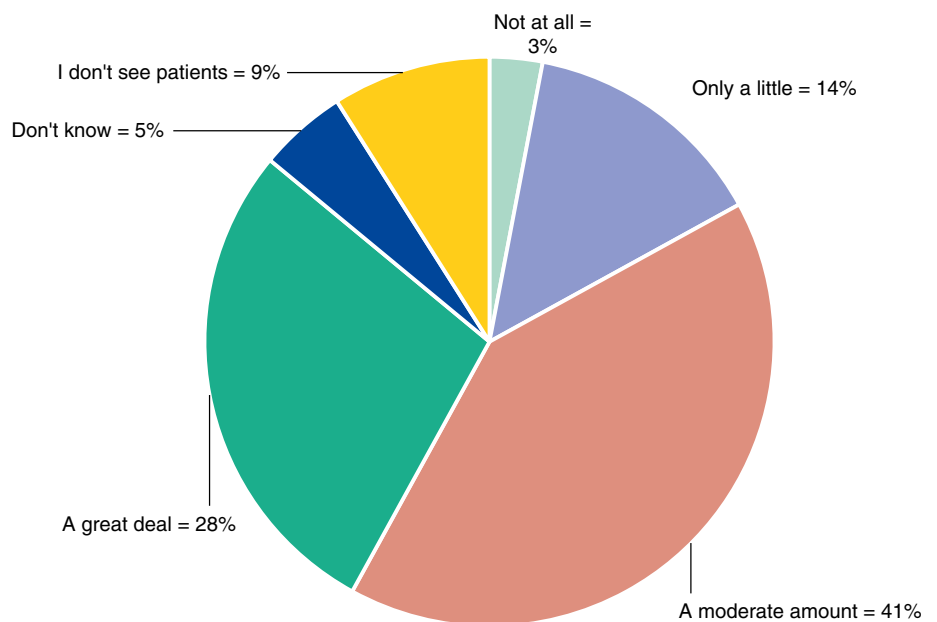


Figure 1. Answers to question, “How much do you think climate change is affecting the health of your patients?”

North America (18%), Australia or New Zealand (9%), and Africa (6%). The 95% confidence intervals for all reported proportions are ± 5% or less.

Knowledge, Assessments, and Attitudes

A majority of respondents (96%) indicated that they think that climate change is happening, based on the following provided definition: “Climate change refers to the idea that the world’s average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world’s climate is changing as a result.” Over two-thirds (70%) assessed that it is mostly or entirely caused by human activity.

Clinical Experience

Over 80% of respondents indicated that climate change is “relevant to direct patient care,” and 69% indicated it was already affecting the health of their own patients either “a great deal” or “a moderate amount” (Figure 1). The most common health effects of climate change that participants noted among their own patients were air pollution–related increases in severity of chronic disease (88%), increased allergic symptoms (72%), heat-related effects (70%), injuries due to severe weather (69%), vector-borne infections (59%), and diarrhea from food/waterborne illnesses (55%). Across all the categories of health effects, an even greater proportion of physicians thought that more of their patients would experience these harms in the next 10 to 20 years than are harmed currently (Table 1). A request for anecdotes about patient experiences produced 43 comments (see Table 2 for examples of these anecdotes).

Respondents were asked to identify barriers to addressing climate change–related health issues with patients. About half the respondents selected “lack of time,” and 45% indicated “lack of knowledge about how to address the issue with their patients.” When asked whether the hospitals they admitted to were prepared for climate-related events and whether their offices were minimizing the use of fossil fuels, 30% or less agreed that this was the case.

Affected Groups

The majority of respondents (92%) indicated that they had personally

Table 1. Responses to the question: “In which of the following ways, if any, do you think your patients are currently being affected by climate change, or might be affected in the next 10–20 years?”

	Yes	No	Don't Know	N
Injuries due to severe storms, floods, droughts, fires				
Now	69%	21%	9%	407
10–20 yr from now	77%	8%	15%	370
Air pollution related increases in severity of illness				
Now	88%	7%	6%	409
10–20 yr from now	89%	4%	6%	369
Increased care for allergic sensitization and symptoms of plant/mold exposure				
Now	72%	10%	19%	405
10–20 yr from now	76%	4%	20%	368
Heat-related effects				
Now	70%	19%	12%	408
10–20 yr from now	79%	8%	14%	371
Vector-borne infection				
Now	59%	23%	19%	406
10–20 yr from now	68%	7%	25%	368
Diarrhea from food/waterborne illnesses				
Now	55%	26%	19%	405
10–20 yr from now	65%	11%	25%	372

experienced climate change to some extent outside their role as a health professional; 61% had experienced it “a great deal” or “a moderate amount.” A majority reported that certain groups will be disproportionately affected by climate change, including people with chronic diseases (76%), the poor and working poor (64%), young children ages 0–4 (71%), and adults over age 60 (70%).

Trusted Sources of Information

The survey sought views on trusted sources of climate change information. Only half of the respondents rated the report of the global Intergovernmental Panel on Climate Change (IPCC, fifth report) as “Trusted/Strongly Trusted”; 22% did not know. The sources trusted by the greatest proportion of respondents were the American Thoracic Society (86%), the World Health Organization (83%), the United Nations Climate Change Framework Convention and Environmental Program (69%), the U.S. National Aeronautics and Space Administration (66%), and the European Climate Change Program and the European Environment Agency (66%).

Responding to Climate Change

The survey indicated that a large majority agreed that physicians should have a significant advocacy role in relation to climate change and health (85%), and felt that actions they take in their personal and/or professional life could contribute to effective action on climate change (76%). Over three-quarters of respondents agreed that physicians have a responsibility to bring the health effects of climate change to the attention of patients (80%) and of the public (79%). A similar majority indicated that physicians should have a leadership role in encouraging offices, clinics, and hospitals to be environmentally sustainable (84%).

Only 54% of respondents felt “moderately” or “very” knowledgeable about the association between climate change and health; 39% felt “modestly” knowledgeable, and 6% “not at all” knowledgeable. The survey showed support for education on climate change as continuing medical education (CME) (84%), in medical school education (89%), in patient education materials (82%), and through association policy statements (85%).

Table 2. Brief responses to the question: “Please describe if you have a relevant anecdote about a patient who has experienced one of these impacts.” (In parenthesis is the location of the physician respondent.)

Air pollution–related increases in severity of chronic disease	<p><i>Change in the classic characteristic of the seasons makes winters warmer with abrupt change of humidity and temperature which apparently increases the rate of COPD and asthma exacerbations. (Argentina)</i></p> <p><i>Frequency and severity of bronchial asthma, COPD, and related cardiovascular diseases are increasing and causing increased hospital bed occupancy as well as health-related budget. (Bangladesh)</i></p> <p><i>Mostly I see severe asthma and COPD exacerbations during periods with very moist and hot weather and during periods of sandstorms. These I see frequently, as I work in Cyprus (Mediterranean Sea). Many patients without pre-existent lung disease see me with breathlessness, cough, and wheeze during sandstorms and periods of hot, moist weather. These are increasing in frequency over the past 10 yr. (Georgia)</i></p> <p><i>On one of the dusty days due to desert dust storm in Gaziantep, Southeast Turkey, I saw a patient with COPD exacerbation at outpatients’ clinics, and asked what the reason he thought about his symptoms. He said that his symptoms started with dust storm, and he stated that there were more dust storms comparing the old days, when he was young. I asked what he thought about the cause of more dust storms. He said that he believed this was due to global climate change and temperature increase. I hear these kinds of anecdotes more from my patients comparing to old days when I started as a young physician. (Turkey, Mid-East)</i></p>
Allergic symptom increases	<p><i>Seasonal allergy to grass pollens and to house dust mites is clearly occurring over a much longer period of time for my patients due to increased humidity arising out of climate change. (Australia)</i></p> <p><i>Patient with new-onset asthma due to mold in her workplace. The concrete building she works in sits on a mountain top where extreme rain events and other storms seem to be increasing. The building is now leaking. Maybe not only related to climate change, but our built environment faces new stressors due to climate change. (Canada)</i></p>
Heat-related effects	<p><i>In our part of Canada (northern), we did not have long summers and therefore most houses (even cars) did not need air conditioning. In the last 2-3 years, however, peak summer temperatures have gone up noticeably and stayed up for longer periods of time. As a result, those people who have not installed air conditioning in their houses find it difficult to fall asleep and stay asleep at night in the summer months. In our practice, we have seen an increase in the frequency and intensity of complaints relating to the lack of sleep and poor sleep quality, not just in the summer months, but lingering through subsequent seasons. (Canada)</i></p> <p><i>We had about 100 people die from heat stroke this year because of high temperature. I think the land temperature is increasing and it will continue to increase in the coming years and this will have great impact on humans and also patients’ lifestyle as well. (Egypt)</i></p> <p><i>In the very hot summer of 2015 we treated 3 patients with heat stroke, a disease formerly virtually unknown in our region. (Switzerland)</i></p>
Vector-borne Infections	<p><i>We suffered a Chikungunya epidemic in our area. (Ecuador)</i></p> <p><i>I am from Delhi, India. I am 40 years old. My birthday is in month of October and an important festival ‘Diwali’ is in November. I remember I used to wear sweaters on my birthday and on Diwali when I was young. Now we wear half sleeve shirts till start of December. In my childhood, there were mosquitoes till about September-early October only. Now we have mosquitoes till December. In recent past my wife, son and daughter have caught Dengue, thankfully a non-shock, non-hemorrhagic severity. (India)</i></p>
Injuries due to severe weather, storms, floods, droughts, fires	<p><i>More flooding, more malnutrition and ill-health. (Nigeria)</i></p> <p><i>Generally: Cities have plans for extreme heat events; more attention than ever is being paid to air quality (thank goodness!); allergies are increasing; smoke from forest fires is affecting the population more than ever. (Canada)</i></p>

Definition of abbreviation: COPD = chronic obstructive pulmonary disease.

Discussion

The results of this survey of international ATS members are similar to the survey of U.S. members in many respects, although their answers to many questions suggest that the international respondents perceive greater impact of global warming on their patients’ experience than did the U.S. respondents.

Among the international members who responded, there was a striking consensus that climate change is occurring, surpassing the level of agreement among U.S. members (96% of international respondents vs. 89% of U.S. respondents). A large majority of both groups of respondents indicated that climate change has direct relevance to patient care (81% international vs. 66%

U.S.); but many more international physicians than U.S. physicians indicated that it was affecting their own patients “a great deal” or a “moderate amount” (69% international vs. 44% U.S.). While the limited response rates threaten generalizability and make it difficult to interpret these percentages, it seems appropriate to conclude that international

Table 3. Survey respondent demographics (N = 474) in comparison to ATS international membership (N = 5,013)

	Full ATS International Membership (%)	Survey Respondents (%)	χ^2 (P Value)
Age, yr			2.91 (0.41)
18–30	9.6	7.2	
31–50	48.9	49.3	
51–65	33.0	33.9	
>66	8.5	9.6	
Gender, female	27.0	26.0	0.47 (0.49)
Primary degree			
M.D.	74.0	67.2	10.90
Ph.D.	26.0	32.8	(0.001)
Region			27.21 (<0.001)
Africa	3.9	5.8	
Americas	28.0	35.8	
Asia	37.0	24.4	
Europe	24.2	25.0	
Oceania	6.9	8.9	

physician respondents to the survey are more united in their recognition of climate change, and perceive greater harm attributable to climate change among their own patients, than U.S. respondents.

Most noteworthy is that responses about specific medical conditions showed that physicians in many areas of the world are witnessing the same or similar impacts to those witnessed by U.S. physicians in large percentages, albeit larger percentages in the foreign context. The climate change-related condition most recognized by international and U.S. ATS members as affecting their patients is air pollution-related increases in severity of illness for asthma, chronic obstructive pulmonary disease (COPD), pneumonia, and cardiovascular disease (88% international vs. 73% U.S.), followed by increased care for allergic sensitization and symptoms of exposure to plants and mold (72% international vs. 58% U.S.).

For other categories of health impacts, more international physicians than U.S. physicians are also witnessing effects in their own patients: heat-related effects (69% vs. 48%, respectively); injuries due to severe storms, floods, droughts, and fires (69% vs. 57%); vector-borne infections (59% vs. 49%); and diarrhea from food or waterborne illnesses following downpours or floods (55% vs. 26%). The last category, diarrhea, demonstrated the largest difference in

proportions between international and U.S. physicians. The specific percentages are less noteworthy than the fact that parallel effects are witnessed and described by international and U.S. physicians who attribute them to environmental changes associated with climate change. On both surveys, the responses to the open-ended questions reinforced the quantitative results by identifying illustrative cases with symptoms and diagnoses that practitioners associate with the environmental effects of climate change.

If we assume that these differences in extent of witnessed patient presentations are not simply different personal experiences of the physicians in the two respondent samples but reflect real quantitative differences in regional climate effects, there are factors to consider that may be at work, especially the reduced adaptive capacity to address the health effects in low- to middle-income countries compared with the United States, and/or a lack of early access to health care services within those countries. Greater severity of illness among patients seeking treatment may also be a factor. Similar judgement between the international and national respondents about what populations are most vulnerable is notable. Those with chronic disease (75% vs. 76%), poor people (65% vs. 64%), young children (71% vs. 66%), and the elderly (70% vs. 63%) are recognized as more vulnerable on both surveys.

With regard to disparities, people of color were perceived at greater risk by U.S. physician respondents (27%) compared with international physician respondents (16%). Given the 5% margin of error, the only categories that differ between the international and domestic samples are the elderly, who are perceived as more vulnerable by international respondents, and people of color, who are perceived as more vulnerable by U.S. respondents.

Like the findings of the U.S. member survey, this survey reinforces elements of the Official ATS Workshop Report on Climate Change and Human Health (“Workshop Report”), which points to the evidence that climate change was driving respiratory disease onset and exacerbation as a result of increased ambient and indoor air pollution; heat stress; wildfires; and spread of pollens, molds, and infectious agents (1). The international survey participants, like their counterparts in the United States, support many of the actions identified as opportunities for mitigation in the Workshop Report, namely education for physicians, the public, and policy makers regarding measures that will reduce risk, as well as the need for advocacy regarding sustainable energy efficient buildings (2–5). The Workshop Report also strongly emphasized the need for more research to better understand and prepare for the health impacts of climate change.

The primary limitation to this study is the response rate (9.8%), which was lower than the response rate to the U.S. member survey (17%). The initial invitation to survey and the reminders produced limited returns. While 40% of U.S. member recipients opened the survey e-mail, only 30% of international member recipients opened it. It was unclear whether the appeals for participation simply evoked limited interest in potential respondents, lack of familiarity with survey approaches, or lack of relevance of an online survey of this nature to in-country contexts. Language may have been a factor; there is some evidence for this. In the final reminder, the word “please” was written in multiple languages in the subject line; this approach provided the largest single boost in respondents,

Although the low response rate limits the generalizability of the results to all international members, the sample was representative of two key characteristics of the full ATS international membership. The age and gender frequencies of our sample

did not significantly differ from those of the population of international ATS members (Table 3). There were differences, however. Respondents whose primary degree was a doctorate in philosophy (Ph.D.) rather than a medical degree (M.D.) were slightly but significantly overrepresented in our survey (33% of U.S. respondents, compared with 26% of ATS international member respondents) ($P < 0.001$). There were significant differences in the regional distribution of our sample compared with the full international membership ($P < 0.001$) (Table 3). Respondents working in the Americas region (including North and South America, with the exception of the United States) were overrepresented

(comprising 36% of survey respondents, compared with 28% of international ATS members), while respondents from Asia were underrepresented (24%, compared with 37% of international ATS members). Survey participants from countries in Africa, Europe, and Oceania responded in similar proportions compared with their representation in the full international membership data (Table 3).

As with the survey of U.S. members of ATS, this survey cannot establish whether the specific health impacts observed and reported by the survey respondents are attributable to climate change. However, the results demonstrate that, in the judgment of these physicians, the health of their patients

has been affected by climate change and will be more affected in the future. The similarity in the observations of these physicians to those made by the U.S. physicians reinforces the notion that those effects are real and span geographic boundaries. Further research is needed to better understand and quantify climate change's impact on respiratory disease, both in the United States and globally. ■

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