FE TURE

Facing the Health Effects of Increasing Exposures from Climate Change and Environmental Hazards

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Introduction

Pennsylvania residents are facing the health effects of increasing exposures from climate change and environmental hazards like contaminated drinking water supplies from per- and polyfluoroalkyl substances (PFAS). While these hazards are common to other parts of the United States, in the state of Pennsylvania there are added environmental exposure hazards from shale gas operations. Many illnesses with environmental etiologies present with non-specific symptoms and are overlooked. Alternatively, clinicians are often asked about environmental health issues but may not feel confident in addressing them. The purpose of this paper is to outline the health implications of these emerging problems and what role clinicians can play from medical and advocacy perspectives by offering tools for strengthening environmental history taking and assessment.

Climate Change

Background: According to the PA Department of Environmental Protection (PA DEP) 2021 Climate Impact Assessment (2021 Climate Impact Assessment, 2023), health will be extremely impacted by increasing temperatures, heat waves, and precipitation, primarily through rain. They predict there will be more days above 90°F; temperature has increased 1.8°F over the last century and is expected to rise 5.9°F by 2050. Pennsylvanians are experiencing a rise in precipitation by at least 80% by 2050. In Philadelphia, just like the state, climate change is projected to create hotter temperatures with prolonged heat waves; more precipitation in the form of rain, although snow events are inevitable. These weather and temperature events can lead to worsening of air and water quality, flooding, landslides, blizzards and creating challenging health effects for Pennsylvania residents. Figure 1 is a summary of the predicted risks on different climate-caused events by 2050 for the state.

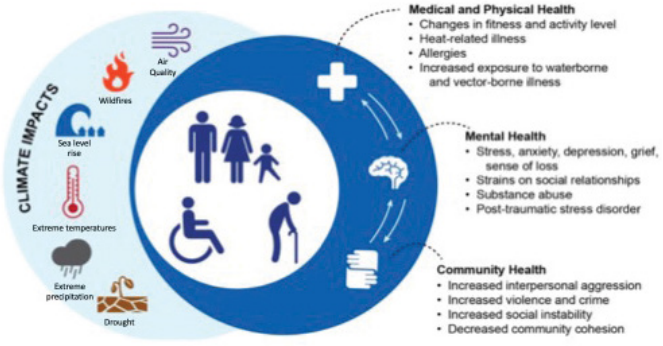
Figure 1: Risks associated from climate events by 2050

	Human health	Environmental justice and equity	Agriculture	Recreation and tourism	Energy and other economic activity	Forests, ecosystems, and wildlife	Built infrastructure
Increasing average temperatures							
Heavy precipitation and inland flooding							
Heat waves							
Landslides							
Sea level rise							
Severe tropical and extra-tropical cyclones							
Risk key	Low	Medium	High	Extreme			

Adapted from the Pennsylvania Climate Assessment 2021.

Climate change affects health in three key ways: medical and physical health, mental health, and community health (Figure 2). Philadelphians, like all people across the United States, will be tested by climate change. Clinicians will be vital in addressing these challenges to health.

Figure 2: Climate Impacts on Health



Source: U.S. Global Change Research Program. 2016. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. https://health2016.globalchange.gov/

Medical and physical health will be challenged directly as described above. Indirectly, the challenge will be reduction of access to resources. For example, there will be issues in accessing food from heavy precipitation or extreme temperatures. Or exposure to nature through forests, ecosystems, and wildlife has been shown to mitigate mental health problems, therefore an increase in temperature will influence access to this resource. The health consequences will not affect all Pennsylvanians equally. Some may be more at risk because of the Social Determinants of Health (SDoH) relating to their location, income, housing, health, work, or other factors, as part of environmental justice and equity. (About Social Determinants of Health (SDOH), 2021) Populations at higher risk include older adults, children, pregnant women, individuals with pre-existing conditions, outdoor workers, low-income communities, and communities of color.

Role of clinicians linking climate to health

Climate change will alter treatments and recommendations that clinicians provide for their patients. To facilitate this, Physicians for Social Responsibility Pennsylvania (PSR PA) has created a climate history taking mnemonic to help clinicians ask their patients how climate change is influencing their health, through an SDoH lens. OCAREER [Occupation; Conditions; Activities; Residence; Environment; Education; and Resources] is a tool for examining the links between climate and health. It is an outgrowth of certain gaps that were identified. Surveys have revealed that many clinicians are concerned about climate change as it relates to health, but they do not feel that they have the tools or the knowledge necessary to assess the people they work with. (Samano-Martin-Del-Campo D, 2020) Clinicians often use mnemonics such as PET-MAC to quickly assess chest pain and we modeled OCAREER similarly. (PETMAC

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as a mnemonic for the 6 deadly causes of chest pain, 2022) And lastly, while health effects of climate change are not billable through ICDS-10 codes, they could be documented as secondary or tertiary codes. This would provide measurable information about the linkages between extreme weather/temperatures and their health impacts through a consistent set of codes. Figure 3 is an example of part of the tool. For each letter, there are associated ICD-10 codes.

Figure 3: Sample of the climate health assessment mnemonic OCAREER

Physicians for Social Responsibility PA: OCAREER

A practitioners' tool for evaluating climate and health

	Description	Questions to consider
		Primary Climate Code: Issues due to physical environment
O	**Occupation and work**	• What do you do professionally? • What is your workplace like (outdoor vs indoor, stationary vs mobile) Have you ever been in the military? worked on a farm? done volunteer or seasonal work? • How do you get to and from work?
C	**Conditions/ Health: medications and mental health**	• Do you have any chronic medical conditions? Are you currently being treated? If so, for what disease/symptoms? What medications do you take: prescribed, over the counter, and/or herbal? • Do you engage in any alternative healing or cultural practices? • *"What brings you here today?" "What do you think is going on?" "Can you trace your symptoms to a date, time, location or event?"*

If interested in OCAREER, please contact: ocareer@psrpa.com

During extreme heat or prolonged heat waves, heart failure patients will need to be counseled about spending time outdoors and activities to prevent heat stroke, accessing food and medications to limit strain on the heart, and potential changes in medications, like diuretics, to address dehydration. The need to apply common sense solutions to these types of issues will be incumbent upon clinicians.

Clinicians may also need to advocate on behalf of their patients to get services reflecting changes in climate. Continuing with extreme heat or prolonged heat waves as an example, air conditioning should be considered as part of a treatment plan. Since paying for electricity is a major concern, clinicians will need to advocate for their patients to receive services like Low Income Home Energy Assistance Program (LIHEAP), such as energy vouchers, in order for them to use air conditioning. This type of advocacy is an upstream approach to address SDoH that impact health from climate change.

Environmental Hazards

Background: With the rise of acknowledged environmental hazards, the medical knowledge of threats to people's health is increasing. These include sources from air pollution, chemical contamination, and emerging disasters. More environmental hazards are being identified and linked to negative health outcomes because of several factors: technology is better able to detect lower levels of contaminants in the air, water, and land; information about the health impacts of contaminants is more complete through research activities; and people are making the connection between exposure and their health issues, looking to clinicians to identify and treat their symptoms. While it is hard to measure these increases, let's consider three examples of environmental hazards: contaminated water supplies from PFAS, contacts with chemicals from military service and those particularly present in this region, and shale gas operations from unconventional oil and gas development.

Examples of Hazards

Shale oil and gas are produced extensively in Pennsylvania, including fracking (as high-volume hydraulic fracturing method of shale gas extraction is referred to by popular media) and liquified natural gas (LNG). Much of the research about health hazards of fracking including cancers, asthma, respiratory diseases, skin rashes, heart problems, and mental health problems identifies living in proximity to shale oil and gas operations as the risk factor. (CHPNY, April 2022) Philadelphia does not lie atop of Marcellus Shale and therefore fracking operations such as extraction and processing do not happen in its metropolitan region. However, the transportation of the fossil fuels in the form of LNG has been approved by city council to go through the city. (Bate, 2019)

LNG is a highly flammable product, making it a security threat but it can also flash freeze human flesh creating a public health hazard. The process of liquefaction is a source of toxic air pollutants and the production process emits 30 percent higher greenhouse gases than conventional gas. (CHPNY, April 2022) In many parts of the state, families seek medical attention as they are experiencing health symptoms they associate with proximity to and length of exposure to nearby fracking operations. Physicians in Philadelphia who may find themselves in the role of a specialty consultant and frontline clinicians in other parts of the state are often at a loss as to how to mitigate the sources of exposures for these families and as such end up downplaying the exposure concerns. The section on role of clinician is aimed to help with history taking and documentation of these concerns as the first step in addressing the exposures.

PFAS, nicknamed the "forever chemical," are human-made chemicals used in many industries and consumer products. They are resistant to heat, water and oil, and persist in the environment and the human body. PFAS are not found naturally in the environment. Since the 1950s they have been applied to manufacture cookware, carpets, clothing, fabrics for furniture and packaging for food. They are also used in firefighting foams and in a number of industrial processes. In the Philadelphia region, the former Willow Grove Naval Air Station in Horsham has demonstrated high levels of PFAS, contaminating public wells. In a publication by the Agency of Toxic Substances and Disease registry (What are the health effects of PFAS?, 2022), a number of health effects were associated with PFAS exposure, including increased cholesterol levels, decreased vaccine response in children, changes in liver enzymes, increased risk of pre-eclampsia in pregnant women, decreases in infant birth weights and increased risk of kidney or testicular cancer. In November

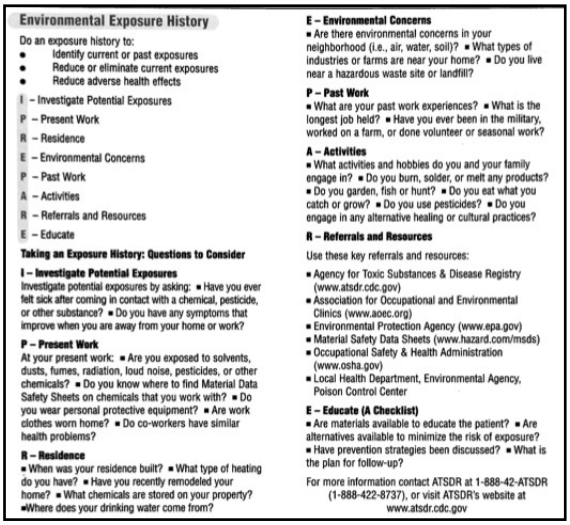
2022, the PA department of health released a public health advisory highlighting these findings. (2022– PAHAN –674 – 11-15 – ADV Per- and Polyfluoroalkyl Substances (PFAS) Exposure, 2022) To read more about the impacts on the pediatric population and what patients can do, you may refer to a blog by pediatrician Dr. Ned Ketyer. (Ketyer, 2022)

A third environmental exposure that has increasingly been discussed occurred in the course of many veterans' military deployments. Pennsylvania has the 4th largest veteran population in the nation. During the military operation in Southwest Asia Theater, in countries such as Iraq and Afghanistan, trash, human waste, and other military items such as batteries and equipment were burned in open pits using gasoline and fuels. Other airborne hazards also existed, such as the fire of oil wells in Kuwait in early 1991. While these exposures occurred in the past, many veterans have expressed significant concern about their current health problems in relation to these and other environmental exposures. In August of 2022 President Biden signed the PACT (Promising to Address Comprehensive Toxics) Act into law. While the Veteran Health Administration (VHA) has historically pioneered the incorporation of assessment of environmental exposures into clinical care by creating environmental health registries, this act is among the first instances where the importance of environmental exposures has been highlighted throughout the healthcare system. Many veterans seek care with non-VA clinicians, especially in more rural areas of Pennsylvania and as such, these clinicians may find themselves needing to assess military exposures. VHA offers extensive informational training and clinicians are encouraged to take advantage of these educational resources. (Department of Veteran Affair Public Health, 2022)

Role of clinicians in Assessing Environmental Exposures

Clinicians need to identify and diagnose environmental exposures. Similar to climate change, they are faced with the need to assess them without possessing the tools to do so. To assist clinicians, the I-PREPARE (Paranzino GK, 2005) tool is a mnemonic developed in the late 1990s by public health and nursing professionals to take an environmental history. I PREPARE is: I - Investigate Potential Exposures; P - Present Work; R – Residence; E - Environmental Concerns; P - Past Work; R - Referrals and Resources; E - Educate (Figure 4).

Figure 4: " I-Prepare" mnemonic card



Environmental Exposure History

Do an exposure history to:
- Identify current or past exposures
- Reduce or eliminate current exposures
- Reduce adverse health effects

I – Investigate Potential Exposures
P – Present Work
R – Residence
E – Environmental Concerns
P – Past Work
A – Activities
R – Referrals and Resources
E – Educate

Taking an Exposure History: Questions to Consider

I – Investigate Potential Exposures
Investigate potential exposures by asking: ▪ Have you ever felt sick after coming in contact with a chemical, pesticide, or other substance? ▪ Do you have any symptoms that improve when you are away from your home or work?

P – Present Work
At your present work: ▪ Are you exposed to solvents, dusts, fumes, radiation, loud noise, pesticides, or other chemicals? ▪ Do you know where to find Material Data Safety Sheets on chemicals that you work with? ▪ Do you wear personal protective equipment? ▪ Are work clothes worn home? ▪ Do co-workers have similar health problems?

R – Residence
▪ When was your residence built? ▪ What type of heating do you have? ▪ Have you recently remodeled your home? ▪ What chemicals are stored on your property? ▪Where does your drinking water come from?

E – Environmental Concerns
▪ Are there environmental concerns in your neighborhood (i.e., air, water, soil)? ▪ What types of industries or farms are near your home? ▪ Do you live near a hazardous waste site or landfill?

P – Past Work
▪ What are your past work experiences? ▪ What is the longest job held? ▪ Have you ever been in the military, worked on a farm, or done volunteer or seasonal work?

A – Activities
▪ What activities and hobbies do you and your family engage in? ▪ Do you burn, solder, or melt any products? ▪ Do you garden, fish or hunt? ▪ Do you eat what you catch or grow? ▪ Do you use pesticides? ▪ Do you engage in any alternative healing or cultural practices?

R – Referrals and Resources
Use these key referrals and resources:
- Agency for Toxic Substances & Disease Registry (www.atsdr.cdc.gov)
- Association for Occupational and Environmental Clinics (www.aoec.org)
- Environmental Protection Agency (www.epa.gov)
- Material Safety Data Sheets (www.hazard.com/msds)
- Occupational Safety & Health Administration (www.osha.gov)
- Local Health Department, Environmental Agency, Poison Control Center

E – Educate (A Checklist)
▪ Are materials available to educate the patient? ▪ Are alternatives available to minimize the risk of exposure? ▪ Have prevention strategies been discussed? ▪ What is the plan for follow-up?

For more information contact ATSDR at 1-888-42-ATSDR (1-888-422-8737), or visit ATSDR's website at www.atsdr.cdc.gov

In an evaluation of this tool, 80% of the participants said that they would be more likely to ask patients environmental health history questions if they had a mnemonic card. Two-thirds would use at least part if not all the questions on the tool. Overall, the response for use of this mnemonic was very positive and helpful for clinicians.

As environmental medicine experts, we recognize the difficulty facing clinicians in assessing environmental hazards and addressing the concerns of the patients. Often front-line healthcare workers conduct the preliminary assessments and then proceed to refer to specialists when more complex evaluations and/or treatment regimens are called for. The dearth of specialists in environmental medicine and related fields such as toxicology limit the ability of clinicians to refer their patients when environmental exposures arise. Furthermore, the lack of comprehensive treatments especially for past exposures may be sources of frustration for both the clinician and patient alike. (Ryan EC, 2020) In outlining these mnemonic aides, we hope to increase the repertoire of tools available to clinicians to elicit histories that lead to accurate documentation, applicable medical evaluation and ideally possible solutions for treatment and at the very least management of environmental exposures. It is paramount to end on the importance of clinicians advocating for what can be done to lessen the hazards of the impact of climate change and other environmental exposures on the health of their patients, as well as offering social and educational resources to their patients so that they can be their own advocates. •

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