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We can and we must do better to protect children from drinking water contaminant

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A child's environment plays a key role in their health and development, and is a top concern among caregivers. Whether at a patient's bedside or legislative hearing, pediatricians are well-positioned to prescribe clinical strategies to reduce the impact of environmental exposures on children, as well as to provide medical expertise in support of environmental policies that are protective of children's health. This is especially important for pediatricians serving communities of color and low-income families, both of whom are at increased risk for environmental exposures and their resulting adverse outcomes.

We thank Bantol et al. for highlighting the importance of safe drinking water in "*Perspectives from the Society for Pediatric Research: Contaminants of Water and Children's Health: Can We Do Better?*", especially given children's unique susceptibility to the adverse effects of environmental contaminants, many of which are long-term (1). Along with clean air, adequate housing, and a safe food supply, drinking water is among the most fundamental environmental determinants of health.

Although US policymakers have made tremendous strides to improve water safety over the past few decades, the current political landscape threatens these important gains. Here we expand upon the issues identified in the review and advocate for the integration of environmental health (EH) into pediatric care, research, and advocacy. We provide an overview of recent regulatory rollbacks and argue for a more prominent role of the healthcare community in promoting equitable access to clean drinking water for all children.

Protection and Regulation of Drinking Water in the United States

Under the Clean Water Act (CWA) of 1972 and the Safe Drinking Water Act (SDWA) of 1974, the US Army Corps of Engineers and the US Environmental Protection Agency

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Competing Interests

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Patient Consent

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(USEPA) set and enforce standards that limit the discharge of pollutants into federal waters and establish health-based drinking water standards for a number of pollutants. These enforceable standards, “Maximum Contaminant Levels” (MCLs), apply to public water systems serving more than 25 customers (excluding well water and small water systems (2). While MCLs are available for more than 90 contaminants (biological, chemical, radiologic), this represents a small percentage of contaminants detected in drinking water. Further, MCLs consider not only health impacts, but also cost and available water treatment technology.

The CWA and SDWA have dramatically improved drinking water quality, yet low-income and communities of color continue to be impacted by substandard drinking water. A recent analysis found that communities with a high percentage of people of color have a 40% greater likelihood of having frequent and persistent SDWA violations (3). These disparities are notable in urban areas like Newark, New Jersey, where high levels of lead have been reported in drinking water, as well as small agricultural communities with elevated nitrates and pesticides (3,4).

Rollbacks of Environmental Regulations Threaten our Drinking Water

The Trump administration has imperiled access to clean water by dismantling industry regulations and weakening federal protection of the national water supply (5). April of this year saw the repeal of the 2015 Clean Water Rule, a piece of legislation which enhanced the CWA by protecting the drinking water of an additional 117 million Americans, and its replacement by the weaker Navigable Waters Protection Rule (NWPR) (6). The NWPR dramatically reduces the number of waterways that qualify for federal protection and limits USEPA’s authority to regulate the discharge of pollutants into them. In response, Representative Peter DeFazio (D-OR) introduced the Clean Water for All Act, which would replace the NWPR with legislation that establishes science-based protections for the health of the nation’s waterways and those who depend upon them for clean drinking water (7).

The current administration’s weakening of greenhouse gas emission regulations meant to curb climate change also affects the availability of safe drinking water. Examples include the repeal of the Clean Power Plan, which limited carbon emissions from power plants, and the weakening of automobile fuel efficiency standards (5). As climate change accelerates, extreme weather and storm surges often disrupt water system infrastructure, much of which is aging and in need of repair (8). Frequent and more intense precipitation increases urban and agricultural runoff into source water, and rising temperatures lead to increased toxin-producing algae blooms and water-borne pathogens (9).

Sound Science Must Guide Policy

We strongly agree with Bantol et al. on the need for research that informs protective environmental policies. An extensive body of literature confirms the harms of low levels of the drinking water contaminants outlined in their review (lead, arsenic, nitrates, perchlorate, and organophosphate pesticides); while science should guide their regulation, this no longer appears to be the case. For example, despite overwhelming evidence of the neurotoxicity of

the organophosphate chlorpyrifos and against advice from USEPA scientists, the Trump administration overturned a scheduled nationwide ban on this harmful chemical (10). Likewise, in May of this year, contrary to the agency's own scientific evidence, the USEPA withdrew a proposal to establish a safe drinking water standard for perchlorate (11), a widespread contaminant that interferes with thyroid function (1).

The case of per-and poly-fluoroalkylated substances (PFAS; "Teflon chemicals") further exemplifies the failure of the government to consider the best available science in establishing drinking water standards. An estimated 110 million Americans have tap water contaminated with PFAS (12) and 97% of Americans have detectable levels of PFAS in their bodies (13). PFAS exposure in children is associated with thyroid, immune, and renal dysfunction, dyslipidemia, and neurodevelopmental impacts (14). USEPA released a non-enforceable "health advisory guideline" in 2016 and PFAS Federal Action Plans in 2019 and 2020, but has not enacted any enforceable regulations, despite the fact that drinking water is a major source of PFAS exposure. Given federal inaction, several states have enacted or proposed enforceable limits for PFAS. Importantly, at least five states have restrictions that prohibit them from setting drinking water limits that exceed federal standards, while others lack resources or technical ability to implement regulations, testing, and cleanup, reinforcing the need for coordinated federal action on contaminants such as PFAS (15).

While the existing data on health hazards of chemicals like perchlorate, chlorpyrifos, and PFAS must be used to guide policymaking, new research should prioritize the investigation of emerging contaminants of concern (including pharmaceuticals, endocrine disrupting chemicals, and microplastics). Given the vast number of industrial pollutants that may be present in the water supply, untargeted screening tests should be used to identify previously undetected contaminants that warrant regulation (16). Studies that investigate sensitive developmental periods and research that includes populations disproportionately impacted by contaminated drinking water are also critical to the development of safe drinking water standards. To this end, recent innovations in EH research, such as the analysis of baby teeth to pinpoint the timing of exposures *in-utero* and during early childhood should be incorporated into drinking water studies (17). Likewise, statistical methods that assess the impact of chemical mixtures (18), and gene-environment interactions (19) are critical to inform health-protective policies.

Lastly, community-engaged research is a powerful tool for water quality research (20). Involving local residents directly impacted by water contaminants can aid in identification of local pollution sources. Academic-community partnerships have been successful in mapping water contaminants and instigating protective measures for vulnerable populations across the country (21,22). Community-driven science initiatives empower citizens with knowledge and agency to take concrete actions to improve their environment, and can connect them to services such as legal support.

Pediatricians Should Promote Healthy Environments

It is not reasonable to expect all pediatricians to become experts in environmental medicine and EH policy. However, there are accessible ways for providers to increase their EH

literacy and promote safe environments for their patients. Clinicians should integrate components of an environmental history into clinic visits, targeted to the patient's age (e.g., lead hazards for infants and toddlers) and/or medical conditions (e.g., mold in homes of children with asthma). Providers should also incorporate EH anticipatory guidance into routine visits. Figure 1 provides age-based anticipatory guidance on drinking water and links to clinical tools including the "Prescriptions for Prevention" program, which facilitates patient counseling and guides physician referrals for a range of environmental topics.

For guidance on the prevention, identification, and management of environmentally-related conditions or exposures of concern, providers can contact the Pediatric Environmental Health Specialty Units (PEHSUs) (23). Numerous online and educational resources are available to assist clinicians with addressing common EH concerns, including PFAS and other water contaminants (Table 1A & 1B). Providers can also refer families impacted by contaminated water to local organizations that provide opportunities for community science, advocacy, or offer legal support.

Outside of the patient encounter, pediatricians can lend their voice to existing advocacy and public health campaigns through medical societies or other organizations to ensure that children's health guides environmental policy (Table 1C). This advocacy is important on the local, state, and federal level; for example, pediatricians can call for the passage of the Clean Water for All Act or the establishment of enforceable health-based PFAS standards. For academic pediatricians, there is a growing movement for institutional recognition of advocacy-related activities as part of the academic portfolio (24). Further, the Accreditation Council for Graduate Medical Education and the American Board of Pediatrics have added advocacy-related core competencies for pediatric residents to ensure that future pediatricians are equipped to advocate for individual patients and communities (25).

Now more than ever, the medical and scientific community's expertise are needed in the fight for clean drinking water and other critical environmental protections. Pediatricians must advocate for children to ensure that the highest quality and most current science is used in regulatory processes, and that the most vulnerable amongst us have equitable access to safe and healthy drinking water. We can and we must do better to protect children.

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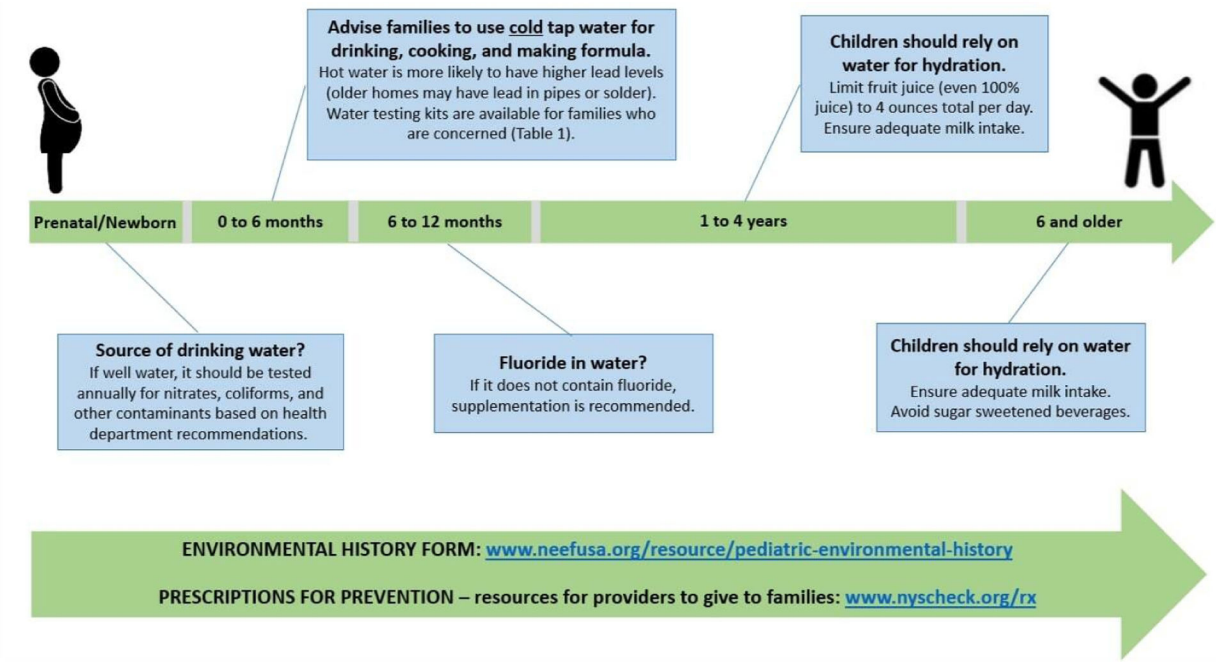

Figure 1. Resources to Address Drinking Water and Environmental Health in Pediatric Care.

The timeline provides drinking water-related anticipatory guidance (light blue boxes) for well-child checks through age 10 years, adapted from Bright Futures, 4th Edition (https://brightfutures.aap.org) and Pediatric Environmental Health, 4th Edition (https://shop.aap.org/). The lower green arrow highlights recommended tools to incorporate into pediatric care including Environmental Health history tools and the "Prescriptions for Prevention," resources providers can use to assist families with preventing common environmental exposures in the home.

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Table 1.

Summary of tools for pediatricians to address environmental health, including responses to common patient questions about drinking water (A), environmental health resources for pediatricians (B), and advocacy opportunities to promote healthy environments for children (C).

A. Responding to Common Patient Questions about Drinking Water
Should I test my water to make sure it is safe to drink? Families with a **private well** should test it regularly for coliforms (bacteria), nitrates, and other contaminants based on local health department recommendations. For more information: www.cdc.gov/healthywater/drinking/private/wells For families using **public/municipal tap water,** in most circumstances, testing of tap water is not necessary. Public water systems are regulated by the federal and state governments to ensure that drinking water standards are met. Consumers are provided a yearly report on their water system, including any violations. For more information: www.epa.gov/ccr
Should I test my water for lead? Public systems test water for lead. However, older homes can have lead water pipes (or lead soldering), and lead can leach out into the water especially after long periods of stagnation. Concerned families can contact their local water supplier for more information, or use a home test kit from a certified laboratory. Simple strategies for reducing lead in water include: using only cold water for drinking, cooking, and making baby formula; flushing pipes in the morning; regularly cleaning faucet screen/aerator; considering using a water filter (see next question). For more information: www.epa.gov/ground-water-and-drinking-water
Should I use a water filter for my tap water? Granulated carbon filters (on pitchers or installed on the tap) can improve the taste of tap water. They can reduce the levels of lead and other contaminants. The filters must be replaced regularly according to manufacturer's instructions to ensure they are functioning optimally and to prevent the growth of microorganisms. Look for filters with NSF certification. For more information: www.nsf.org/consumer-resources/water-quality
Should I use bottled water? Unless there is known contamination in your public tap water system, bottled water is not necessary. Bottled water is not as strictly regulated as tap water, does not contain fluoride for dental health, costs up to 1,000 times more than tap water, and contributes to plastic pollution.
What should I use to mix my baby's formula?

It is important to make sure the water used to mix formula is safe, and meets drinking water standards. Unless there is known contamination, bottled water is not necessary. Use cold tap water to prepare formula. If there are concerns about microbial contamination of the water supply, use cold tap water that has been boiled for 1 minute and then cooled to room temperature.
For more information:
www.healthychildren.org/English/ages-stages/baby/formula-feeding

B. Environmental Health Resources

Pediatric Environmental Health Specialty Unit (PEHSU): www.pehsu.net
Pediatric Environmental Health Toolkit (online resource): peht.ucsf.edu
Prescriptions for Prevention-resources for providers to give to patients: nyscheck.org/rx
AAP's Pediatric Environmental Health, 4th Edition (The Green Book):shop.aap.org/pediatric-environmental-health-4th-edition-paperback
National Environmental Education Foundation (NEEF): https://www.neefusa.org/resource/pediatric-environmental-history
Clinical Guidance on addressing PFAS concerns from the Agency of Toxic Substances and Disease Registry: www.atsdr.cdc.gov/pfas/docs/ATSDR%20PFAS%20ClinicalGuidance_12202019.pdf
PFAS information from the PEHSU: www.pehsu.net/PFAS_Resources.html

C. Environmental Health Advocacy Opportunities for Pediatric Professionals

Vote Kids! An initiative of the American Academy of Pediatrics: www.aap.org/en-us/Vote/Pages/VoteKids.aspx

Academic or medical societies offer opportunities for members to participate in advocacy initiatives in environmental health and other important child health topics:

- American Academy of Pediatrics (AAP): www.aap.org
- Academic Pediatric Associations (APA): www.academicpeds.org
- American Public Health Association (APHA): www.apha.org/apha-communities/member-sections/environment

Non-profit organizations offer advocacy opportunities and highlight the medical voice to promote healthy environments using sound scientific evidence:

- Children's Environmental Health Network (CEHN): cehn.org
- Center for Health, Environment & Justice (CHEJ): chej.org

Learn more about environmental health laws and policies:

- APHA Environmental Health Playbook: www.apha.org/topics-and-issues/environmental-health
- Earthjustice: earthjustice.org

Encourage patients and communities to engage in "Community Science": www.niehs.nih.gov/research/supported/translational/community/
Climate MD program of the Harvard Center for Climate, Health, and the Global Environment www.hsph.harvard.edu/c-change/issues/climate-md