Artificial Turf and Children’s Health

Sarah Evans, PhD MPH
Institute for Exposomics Research
Department of Environmental Medicine and Public Health
Icahn School of Medicine at Mount Sinai

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Children’s Environmental Health Center
### Chronic diseases are on the rise

Your lifetime risk has doubled or tripled for many common diseases in the past 20 years

<table>
<thead>
<tr>
<th>Disease</th>
<th>Lifetime Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alzheimer’s Disease</td>
<td>1 in 10</td>
</tr>
<tr>
<td>Asthma</td>
<td>1 in 12</td>
</tr>
<tr>
<td>Autism</td>
<td>1 in 44</td>
</tr>
<tr>
<td>Cancer in Women/Men</td>
<td>1 in 3 / 2</td>
</tr>
<tr>
<td>Cardiovascular Disease</td>
<td>1 in 12</td>
</tr>
<tr>
<td>Developmental Disabilities</td>
<td>1 in 6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1 in 10</td>
</tr>
<tr>
<td>Food Allergy</td>
<td>1 in 10</td>
</tr>
<tr>
<td>Infertility in Couples</td>
<td>1 in 10</td>
</tr>
</tbody>
</table>
Overview

- Vulnerable populations
- Chemicals of concern
- Heat
- Injuries and abrasions
- Tips for safer play
Windows of Susceptibility
Not just *what*, but *when*

During these time periods, developing systems are most sensitive to certain environmental toxins.
Children are not little adults
Our Chemical Body Burden

- 200+ chemicals
- Some exposures higher in children
- Higher exposures in Black and Hispanic participants
- Chronic, low-dose + cumulative
- Clinical relevance?

https://www.cdc.gov/nchs/nhanes/
Chemicals of Concern in Turf

<table>
<thead>
<tr>
<th>Carcinogens</th>
<th>Neurotoxicants</th>
<th>Reproductive Toxicants</th>
<th>Respiratory Irritants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Lead</td>
<td>Phthalates</td>
<td>VOCs</td>
</tr>
<tr>
<td>PAHs</td>
<td>Zinc</td>
<td>Plasticizers</td>
<td>Particulate matter</td>
</tr>
<tr>
<td>Styrene</td>
<td>Phthalates</td>
<td></td>
<td>Silica</td>
</tr>
<tr>
<td>Cadmium</td>
<td>VOCs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
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<td></td>
</tr>
<tr>
<td>PFAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOCs</td>
<td></td>
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</tr>
</tbody>
</table>

- Inhalation of chemicals and particles
- Dermal contact and absorption through the skin or open wounds
- Ingestion of turf infill particles
Federal Turf Study

“Studies to date...have limitations and do not comprehensively evaluate the concerns about health risks from exposure to tire crumb rubber.”
Heat effects of turf

- Surface temperatures up to 200°F
  - 50°F higher than natural grass
  - 70°F hotter than air temp
- Increased air temperature at head height
- Watering provides limited cooling

Luz Claudio, Environmental Health Perspectives Vol 116 No. 3 March 2008
Surface Temperature in Turf Field and Playgrounds

Crumb Rubber Infill Turf Field
Ambient temperature: 80°F
Surface temperature: 101.9°F

Crumb Rubber PIP Playground
Ambient temperature: 85°F
Surface temperature: 157.4°F

Figure. Measurement of Crumb rubber Turf Field Surface Temperature with Infrared (IR) Thermometer: a) Image of crumb rubber playground surface; b) IR Thermal image of surface. Ambient temperature: 80°F

Figure. Measurement of Playground Surface Temperature with Infrared (IR) Thermometer: a) Image of crumb rubber playground surface; b) IR Thermal image of surface. Ambient temperature: 85°F

Courtesy: Homero Harari, Mount Sinai
Health effects of hot turf

- **Heat illness**
  - #1 cause of death and disability in high school athletes
  - Football players most impacted
  - Marching bands also at risk
- **Skin burns**
  - 1\textsuperscript{st} degree: 118ºF
  - 2\textsuperscripts{nd} degree: 131ºF
Injuries and Abrasions

- **Knee injuries**
  - ACL, PCL

- **Concussion**
  - Temperature and maintenance are key

- **“Turf burn”**
  - Skin abrasion
  - May increase risk of chemical exposures
  - Increases risk of infection include MRSA
Indirect health effects: climate change

- Heat islands
- Flooding
- Petroleum-based
- Greenhouse gas emissions

- Extreme heat increases risk of illness and dehydration.
- Poor air quality due to increased pollutants and pollen worsen asthma and other breathing and heart problems.
- Warmer temperatures promote the growth of bacteria, viruses, and insects.
- Extreme weather causes injuries, missed work and school, and mental health issues.
- Food supply problems cause malnutrition.
Tips for Safer Play

- Post safety warnings
- Avoid use on hot days; measure surface temperature
- Avoid lounging and passive activities
- Wash hands before touching face/eating
- Clean cuts immediately
- Remove and shake out gear and clothes
- Brush hair and shower ASAP
- Monitor for ingestion
- Vaccuum any infill that enters your home or car
- Ventilate indoor fields

Westport, CT
Be a Smart Consumer

- Consider properly maintained grass fields
- Consider wood mulch or pea gravel on play grounds
- Be aware of Greenwashing
- Look for transparency
  - Composition
  - Hidden costs
  - Maintenance chemicals
- Consider the site
  - Wetlands?
  - Residential?
  - Shade?
  - Environmental Justice community?

The Partnership for Healthy Playing Surfaces

For Players & Coaches
Learn more about different playing field surfaces and how they can affect your performance and safety.

For Parents
The choice of playing field surfaces can have implications for your child's future. Learn more.

For Policy Makers
A wide range of health and cost issues should be considered in the choice of playing field surfaces. Learn more.

For Medical Professionals
The materials used to construct playing field surfaces can present significant health risks. Learn more.

https://www.healthyplayingsurfaces.org/
Many turf products are available or “eco-friendly”, but it can be difficult to understand what the potential risks of these products may be. Read this entry to learn more.
BPA and Phthalates

Bisphenol A (BPA) and phthalates are chemicals that are added to some products to make them more durable, flexible, or fragrant. These chemicals can leach into food, water, or air and can cause harm to human health, especially to infants and young children.

Household Chemicals: Keeping Your Family Safe During COVID-19

Pharmaceuticals, household cleaners, and other products can interact with each other and with the environment. It is important to understand how these chemicals are used, how they are disposed of, and how they can affect human health.

Outdoor Air Pollution

Air pollution refers to harmful gases or particles in the air that come from both natural and human-made sources. It can contribute to respiratory and cardiovascular diseases.

Artificial Turf

Artificial turf is a multi-layer product used as a surface on athletic playing fields, golf courses, and residential lawns. It typically consists of:

- Top layer of fibers usually made of nylon, polypropylene, or polyester that are designed to mimic natural grass blades.
- Mat layer or drainage layer that allows for water drainage and reduces the risk of standing water.
- Base or sub-base layer that provides support and stability.

Artificial turf poses a health risk to children through chemical exposures.

- Chemicals known to be carcinogens such as heavy metals, volatile organic compounds (VOCs), polyvinyl chloride, and polystyrene phthalates may be released if turf is allowed to dry for extended periods or if it is treated with certain chemicals.
- Exposure to these chemicals may cause respiratory problems, skin irritation, or other health issues.

Flame Retardants

Flame retardants are chemicals added to materials to make them less flammable. Some flame retardants, such as polybrominated diphenyl ethers (PBDEs), can disrupt the endocrine system and contribute to health problems.

Pesticides

Pesticides are chemicals used to kill pests such as insects, rodents, weeds, or disease-carrying organisms. They can have harmful effects on human health and the environment.

Staying Healthy Through the Pandemic

- Wash your hands frequently with soap and water for at least 20 seconds.
- Avoid touching your face, nose, and mouth.
- Stay home if you are ill.
- Practice social distancing by maintaining at least 6 feet of distance from others.
- Wear a mask in public settings.

https://sinaiexposomics.org/learning-hub/
https://icahn.mssm.edu/about/departments/environmental-public-health/cehc/information
Acknowledgments

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