



Town of Arlington
Department of Health and Human Services
Office of the Board of Health

27 Maple Street
Arlington, MA 02476

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Artificial Turf Study Committee Agenda
02/13/24

Meeting Date: February 13, 2024

Meeting Time: 5PM-6:30PM

Location: Zoom

Objectives:

- 1) To hear from subject matter experts on various topics concerning the Health, Safety, and Environmental concerns associated with natural grass and artificial turf fields.
- 2) To discuss logistics in regards to Working Group and Committee reports, deliverables and project timeline.

Agenda

- I. Acceptance of Meeting Minutes
- II. Correspondence Received
- III. Guest Speaker (s)
 - a. Safety
 - i. Samantha Jones, Head Athletic Trainer, Arlington High School
 - b. Environmental Group
 - i. Helen Poynton, Associate Professor, School for the Environment, Umass Boston
Bio: <https://blogs.umb.edu/helenpoynton/>
- IV. Discussion: Reports, Deliverables, Project Timeline
- V. New Business
- VI. Adjourn



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Artificial Turf Study Committee Meeting Minutes

Meeting Date: January 30, 2024

Meeting Time: 5PM-6:30PM

Location: Zoom- Registration link:

<https://town-arlington-ma-us.zoom.us/meeting/register/tZAvcuqoqTssHt1BnuSXOpbXEnysRzAC-LUe>

Objectives:

- 1) To provide feedback/guidance to each working group on current research findings.
- 2) To further clarify additional research needs within working groups and any additional topic areas relevant to Artificial and Natural Turf fields.
- 3) To identify potential Subject Matter Experts that members of the working groups would like to invite to a future meeting to present information to the Committee.

Committee Members present: James DiTullio, Chair; Natasha Waden, Clerk; Mike Gildesgame; Leslie Maher; Joseph Barr; Jill Krajewski; Claire Ricker

Agenda

- I. Acceptance of Meeting Minutes

Motion to approve meeting minutes from 01/23/2024 was made by Mike Gildesgame.

2nd by Jill Krajewski.

Vote:

Mike Gildesgame, Yes
Leslie Mayer, Abstain
Joseph Barr, Yes
Jill Krajewski, Yes
Natasha Waden, Yes
Marvin Lewiton, Absent
James DiTullio, Yes

Approved (5-0 with 1 Absent and 1 Abstain)

- II. Correspondence Received

Natasha Waden reviewed correspondence received including 3 emails from Susan Chapnick and one from Clarissa Rowe.

Waden responded to Ms. Chapnick's email about PFAS as a chemical of concern, stating that although the Health group has not discussed this specific matter in detail at the Committee Meetings, PFAS as a chemical of concern, it is one of the topics that the group is looking at. The intent of the Health working group's update at the last meeting was to provide a brief overview to the Committee about the overall topics and general findings of their research to date.

No additional discussion by Committee Members.

III. Working Group updates

a. Health

This group is composed of Marvin Lewiton, Jill Krajewski and Natasha Waden. Lewiton was unable to attend this meeting, but did provide input/feedback to the Health working group via email which was incorporated into the update provided by the group.

This group reported that this past week they continued to work on reviewing and synthesizing their research, writing their report, and identifying potential guest speakers. The group acknowledged that they are still trying to understand more about access and usability issues of fields as it relates to health.

The group discussed the challenge of trying to quantify and understand acceptable PFAS exposure limits other than those established for drinking water. For example, whereas Arlington's drinking water comes from the MWRA, the concern for PFAS to contaminate Arlington's drinking water as it relates to water runoff from an artificial turf field in town does not seem to be an issue in this context. However, there are no standards or limits that have been set as "acceptable" for any other routes of exposure to PFAS. Although, a point was made about surface water runoff and potential contamination of drinking water resources to Arlington's neighboring communities.

As a point of clarification, James DiTullio added that it is not to say that other PFAS contamination (surface runoff into a Brooke and the effects on aquatic life) are not important to understand or explore, but thus far PFAS in drinking water has been the primary focus on regulatory agencies. Additionally, in the context of this Committee, PFAS may be discussed more heavily by the environmental working group than the health group.

b. Safety

This group is composed of James DiTullio, Leslie Mayer, and Joseph Connelly. Joe was unable to attend this meeting, but did provide input/feedback to the Safety group during the weekly meeting which was incorporated into the update provided by the group.

The group reported on the work they have been doing in terms of looking at Maintenance and Costs associated with artificial turf, natural grass fields, and organic maintenance/treatment of natural grass fields vs. the current maintenance and

treatment of Arlington's grass fields. This discussion led to the comparison of grass fields vs artificial turf fields. Another Committee Member referenced a contact in the Athletics department at MIT who indicated that the maintenance costs between the two were significantly different. This Member will reach out to MIT to get additional information as a reference point. The safety group indicated that regardless how a grass field is treated, the issue remains the same; users cannot utilize a grass field when there are vulnerable conditions (wet weather) in the same way that they would be able to utilize an artificial turf field. The group indicated this is especially true in the early spring and late Fall/early winter months. The group expressed interest in finding a speaker who could talk more about this topic at a future meeting.

c. Environmental

This group is composed of Mike Gildesgame, Joseph Barr, and Claire Ricker.

The group reported that they are making progress on narrowing down their environmental topic areas to 4 or 5 bullet points and they are looking into several possible speakers.

This group inquired about the format and time allotment for guest speakers at upcoming meetings. James DiTullio stated that a presentation, Q&A, or combination of the two would be appropriate. The format and time allotment may be based more on what is being presented/discussed to/with the Committee. The speaker details will be worked out prior to the meeting date and in consultation with the Chair on a case by case basis.

The group is in the process of reviewing Town published plans such as Arlington's Hazard Mitigation Plan and Corporate Action plan to determine how those plans/goals relate to the discussion about artificial and natural turf fields. The group briefly discussed that the potential classification of artificial turf as an impermeable surface could have a big impact on the management practices for both storm water and other water runoff. The group also referred to the climate work being done in the community; the limited green space and potential impacts of converting a grass field to an artificial turf field in connection with other playing areas; issues related to the over fertilization of fields which leads to runoff into waterbodies that may cause high nutrient levels/algae blooms, etc. in the waterbodies; and recycling of the artificial turf itself.

The group also asked if it would be appropriate to reach out to a landscape architect/designer to present to the Committee. The Committee seemed to agree that if such a speaker could discuss both artificial turf and natural grass fields it would be helpful and appropriate. The group reported that during a conversation with a representative from the Mass Municipal Association, it was made clear that there could be changes at both the State and Federal levels in regards to artificial turf in the near future.

Another Committee Member inquired about whether or not trees and foliage could be incorporated into a plan where artificial turf is being utilized as opposed to grass. The group was interested in this possibility and discussed potential issues associated with

the root system and interference the artificial turf system, but ultimately thought this might be better answered by a landscape architect.

IV. Discussion: Report Format/Template

James DiTullio described that working group reports should generally be organized by providing an introduction as to what and why the group studied certain topics. Each topic can be broken into its own section and discussed further to include what the group studied, what the findings were, what types of resources were utilized, what type of mitigation measure were identified, and/or what gaps or information was not available. Groups can decide if they want to break out areas such as mitigation measures, gaps in research, and resources cited into completely different sections and talk about them as a whole or fold them into each one of their topic sections. In some cases a group may have identified a topic, but that topic may have led to additional points, in which the group can follow the same outline for discussing different points/issues under the general topic heading.

The bulleted report should be similar to the report structure and be reflective of an outline, but with slightly more detail about the topics. One example given to provide more substance in this context was something similar to a thesis statement for each topic that will help the reader understands the points the group is trying to make.

V. Discussion: Subject Matter Experts

This agenda item was discussed under the working group updates.

VI. New Business

The Committee determined that they will not meet on 2/6/2024, unless a speaker has been identified and is available to present on that day. The Committee agreed it would be a better use of time for working groups to meet and continue to work on their reports.

VII. Adjourn

Motion to adjourn was made by Leslie Maher.

2nd by Mike Gildesgame.

Vote:

Mike Gildesgame, Yes
Leslie Mayer, Yes
Joseph Barr, Yes
Jill Krajewski, Yes
Natasha Waden, Yes
Marvin Lewiton, Absent
James DiTullio, Yes

Approved (5-0, with 1 Absent)



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ARTIFICIAL TURF COMMITTEE MEETING COMMENTS FROM THE CHAT

Date: January 30, 2024

Time: 5PM

Location: Remote Participation

Grant Cook

11:12

GC

I assume that's tied to Springfield, MA use of artificial turf which they do use, like this new article about the mayor of Springfield checking out their new turf installation at Ted Plumb Field

https://www.springfield-ma.gov/cos/news-story?tx_news_pi1%5Baction%5D=detail&tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Bnews%5D=16604&cHash=3fbbcc283d035e6476b3950aeb458407

Grant Cook

19:29

GC

I got in just fine using my browser

I didn't have to use a PW, just came off the town website go off the town calendar entry

<https://www.arlingtonma.gov/Home/Components/Calendar/Event/33853/18>

Grant Cook

23:17

GC

Its the way I got in.

Phil Lasker

33:43

PL

1

Absolutely Jill. Less use.

Phil Lasker

46:51

PL

Turf fields are permeable. They are designed to drain vertically and are tested by 3rd party independent labs that measure their permeability.

Phil Lasker

48:32

PL

They are also tested for Heavy Metals and PFAS at the factory prior to delivery to the site. This is written into the job specifications.

Infills are often recycled and incorporated into the new fields. The carpet is being recycled at plants in the US.

3rd party independent labs have tested Brockfill and the underlayment pads. They are non-detect for PFAS.

It is actively being recycled

Susan Stamps

53:02

SS

Our research indicated that while the turf industry says old turf carpets are recycled, they frequently end up just dumped somewhere

Susan Stamps

01:03:05

SS

Per 2023 TM vote on Artificial Turf (article 12): 2. Committee Charge and Reporting

a. The Committee shall review and report on artificial turf: its health, safety, and environmental impacts, and potential mitigation measures, and a comparison of artificial turf to natural turf fields.

Wynelle Evans

01:07:31

WE

<https://www.safehealthyplayingfields.org/cost-grass-vs-synthetic-turf>

<https://www.safehealthyplayingfields.org/the-problem-with-alternative-infills>

Wynelle Evans

01:08:43

2

WE

Thanks to all for your continuing detailed and thoughtful work

High School Athletes injury rates: Artificial vs. Natural turf: 2021

Susan D. Chapnick <s.chapnick@comcast.net>

Tue 2/6/2024 4:50 PM

To:BOH <BOH@town.arlington.ma.us>

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Natasha & Artificial Turf Study Committee members,

Please accept this communication including the link to the Abstract of

"Injury incidence is higher on artificial turf compared with natural grass in high school athletes: a retrospective cohort study," Paliobeis, Andrew, et al., published in Current Orthopaedic Practice, 32(4): p 355-360, July/August 2021:

https://journals.lww.com/c-orthopaedicpractice/abstract/2021/07000/injury_incidence_is_higher_on_artificial_turf.6.aspx

This study is relevant because it specifically compares injury incidences on artificial versus natural playing surfaces among high school athletes.

The conclusion of this study were that high school athletes were "58% more likely to sustain an injury on artificial turf. Football, soccer, and rugby athletes were at a significantly greater injury risk on artificial turf. Upper and lower extremity and torso injuries also occurred with high incidence on artificial turf."

Respectfully submitted,

Susan

Susan D. Chapnick, M.S.

President & Principal Scientist

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Chapnick Email 1_ Link 1

Injury incidence is higher on artificial turf compared with natural grass in high school athletes: a retrospective cohort study : Current Orthopaedic Practice

[July/August 2021 - Volume 32 - Issue 4](#)

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Original Research

Injury incidence is higher on artificial turf compared with natural grass in high school athletes: a retrospective cohort study

Paliobeis, Andrew BS^{a,b}; Sivasundaram, Lakshmanan MD^{a,b,c}; Knapik, Derrick M. MD^{a,b,c}; Labelle, Mark W. MD^{a,b,c}; Olson, Matthew BS^{a,b}; Karns, Michael R. MD^{a,b,c}; Salata, Michael J. MD^{a,b,c}; Voos, James E. MD^{a,b,c}

[Author Information](#)

^aUniversity Hospitals Cleveland Medical Center, Cleveland, Ohio

^bCase Western Reserve University, School of Medicine, Cleveland, Ohio

^cUniversity Hospitals Sports Medicine Institute, Cleveland, Ohio

The preliminary data from this study was presented at American Orthopaedic Society for Sports Medicine (AOSSM) Annual Meeting in Boston, MA July 11 to 14, 2019 and can be found at <https://www.uhhospitals.org/for-clinicians/articles-and-news/articles/2019/08/artificial-turf-versus-natural-grass>.

Financial Disclosure: The authors report no conflicts of interest.

Correspondence to Andrew Paliobeis, BS, 10900 Euclid Avenue, Cleveland, OH, 44106 Tel: +440-477-2488; fax: +(216) 844-8481; e-mail: Asp73@case.edu.

Current Orthopaedic Practice [32\(4\):p.355-360, July/August 2021](#). | DOI: 10.1097/BCO.0000000000001012

- [Buy](#)

Metrics

Abstract

Background:

Prior investigations have demonstrated increased injury risk on artificial turf at the collegiate and professional levels. However, no prior study has examined this risk among high school athletics beyond football. The purpose of this study was to compare injury incidences on artificial versus natural playing surfaces among high school athletes.

Methods:

Data collected from 26 high schools was analyzed to compare injury incidences on artificial turf versus natural grass based on sport. Analyses were also performed to compare injury incidence by injury location (upper extremity, lower extremity, torso), sport, level of competitive play (freshman, junior varsity, varsity), and practice versus competition.

Results:

We identified 953 injuries, with 61% (n=585) occurring on turf and 39% (n=368) on grass. Athletes were 58% more likely to sustain injuries on artificial turf than natural grass relative risk ratio [RR] 1.5897, confidence interval [CI]: 1.4062 to 1.7971, $P<0.0001$). Lower extremity (RR 1.9597, CI: 1.6169 to 2.3752, $P<0.0001$), torso (RR 1.8636, CI: 1.1123 to 3.1225, $P=0.0181$), and upper extremity (RR

1.4494, CI: 1.1104 to 1.8919, $P=0.0063$) injuries were significantly more likely to occur on artificial turf. Football (RR 1.4572, CI: 1.2726 to 1.6687, $P<0.0001$), girls soccer (RR 1.7073, CI: 1.1857 to 2.4583, $P=0.0040$), boys soccer (RR 1.8286, CI: 1.2296 to 2.7194, $P=0.0029$), and rugby (RR 23.0000, CI: 3.1998 to 165.3244, $P=0.0018$) had higher injury incidences on artificial turf.

Conclusions:

Athletes were 58% more likely to sustain an injury on artificial turf. Football, soccer, and rugby athletes were at a significantly greater injury risk on artificial turf. Upper and lower extremity and torso injuries also occurred with higher incidence on artificial turf.

Level of Evidence:

Level IV.

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Related Articles


Icahn School of Medicine at Mount Sinai - Letter to Town Meeting on Artificial Turf - April 2023

Susan D. Chapnick <s.chapnick@comcast.net>

Fri 2/2/2024 4:39 PM

To:BOH <BOH@town.arlington.ma.us>

Cc:mikeg125@gmail.com <mikeg125@gmail.com>;Claire Ricker <cricker@town.arlington.ma.us>;jobar@alum.mit.edu <jobar@alum.mit.edu>

 1 attachments (401 KB)

Mount Sinai Letter to Arlington Town Meeting April 2023.pdf;

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Natasha and members of the Arlington Artificial Turf Study Committee,

I have attached a letter from Dr. Sarah Evans, Children's Environmental Health Center, Dept. of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai, that was submitted to the Arlington Town Meeting Members, dated April 7, 2023. Some of the committee members may have seen this letter - but I was unsure if all had.

The letter "strongly discourages the installation of artificial turf playing surfaces and fields due to the uncertainties surrounding the safety of these products and the potential for dangerous heat and chemical exposures. "

This letter includes extensive references for all of the statements made in the letter for the following topic areas:

- Studies to assess the safety of artificial turf are ongoing and inconclusive
- Questions remain about the safety of alternatives to crumb rubber
- Undisclosed chemicals of concern are present in plastic grass blades and turf pads and matting
- Risk of heat injury is elevated on artificial turf
- Children are uniquely vulnerable to harmful exposures from artificial turf surfaces
- Chemical hazards escape from artificial turf surfaces to the environment
- Tur materials are transported home

Respectfully submitted,
Susan

Susan D. Chapnick, M.S.

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Medicine at
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*Children's
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Chapnick Email 2_ Attachment 1

April 7, 2023

To the Arlington Town Meeting Members:

The Children's Environmental Health Center of the Icahn School of Medicine at Mount Sinai strongly discourages the installation of artificial turf playing surfaces and fields due to the uncertainties surrounding the safety of these products and the potential for dangerous heat and chemical exposures.

As pediatricians, epidemiologists, and laboratory scientists, recipients of numerous research grants from the National Institute of Health, and host to one of 10 nationally funded Pediatric Environmental Health Specialty Units, we receive frequent inquiries from communities regarding the wide-scale use of artificial turf surfaces on school grounds and in park properties. This led us to conduct a review of the risks and benefits of artificial playing surfaces, during which we found **significant gaps in the evidence supporting the safety of artificial turf products**. Our findings are summarized below and in our online resources accessible at <https://sinaiaexposomics.org/artificial-turf/> and <https://www.healthypayingsurfaces.org/> and via webinar on the Environmental Health Impacts of Synthetic Turf and Safer Alternatives.¹

Studies to assess the safety of artificial turf are ongoing and inconclusive. The preponderance of existing data on artificial turf pertains to recycled tire infill, or "crumb rubber", which contains known carcinogens and neurotoxins. Concerns about the safety of recycled rubber playing surfaces have been raised by the federal government, based on a lack of comprehensive studies. In 2016, the United States Environmental Protection Agency (USEPA) announced the launch of an investigation into the safety of crumb rubber in partnership with the Centers for Disease Control and Prevention and the Consumer Product Safety Commission, stating "**existing studies do not comprehensively evaluate the concerns about health risks from exposure to tire crumb**".² In July 2019, USEPA published a portion of their findings from these studies, which confirmed the presence of chemicals linked to cancer, nervous system toxicity, and impaired reproductive development such as polycyclic aromatic hydrocarbons, benzene, lead, and phthalates.³ The authors emphasize that the reported findings **do not constitute a risk assessment** and cannot be interpreted as evidence of safety.

Questions remain about the safety of alternatives to crumb rubber. Extremely few studies have examined the composition and safety of alternative infills including those purported to be "natural". A 2016 USEPA report found research supporting the safety of alternative infills such as EPDM, TPE, and plant-based infills "lacking or limited".⁴ Recent studies including one conducted by Mount Sinai and the Toxic Use Reduction

¹ <https://www.healthandenvironment.org/webinars/96595>

² http://www.epa.gov/sites/production/files/2016-02/documents/us_federal_research_action_plan_tirecrumb_final_0.pdf

³ https://www.epa.gov/sites/production/files/2019-08/documents/synthetic_turf_field_recycled_tire_crumb_rubber_research_under_the_federal_research_action_plan_final_report_part_1_volume_1.pdf

⁴ <https://www.epa.gov/chemical-research/december-2016-status-report-federal-research-action-plan-recycled-tire-crumb>



Institute (TURI) found the **presence of known carcinogens and neurotoxins including polycyclic aromatic hydrocarbons (PAHs), lead, zinc, and black carbon in almost all alternative infill materials examined.**^{5,6}

Adequate safety assessment requires biomonitoring to determine chemical exposures under realistic play conditions. Importantly, no studies have addressed children's exposure to chemicals from artificial turf surfaces via oral and dermal routes, the two most likely ways that turf chemicals enter the body during play. These studies are underway at USEPA; until findings are available and conclusively demonstrate the safety of artificial surfaces, we recommend a moratorium on the use of these materials where children play.

Undisclosed chemicals of concern are present in plastic grass blades and turf pads and matting. A recent study identified per- and poly-fluoroalkyl substances (PFAS, aka "Teflon chemicals"), a class of more than 5000 chemicals linked to numerous health problems including cancer, nervous system toxicity, immune dysfunction, thyroid, and cardiovascular disease in the plastic grass blades and backing used on artificial turf fields and in adjacent bodies of water.^{7,8,9,10} PFAS are considered "forever chemicals" because they persist in the body and the environment and are widespread drinking water contaminants. These findings raise concerns about PFAS groundwater and environmental contamination from turf field run off and emphasize the need for further examination of exposures that may occur from turf components other than infill.

PFAS contamination is widespread in Massachusetts, prompting formation of a PFAS Interagency Task Force and resulting in 13 lawsuits against PFAS manufacturers in May 2022.¹¹ On March 14, 2023, USEPA proposed National Primary Drinking Water Regulations for six PFAS, dramatically lowering the recommended levels of PFOA and PFOS and citing scientific evidence of health impacts at drinking water levels close to zero.¹² These guidelines also include advisories for newer PFAS chemicals PFNA, GenX, PFBS, and PFHxS. The federal government has also taken steps to designate PFAS hazardous substances and to restrict their use in certain products.^{13,14} **To allow the installation of PFAS-containing surfaces would be extremely short-sighted as further restrictions and regulations on these chemicals are likely to come.**

Risk of heat injury is elevated on artificial turf. On hot summer days, temperatures of over 160 degrees Fahrenheit have been recorded on recycled rubber play surfaces.¹⁵ All artificial turf surfaces examined have been shown to have higher surface temperature and air temperature at head height compared with natural

⁵Massey *et al.* *New Solut.* 2020 May;30(1):10-26. doi: 10.1177/1048291120906206.

⁶Armada *et al.* *Sci Total Environ.* 2022 Mar 15;812:152542.

⁷<https://www.atsdr.cdc.gov/pfas/PFAS-health-effects.html>

⁸<https://www.bostonglobe.com/metro/2019/10/09/toxic-chemicals-found-blades-artificial-turf/1mIVxXjzCAqRahwgXtfy6K/story.html>

⁹<https://sinaisexposomics.org/pfas-chemicals-and-your-health/>

¹⁰https://www.turi.org/TURI_Publications/TURI_Chemical_Fact_Sheets/PFAS_in_Artificial_Turf_Carpet

¹¹<https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas>

¹²<https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas>

¹³<https://www.epa.gov/superfund/proposed-designation-perfluorooctanoic-acid-pfoa-and-perfluorooctanesulfonic-acid-pfos>

¹⁴<https://www.epa.gov/newsreleases/epa-proposes-stop-authorized-use-certain-pfas-pesticide-products>

¹⁵ Devitt, D.A., M.H. Young, M. Baghzouz, and B.M. Bird. 2007. *Journal of Turfgrass and Sports Surface Science.* 83:68-82



grass, regardless of infill type.¹⁶ Vigorous play in these conditions conveys a very real risk of burns, dehydration, heat stress, or heat stroke. Children are less able to regulate their body temperature than adults, making them particularly susceptible to conditions of extreme heat.^{17,18}

High temperatures and risk of heat illness lead to a loss of field usage even on hot days, which have become increasingly common due to climate change. Like asphalt, artificial turf fields contribute to the “heat island effect”, in which communities close to the fields become hotter than surrounding areas.¹⁹ Artificial turf contributes to the climate crisis throughout its lifecycle, requiring fossil fuels during production and emitting greenhouse gases during use and disposal.²⁰

Children are uniquely vulnerable to harmful exposures from artificial turf surfaces because of their unique physiology and behaviors, rapidly developing organ systems, and immature detoxification mechanisms.²¹ Children may be exposed to artificial turf chemicals through ingestion, inhalation, skin absorption, and open wounds or broken skin. Children and young athletes breathe faster than adults, putting them at greater risk for inhalation of chemicals that off-gas from turf fields. Small children put their hands and other objects in their mouths, increasing the risk of exposure via ingestion. In addition, youth have a higher surface area to body mass ratio, produce more body heat per unit mass, and sweat less than adults, all factors that increase susceptibility to heat injuries that have been observed on artificial turf fields.¹⁴ Vulnerability to turf chemicals persists through the teen years as the reproductive and nervous systems continue to develop beyond the first two decades of life. Lastly, children have more future years of life over which chronic diseases linked to the chemicals in turf develop.

Chemical hazards escape from artificial turf surfaces to the environment. A number of the chemical components of artificial turf surfaces are soluble in water. When rain and snow fall on synthetic fields, these materials can leach from the surface to contaminate ground water and soil.²² Recent studies find PFAS in wetlands adjacent to artificial turf suggesting that these chemicals may migrate from field components to contaminate the environment.⁷ Runoff from turf fields also has the potential to release microplastics into the environment. Microplastic contamination is found in drinking water and wildlife throughout the globe and in human blood, lungs, and placenta.^{23,24,25}

¹⁶ <https://plantscience.psu.edu/research/centers/ssrc/sportsturf-scoop/temperature>

¹⁷ <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/Extreme-Temperatures-Heat-and-Cold.aspx>

¹⁸ Falk B, Dotan R. *Appl Physiol Nutr Metab*. 2008 Apr;33(2):420-7. doi: 10.1139/H07-185.

¹⁹ Luz Claudio. *Environmental Health Perspectives*. Vol 116. No 3. March 2008.

²⁰ <https://www.nrpa.org/parks-recreation-magazine/2019/may/synthetic-sports-fields-and-the-heat-island-effect/>

²¹ Bearer, CF. *Neurotoxicology* 21:925-934, 2000.

²² Connecticut Department of Environmental Protection (2010) Artificial Turf Study: Leachate and Stormwater Characteristics. http://www.ct.gov/deep/lib/deep/artificialturf/dep_artificial_turf_report.pdf

²³ Amato-Lourenço et al. *Journal of Hazardous Materials*. Vol. 416, 15 August 2021, 126124. doi: [10.1016/j.jhazmat.2021.126124](https://doi.org/10.1016/j.jhazmat.2021.126124)

²⁴ Ragusa et al. *Environ Int*. 2021 Jan;146:106274. doi: 10.1016/j.envint.2020.106274.

²⁵ Leslie et al. *Environment International*. Vol. 163, May 2022, 107199. [10.1016/j.envint.2022.107199](https://doi.org/10.1016/j.envint.2022.107199)



Icahn School of Medicine at Mount Sinai
Children's Environmental Health Center

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Turf materials are transported home. Over time, play surfaces break down into smaller pieces and fine particles that may be picked up on children's shoes, clothing, and skin. Infill and grass blades accumulate in shoes and stick to bodies of players, bringing these materials into cars and homes. Thus, exposure can continue for many hours beyond the time that a child spends in the play area.

Daily outdoor play and physical activity are essential components of a healthy childhood. Safe play areas are an essential component of any school environment. While it is important to maximize safe play time, we caution against the use of materials which carry risks of chemical and heat exposure and have not been comprehensively tested for safety.

For the reasons outlined above, the Children's Environmental Health Center recommends natural grass fields and playing surfaces as the safest option for areas where children play. For case studies that include data on cost, labor, and play time on organically managed natural grass athletic fields see https://www.turi.org/TURI_Publications/Case_Studies/Organic_Grass_Playing_Fields.

I would be happy to answer any questions that you might have.

Kind Regards,

A handwritten signature in cursive script that reads "Sarah Evans".

Sarah Evans, PhD, MPH
Assistant Professor
Children's Environmental Health Center
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Gildesgame Email 1

turf vs. turf

Mike Gildesgame <mikeg125@gmail.com>

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Turf vs. Grass Injuries: What Athletes Need to Know

Contributor: Mark Cote, PT, DPT, MSCTR *Jan 30, 2024 — 10 minute read*

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A season-ending sports injury can happen in the blink of an eye. In recent years, more and more athletes have ended their seasons, or even their careers, after seemingly tripping on thin air. To some, it can look like a car blowing out a tire; an athlete sprinting at full speed collapses under their own weight without anyone nearby.

Frustrated athletes are quick to blame the surface beneath them, and one common culprit in particular: artificial turf. According to Mark Cote, PT, DPT, MSCTR, a Mass General Brigham Sports Medicine researcher, these athletes make a compelling argument.

Mostly.

“I think they’re right – they have good reason to blame artificial surfaces – but there are a number of reasons why injuries occur, and turf isn’t the only one,” says Cote. “It’s a misconception to say natural grass is uniformly better than artificial surfaces for preventing injury, or vice versa.”

Cote serves as director of Outcomes Research for Sports Medicine & Orthopaedic Surgery at Massachusetts General Hospital. He explains the differences between turf and grass playing surfaces, the risks of playing on each, and how athletes can best protect themselves from non-contact injuries.

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Non-contact lower body injuries are common in sports like [football](#), soccer, field hockey, and lacrosse. Each sport involves sudden movements on indoor fields with artificial turf or on outdoor grass fields. Those sudden movements, which include running, jumping, or cutting, place great stress on a player's joints.

How that stress affects the joints, and the rest of the lower body, often depends on the surface beneath.

Cote uses a yardstick as an example. Imagine jamming the yardstick into the ground, he says, like an athlete planting their leg mid-sprint. If jabbed into soft dirt, the bottom of the stick bends without breaking. Rather, it moves the dirt. Now, imagine jamming the stick into cement so it doesn't move.

"That flimsy yardstick becomes so stuck in the earth that, when you push or run into it hard enough, you break it," he says. "There is no wiggle room against the cement."

Grass surfaces

Whenever an athlete plants their cleats into the ground, they expose muscles, tendons, and ligaments in their legs to similar forces affecting the yardstick. On a natural grass surface, their cleats disrupt dirt beneath the grass, creating a divot.

Those divots allow the foot to break free from the ground, reducing the force from sharp movements. However, natural grass can expose players to several hazards:

- **Poor weather:** Cold or snowy weather can harden dirt. The harder the surface, the less cushion for sharp movements.
- **Poor maintenance:** Too many divots create uneven, chunky, or lumpy surfaces, which can lead to slipping or tripping.

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Artificial surfaces, such as turf and artificial grass, offer an even playing field — literally. They mimic the appearance of natural grass without the uneven bumps and holes created by divots. Some athletes credit turf for helping them run faster; they claim the surface feels easier to grip with their cleat, allowing them to accelerate.

Despite their durability and consistency, artificial surfaces act more like cement against Cote's figurative yardstick. A cleat may fix itself into the surface without room to latch free.

"A natural surface accommodates the cleat; its ability to allow the cleat to move and break free decreases built-up force trying to leave the leg," Cote says. "On a turf surface, the cleat can't move as well, so that force has nowhere else to go, except back up the leg."

Depending on which direction and how fast the cleat lands, several injuries to ligaments, tendons, and muscles can occur. These include straining or tearing the:

- Achilles
- Anterior cruciate ligament ([ACL](#))
- Medial collateral ligament ([MCL](#))
- [Meniscus](#)
- Hamstring
- Quadricep
- [Hip](#)

Why does turf cause more injuries?

Not enough data exists to confirm whether turf alone definitively causes more non-contact injuries than natural grass. Many variables affect an injury, such as:

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likelihood of a non-contact injury occurring.

The devil lies in the details, he says, especially when examining two common types of turf:

1. **Monofilament turf:** The faux surface resembles a chunky blade of regular grass. Except, these blades do not bend or move in the same natural manner.
2. **Slit-film synthetic turf:** Shaped more like a double-helix than regular grass, these fake blades easily clump together. The blades, while more durable than monofilament turf, may catch the spikes of cleats when clustered.



While I'd prefer my own children play on natural grass, I know an injury can happen on any surface without proper conditioning. At the end of the day, it's a part of the sport.

Mark Cote, PT, DPT, MSCTR
Researcher
Mass General Brigham

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Lower body injuries cost professional athletes millions of dollars every year. In 2023 alone, more than 20 National Football League players were sidelined due to ACL or Achilles tears and other serious leg injuries. More than half of those injuries occurred on turf, or partially-turf playing surfaces, *Forbes* reports. The injuries affected some of the league's brightest stars, including New York Jets quarterback Aaron Rodgers.

Rodgers, who tore his Achilles on MetLife Field's artificial playing surface, suggested NFL stadiums switch their surfaces to natural grass the year before his injury. Other NFL players share a similar sentiment. For years, the NFL Players Union has asked the league to switch its 15 artificial playing surfaces to natural grass, often citing non-contact injuries on artificial surfaces.


Cote says the physicality of football can explain why players may prefer natural grass more than artificial surfaces. Tackling and bouncing off players heightens the amount of stress rebounding from the turf into the lower body.

"They're not only exposed to forces from running and cutting, but those forces are compounded by players weighing more than 200 to 300 pounds landing on you," he says. "Even without them coming into contact with you, it's several players chasing and dodging one another with split-second turns."

Risks of playing on artificial turf

A [2018 study](#)  underscores the risks of playing football, and other sports, on turf. The study assessed more than 4,800 NFL foot and leg injuries during regular season games between 2012-2016. It found that, had every game been played on a grass surface, at least 300 fewer foot and leg injuries would have been expected.

Turf fields also appeared to significantly increase the likelihood of non-contact injuries. About 20% more non-contact injuries occurred per play on a turf surface than a grass surface.

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Still, Cote cautions against drawing too many conclusions. After all, athletes who play on natural grass are not immune to injury either. A cleat fixed into a surface can sometimes benefit a player. Players who lose their footing on slick or bumpy natural grass can land awkwardly and tear a muscle, ligament, or tendon anywhere in their lower body.

“I don’t think we’re at a point yet where we can say an injury would have been avoided because a field is turf or natural grass, nor are we at a point where should immediately switch every field in America to natural grass,” he says. “We can easily reverse the argument and say, ‘Well, what about all the injuries turf may have prevented from unkept natural grass fields?’”



A young athlete having her ankle evaluated on a grass field.

Future research

To settle the debate over playing surfaces, Cote would like to see more data published. Future research will help validate several suspicions held by athletes about turf. These include:

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- **Injury severity:** How long an athlete recovers from a serious non-contact injury may depend on the surface their injury occurred on.



long term.

Protecting yourself from injury on turf

Fortunately, you can protect yourself from non-contact injuries regardless of the surface you play on. Cote believes this starts with athletes reminding themselves of what they can and cannot control. More times than not, he says, you can't change the surface you play on. But you can prepare your body to withstand awkward or sudden movements.

"Everyone wants to run faster, jump higher, and lift heavier weights," says Cote. "If you look at the athletes who have long careers, they're often those who pay attention to balancing performance-needed strength with pliability and other preventative measures."

Flexible muscles and joints allow the body to support added strength. Stretching in addition to strength exercises trains muscles and joints not to overexert itself in the heat of the moment. Strength and conditioning coaches and athletic trainers can tailor specific stretches and exercises to athletes competing across a variety of competitive levels and sports, many of which can help [prevent common exercise injuries](#).

"While I'd prefer my own children play on natural grass, I know an injury can happen on any surface without proper conditioning," Cote adds. "At the end of the day, it's a part of the sport."

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Contributor

Mark Cote, PT, DPT, MSCTR
Researcher

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