



PENN STATE

CENTER FOR SPORTS SURFACE RESEARCH

From the Field: Synthetic Turf and Human Health – What Does the Research Say?

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Welcome to From the Field - A Guide to Athletic Field Safety and Care.

Throughout this series, we will focus on a sometimes overlooked but critical component affecting the safety and performance for athletes of all ages – the playing surface.

Our goal is to provide you with simple, helpful tips about playing conditions that maximize both safety and performance.

Synthetic turf has come a long way since it was first installed in the Houston Astrodome in 1966. The current generation of synthetic turf – known as *infilled synthetic turf* because of the crumb rubber “infill” used in its construction – can be found in many communities throughout the country.

The crumb rubber infill is made from recycled car and truck tires and is also commonly used on playgrounds.

Understandably, with the popularity boom of synthetic turf has come increased scrutiny. One of the most commonly asked questions is “are there health risks associated with playing on synthetic turf?”

Fortunately, a number of recent research studies conducted by academic researchers and various state and government agencies are providing answers to that question.

This edition of From the Field focuses on the highlights of studies examining potential health impacts related to the air above synthetic turf fields, synthetic turf fibers, skin infections, and playing surface temperature.

How safe is the air above synthetic turf fields?

An extensive study conducted by multiple state agencies in Connecticut, which included attaching air quality monitoring devices to soccer players playing on synthetic turf, measured air-borne compounds above outdoor synthetic turf. After testing for exposure to 200 chemicals, the researchers concluded that the levels of air-borne compounds were the same as the amounts commonly found in outdoor air and, therefore, there is no elevated health risk when playing on synthetic turf.

Similar studies examining the air above outdoor synthetic turf fields were performed by the New York City Department of Health and Mental Hygiene and the California Office of Environmental Health Hazard Assessment. Both studies resulted in similar conclusions – based on the data collected in each study, the air above outdoor synthetic turf fields does not pose an elevated health risk.

Peer-reviewed scientific research studies, such as “Artificial Turf Football Fields: Environmental and Metagenicity Assessment” by Schiliro et al. (2013) have also found the air above synthetic fields to be comparable to common outdoor air.

The air above indoor synthetic turf fields was also evaluated as part of the studies conducted by the state of Connecticut. While air-borne compound levels in the air above the indoor fields were slightly higher than on outdoor fields, the Connecticut Department of Public Health concluded that the measured levels did not suggest a health risk. Proper ventilation of indoor fields was suggested by the authors of the study.

In addition to breathing the air above synthetic turf fields, field users are also often in contact with the crumb rubber infill – especially in sports like football.

A recent study entitled “Hydroxypyrene in Urine of Football Players after Playing on Artificial Sports Field with Tire Crumb Infill” (van Rooij and Jongeneelen, 2010) measured the amounts of potential contaminants not only through inhalation but also through skin contact with crumb rubber infill.

After playing on synthetic turf for several hours per day over several days, field users were given urine tests to determine potential contaminant levels. The results showed that uptake of tested contaminants was minimal and was within the range produced by common environmental sources and/or variation in diet.

What about synthetic turf fibers?

While crumb rubber infill is often the focus of health-related research on synthetic turf, synthetic turf fibers were the subject of a health scare in 2008. The New Jersey Department of Health and Senior Services found elevated levels of lead in the fibers on two synthetic turf fields.

Because of this finding, many communities became concerned about lead in their own fields. As it turned out, the fields that were tested were older, non-infilled synthetic turf with fibers made of nylon. The fibers had also degraded to the point of turning to dust in some cases.

As a response to the lead concerns, the United States Consumer Products Safety Commission assessed the lead content of infilled synthetic turf fibers. The agency concluded that children are not at risk from exposure to lead when playing on infilled synthetic turf.

The fibers in today’s infilled synthetic turf are typically made of polyethylene and have very low or undetectable levels of lead. In fact, the American Society for Testing and Materials (ASTM) has set a threshold for lead content in synthetic turf fibers

Does synthetic turf cause skin infections?

Skin infections, such as those caused by *Staphylococcus aureus*, are sometimes contracted by athletes. MRSA (Methicillin resistant *S. aureus*) infections are a serious type of staph infection that can cause severe health implications.

The role of synthetic turf in staph infections has been questioned. Some have even gone so far as to claim that synthetic turf fields harbor these bacteria.

Several studies, including two conducted by Penn State's Center for Sports Surface Research, have investigated the presence of staph bacteria on synthetic turf.

In one Penn State study, no staph bacteria was found on 20 randomly tested synthetic turf fields. In the other Penn State study, staph bacteria was placed on the surface of synthetic turf and its survival time was monitored. The bacteria quickly died, likely as a result of UV rays from the sun and the high surface temperature common during warm weather.

There have been no documented cases of field users contracting skin infections from synthetic turf. Surface conditions of synthetic turf are generally not conducive to bacteria survival. Rapid changes in temperature, generally dry conditions, and exposure to UV light are examples of factors that do not favor bacteria survival.

While the odds of coming into contact with staph bacteria on synthetic turf is low, it is important to realize that synthetic turf is more abrasive than natural turf (although it is less abrasive than previous versions of synthetic turf). The more abrasive a surface, the greater chance for breaks in the skin, which can provide an avenue for infection to enter the body via skin-to-skin contact.

As a result, care should be taken to prevent as many skin breaks as possible and any breaks in the skin that do occur should be treated with proper first aid care.

Is there a way to cool synthetic turf?

Finally, there is the issue of high surface temperature. Anyone who has been on a synthetic turf field during a warm, bright sunny day knows that these surfaces can get hot.

The black crumb rubber is commonly believed to be the reason for high temperatures. In reality, the synthetic turf fibers also play a large role. Previous versions of synthetic turf that did not contain any crumb rubber infill also produced high surface temperatures.

What can be done to reduce the surface temperature of infilled synthetic turf? That question has not been fully answered yet. Fields can be watered, but the cooling effect only lasts about 40 minutes. As soon as the surface layer dries, surface temperatures heat back up.

Researchers at Penn State, along with researchers at other universities and synthetic turf manufacturers, are actively testing new products and ideas to reduce surface temperature.

In the meantime, it is up to those responsible for the health of athletes to take precautions such as scheduling practices during cooler portions of the day and making sure athletes are properly hydrated.

The surface of synthetic turf get hottest on bright, clear, sunny days. During hazy and cloudy conditions, surface temperatures tend to be cooler.

Since the first infilled synthetic turf field was installed a little over 15 years ago, the popularity of synthetic turf has grown substantially. Given the large number of children playing on these fields on a regular basis, it is not surprising that there has been a desire to investigate potential impacts on health. Researchers have taken heed and the volume of health-related research on synthetic turf continues to grow and address these concerns.

This column was written to serve as an overview of the research that has been conducted on the potential of health impacts from playing on synthetic turf. Penn State's Center for Sports Surface Research [website](#) contains links to each of the studies mentioned in this column as well as many more related studies.