Episode Title: Back Pain and Whole-Body Vibration

Summary: In this episode, we talk about a common problem for farmworkers: occupational exposure to whole-body vibration, a primary risk factor for back pain. Drs. Fred Gerr and Nate Fethke talk about what whole-body vibration is and ways to reduce exposure. “The machine is shaking and… your muscles are constantly contracting to provide stabilization for your spine, so you need to give those muscles some time to recover.”

Expert: Fred Gerr and Nate Fethke

Episode Quote:

“The machine is shaking and… your muscles are constantly contracting to provide stabilization for your spine, so you need to give those muscles some time to recover.”

– Nate Fethke, Associate Professor, Department of Occupational and Environmental Health, University of Iowa

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Transcript

00:04 K. Crawford

Welcome to the FarmSafe Podcast brought to you by the Great Plains Center for Agricultural Health. In the blink of an eye, an injury can change your life and your farm forever. During each episode, workers in agriculture and public health share first-hand stories and real-life tips for making safer and healthier decisions while on the farm.

When we started planning this podcast, we asked people about what topics they wanted us to cover and one of the most common replies was back pain— what causes it and how to prevent it. Back pain is actually a huge topic, and we could do multiple episodes on it. For today, we are going to focus on how back pain relates to a specific type of exposure— whole-body vibration. Whole-body vibration is something farmers might experience when operating a machine with a power source, like an engine, that can transfer vibration to the operator, usually through the seat they are sitting on. Since it’s harvest season, and we know farmers are spending a lot of time in tractors and combines, we thought it would be a good time to learn more about this.

00:59 K. Crawford

My first guest today is Dr. Fred Gerr, a physician who specializes in both occupational medicine and internal medicine. Dr. Gerr was on the medical staff at the University of Iowa Hospitals and Clinics where he practiced occupational medicine— meaning he took care of people who had injuries or illnesses that resulted from exposures they had while on their job.

To start, Dr. Gerr, could you tell us a bit about back pain? It’s a pretty common problem, right?

01:26 F. Gerr

Back pain, and for the moment, I’ll restrict some of my comments to pain in the lower back, which is the most common place for pain all along the spinal column. Low back pain is an extremely common experience, among adults. And in the United States, at least 75% of all adults will experience a major episode of low back pain at some point during their lives, and many of them will experience low back pain at several or multiple points during their lives.

Low back pain can be the result of something simple like pain that originates from a joint in the spinal column or a nerve that's pinched a little bit in the spinal column. Or it can occur for no reason that we are aware of at all.

It's a big problem because it makes it hard for people to do their typical activities of daily life. And that makes it hard for people to go about doing their jobs. It's the single most common cause of work-related disability in people under the age of 45 in the United States. It's also the single most expensive cause of work-related disability.

02:49 F. Gerr

It’s important to know that back pain occurs more often, among people who engage in certain occupational activities. So, people whose jobs require them to engage in heavy lifting, lifting and twisting of the body, prolonged sitting, and vibration, that's delivered to the entire body, often called whole-body vibration, and that often occurs among people who have to work seated in a moving implement—a truck, a tractor, a combine—these kinds of occupational activities, increase the likelihood that a particular working person is going to experience an episode, or more than one episode of low back pain.

One of the reasons why I'm talking about risk factors or characteristics of work that increase the likelihood that a person gets low back pain is because if we can reduce the exposure or the presence of those risk factors, fewer people will get low back pain, but furthermore, when a person gets low back pain, they're likely to get better, a whole lot quicker if they can avoid, even temporarily, some of these risk factors..

04:08 K. Crawford

My second guest is Dr. Nate Fethke, a certified professional ergonomist, and an associate professor at the University of Iowa, with a background in biomechanics and biomedical engineering. In his research, he measures these risk factor for musculoskeletal problems, like back pain. He also has experience measuring and evaluating whole-body vibration. I asked him to join us to tell us more about what he does and how occupational exposure to whole-body vibration relates to back pain.

04:33 N. Fethke

Occupational exposure to whole-body vibration is considered one of the primary risk factors for the occurrence of back problems, back pain, which is extremely common, not just in agriculture, but in many occupational groups that operate heavy machinery.

And so, I focus on ways in which we can measure and characterize a person's exposure to whole-body vibration in order to understand the extent to which that exposure may increase one's risk of experiencing back pain.

05:11 K. Crawford

So, what exactly is whole-body vibration?

05:14 N. Fethke

Sure. Well as Dr. Gerr mentioned, whole-body vibration occurs when a person is typically seated in a machine that has its own power source— so an engine, a motor. When that machine is running, that power plant delivers vibration to the machine chassis, which then transmits through the seat to the operator. And when that machine is moving over terrain, the characteristics of the terrain also impart vibration through the machine to the operator, so it's a combination of both the machine itself, under power, and also the terrain that it's moving over.

05:52 K. Crawford

Is this something that people are aware of? I mean, I know if I’m riding on the mower, I can feel that shaking but I don’t know that I’ve ever thought, “this is a problem.”

06:03 N. Fethke

I think it's important to know that just because the thing is shaking doesn't necessarily mean it’s going to be harmful. It depends both on the strength or the amplitude of the shaking and the frequencies involved.

In general, people that operate machinery often have an awareness of when that machine is rough on their bodies in terms of mechanical vibration. Now it's not as simple as that, because there are a lot of factors that influence the potential harm that vibration can do, including one’s posture while operating so if a person is leaning very far forward on the seat, reclining very far, leaning to the side, or twisting to looking around, which is common in agriculture. So, twisting around in a seat to view an implement behind the tractor, for example. Those kinds of situations can influence the amount of vibration or the extent of vibration that is delivered.

06:59 F. Gerr

It's also important to recognize that low back pain isn't the same as, say, burning your hand on a hot stove. You stick your hand on a hot stove, it hurts instantly, and you know it's a problem. People can operate equipment like this, and begin to experience low back pain that night, for example, or may find that it interferes with their ability to sleep, or they wake up the next morning, get out of bed and their back hurts. So that linkage may not be instantaneous, the way the stove and the burnt finger are, but nevertheless it may manifest within a few hours or a day or two days.

It's also true though that some people can work with equipment for long periods of time and then begin to experience the effects after years have passed or after their bodies age some.

It's no secret that people are a bit more robust physically when they're in their teens and 20s, and experiences that they may have, that have the potential to harm them may not result in discomfort when they're younger and do manifest as discomfort when they go through the normal aging process.

08:17 K. Crawford

So, what's happening in between the vibration entering the body to the eventual back pain outcome— what's happening?

08:24 N. Fethke

The actual mechanism by which vibration leads to increased risk for low back pain is not fully understood. But what we do know is that the human body is a mechanical system, and that mechanical system responds to vibration differently depending on the frequency and the vibration.

One of the things that happens when a person is seated on a machine that is that under power right the vibration is coming in, it's the job of the muscles in your back to stabilize the spine. And so, when you have vibration coming into the seat, when you're going over rough terrain that's causing more impacts or mechanical shocks, the muscles are constantly responding to those vibrations and shocks to stabilize the spine. So, the muscles are firing all the time to keep things stable and often can become fatigued over time. And so that is one possible way in which the vibration can lead to increased risk for back pain.

09:34 K. Crawford

So that's interesting to me. You're saying when you're operating these machines, even if it seems like you're just sitting there, your muscles are still working and potentially getting tired.

09:43 N. Fethke

That's exactly right. Yeah, people often have this perception that if I'm if I'm seated, even if it's in an office chair right when you don't have vibration when you are seated, you're really still in an active proposition— your muscles do not shut off. And when you're in a machine that's vibrating, there are so many little bumps, and movements that your body needs to respond to in order to keep yourself stable.

So, as an ergonomist, one of the things that I recommend is that when you get out of the machine, give your body a chance to recover before you start doing other manual work. Certainly, don't hop out of a machine and then start lifting heavy things around. Your muscles are already compromised just from the vibration, and now if you start lifting, there's a chance that your risk of a back injury could increase.

10:37 K. Crawford

Right now, it's harvest time. So, we're thinking about farm workers that are in these vehicles for a long time, are we worried about time spent doing this or we worried more about how intense that vibration is.

10:50 N. Fethke

It's both actually. There are relatively well-established international standards for how whole-body vibration should be measured and evaluated with respect to the potential for health effects including low back pain. So, what we consider is how strong the vibration is so what's the amplitude of the vibration. We consider the frequency content of the vibration. And then we also consider the duration of time a person is exposed.

And during harvest time that duration can be greater than during other times of the year, when it's time to get the product out of the field, it's time to get the product out of the field, and we're really operating under constraints that way.

You know one of the things about a combine that I've observed in past research is that actually the amplitude of vibration tends to be lower for combines and for other machines like small tractors and ATVs in particular. That's because those combines are so massive, there's so much, just mass in those machines that it tends to decrease the level of vibration and also combines typically have very sophisticated and very well-designed seat suspension systems that limit the extent of vibration that enters the human operator.

But still, a farmer maybe operating that combine for eight hours 10 hours 12 hours. And so even though the vibration level may be lower in the combine the duration is quite long and we still can run into problems with, in terms of just the overall dose of the vibration that the person experiences in the day.

12:25 K. Crawford

So, the goal is to reduce the intensity of the vibration and/or the time someone is exposed. So how do we do that?

12:32 N. Fethke

There are lots of things that we can do to minimize or limit our exposure to whole-body vibration. Agriculture is tricky because we're pretty much constrained on the duration component. But limiting the duration that you're in the machine for any one period of time, taking regular breaks, and just getting out and moving around a little bit, stretching.

12:54 F. Gerr

Agricultural producers often don't get to choose their working hours, and Nate touched on this a little, and even during the current harvest season it's pretty clear. When the weather is dry and the crop in the field is ready to come in, the longer it stays out there, the greater it is at risk of degradation of its condition and agricultural producers need to get the crop in when it's in good condition and it's dry.

And so, it's very easy for those of us who are not doing this work to say, “don’t sit in the combine for more than two hours without taking a 30-minute break and don't spend more than eight hours a day in the combine.” And I think that agricultural producers will view that as advice that's coming from people who don't really understand the realities of their employment.

As much as it would be nice for an agricultural producer to have, you know, a backup and say, “okay I've done my four hours in the combine, you know worker number two, hop in there, and I'm going to do something now that doesn't involve whole-body vibration.” A lot of farmers are so low or very small operators and just have a few people who are qualified and able to operate the combine in a way that uses the machine correctly, safely, and efficiently to bring in the crop in the quickest time and with the least amount of fuel burn.

So, I think that the approach to reducing the intensity of the vibration that's transmitted to the operator is probably the most feasible approach.

14:33 N. Fethke

In terms of the machine itself, making sure that the seat suspension, if it's available, is actually properly adjusted for the operator’s body weight. All of those seats will have some kind of mechanism that can control the sort of resting position of the seat for the operator’s weight.

If a machine is being used by multiple operators, which is common, then all of the operators need to pay attention to the seat suspension adjustment. That should just be part of the checklist. I'm on this machine; I need to set it for my weight.

We can pay attention to tire pressure, and tire balancing, and just the general condition of the tires or track, making sure that it's not overly inflated for example.

We can make sure that we properly maintain, just the overall suspension system of the machine itself. And also, the suspension system of a seat, you know the seats often have a damper inside of them, or spring-damper combination. And those dampers can

wear out. Typically, we think that the lifetime of a seat suspension system is about half of the lifetime of the machine itself, so most machines are going to require regular maintenance and potentially replacement of the seat suspension components.

15:50 N. Fethke

And so, if you're operating a machine on smooth terrain, or maybe just idling the machine and you're able to press the seat down to the end stops, that suggests that maybe the damper has malfunctioned and it's time for a replacement.

You still have to be careful when we do that, because we could put in a stiffer damper, which is going to do a better job of maybe controlling the shocks that you might experience going over really rough terrain, but when we put in a stiffer damper, we may also increase the average level of vibration.

There's a balance there, so you really need to consult with the product manual, with the dealer, maybe with the manufacturer to ensure that if you are replacing components for the seat, that you're replacing them with components that are designed for that application.

16:36 K. Crawford

Dr. Gerr, any final thoughts you want to share?

16:40 F. Gerr

Most people with back pain as a result of exposure to whole-body vibration, the particular part of their back, whether it's a muscle, a joint, a nerve, a disk, a bone, the particular structure in their back that’s generating pain is not easily found. The doctor will come away not knowing what it was. And, for patients that often seems very disturbing. How come the doctor can't figure out what's going on in my back? And this is one of the big gaps in in our ability to work with patients who have low back pain.

The good news here is that the majority of these people who have back pain will not have it permanently. If they engage in very simple, easy to do measures, then their back pain in fact will go away.

Persons with low back pain will get over their low back pain faster. If they are able to reduce the total duration of exposure to whole-body vibration, as well as reduce the intensity or amplitude of the whole-body vibration that they're experiencing.

I think that controlling vibration, using the best possible vibration attenuating seats and making sure that they are maintained to meet factory specifications in the way that Nate was talking about, is a very, very useful approach to reducing back pain among these workers.

18:14 K. Crawford

We have provided links to additional resources in the episode resources section of our website. Check out some of the infographics that the Great Plains Center has made about whole-body vibration.

18:24 R. Anthony

Visit us on the farm safe podcast to join in the conversation about keeping safe on the farm.

18:30 K. Crawford

We want to hear from you. Share your stories about health and safety issues on the farm, about injuries that made you change the way you work, or about the ways you keep yourself and others safe on your farm. Also let us know if there are any topics that you want to hear about on the air. You can visit our website at gpcah.org or email us.

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Episode Resources

- Posters: Whole Body Vibration
- Musculoskeletal Symptoms Among Farmers
- Materials for Health Care Providers: Vehicle Vibration

Photo