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As Injuries Rise, Scant Oversight of Helmet Safety

By ALAN SCHWARZ

NORMAN, Okla. — Moments after her son finished practicing with his fifth-grade tackle football team, Beth Sparks examined his scuffed and battered helmet for what she admitted was the first time. She looked at the polycarbonate shell and felt the foam inside before noticing a small emblem on the back that read, “MEETS NOCSAE STANDARD.”

“I would think that means it meets the national guidelines — you know, for head injuries, concussions, that sort of thing,” she said. “That’s what it would mean to me.”

That assumption, made by countless parents, coaches, administrators and even doctors involved with the 4.4 million children who play tackle football, is just one of many false beliefs in the largely unmonitored world of football helmets.

Helmets both new and used are not — and have never been — formally tested against the forces believed to cause concussions. The industry, which receives no governmental or other independent oversight, requires helmets for players of all ages to withstand only the extremely high-level force that would otherwise fracture skulls.

The standard has not changed meaningfully since it was written in 1973, despite rising concussion rates in youth football and the growing awareness of how the injury can cause significant short- and long-term problems with memory, depression and other cognitive functions, especially in children.

Moreover, used helmets worn by the vast majority of young players encountered stark lapses in the industry’s few safety procedures. Some of the businesses that recondition helmets ignored testing rules, performed the tests incorrectly or returned helmets that were still in poor condition. More than 100,000 children are wearing helmets too old to provide adequate protection — and perhaps half a million more are wearing potentially unsafe helmets that require critical examination, according to interviews with experts and industry data.

Awareness of head injuries in football was heightened last weekend when helmet-first collisions

caused the paralysis of a Rutgers University player, a concussion to Philadelphia Eagles receiver DeSean Jackson and injuries to three other N.F.L. players. Although some injuries are unavoidable results of football physics, helmet standards have not kept up with modern football, industry insiders said. The one helmet standard was written by the National Operating Committee on Standards for Athletic Equipment, or Nocsae, a volunteer consortium that includes, and is largely financed by, the helmet makers themselves. Nocsae accepts no role in ensuring that helmets, either new or old, meet even its limited requirement.

One frustrated vice president of Nocsae, Dr. Robert Cantu of the Boston University School of Medicine, said the organization has been "asleep at the switch" for five years. Cantu joined other prominent voices involved in youth sports concussions in calling for stronger standards.

Recent engineering advances made by Riddell, Schutt, Adams and other manufacturers have undoubtedly improved the performance of the football helmet, which from its leather roots has always symbolized football's duality of valor and violence. But helmets communicate a level of protection that they do not provide, experts said, in part because of lax industry standards and practices.

As she looked again at the helmet of her 11-year-old son, Hunt, Ms. Sparks said: "You just trust. You care so much about your kid, and then you just trust."

One Limited Standard

After more than 100 high school and college football players in the 1960s were killed by skull fractures and acute brain bleeding, Nocsae was formed to protect players against the extreme forces that caused those injuries. The resulting standard, phased in by all levels of football through the 1970s, requires helmets to withstand a 60-inch free fall without allowing too much force to reach the skull.

This standard has accomplished its intent: skull fractures in football have essentially disappeared, and the three or four football-related deaths each year among players under 18 are caused by hits following a concussion that has not healed (known as second-impact syndrome) rather than by a single fatal blow.

As the size and speed of players have increased since the full adoption of the Nocsae standard in 1980, concussion rates have as well. An estimated 100,000 concussions are reported each season among high school players alone, according to Nationwide Children's Hospital in Columbus, Ohio, but many times that figure are believed to go unreported or unrecognized.

Preventing concussions — which are typically marked by confusion, disorientation, nausea and other symptoms following a blow to the head — is trickier than preventing skull fractures. The

brain can crash into the inside of the skull through a wide range of forces, some arriving straight to the head and others suddenly rotating it. Scientists have yet to isolate where thresholds are in different players at different positions and at different ages.

While bicycle helmets are designed to withstand only one large impact before being replaced, football helmets can encounter potentially concussive forces hundreds of times a season. Helmets cannot get too large or heavy, so helmet designers say they face a trade-off: make helmets stiff enough to withstand high impacts and allow less violent forces to cause concussions, or more softly cushion against concussive-type forces while allowing large impacts to crack the skull.

The helmet industry has essentially chosen the former. With some differences among brands, helmets are generally made of polycarbonate plastic shells cushioned inside with foams of various stiffnesses and some air-pocket cushioning. Headgear worn by pee-wees to professionals differs primarily by size; Nocsae's standard makes no distinctions for the wearer's age.

Because of the uncertainty of how concussions occur in football, experts said there was no way to cite real-life examples of players whose injuries might have been avoided by a stronger helmet testing standard. But requiring headgear to perform across a spectrum of impacts would undoubtedly decrease the total number of injuries, they said.

Nocsae's standard for lacrosse and hockey helmets includes tests for concussive-type forces. But because football helmets have already prevented deaths so effectively for decades, and because football's faster and more violent environment leaves biomechanists unsure of how to prevent concussions in the sport, Nocsae has not asked helmets makers to even try.

"When you have something that has worked well for a lot of years, you have to be pretty cautious," said Mike Oliver, Nocsae's executive director and general counsel since 1995. "If we save 15,000 concussions with a new standard but allow one skull fracture, if we save 5,000 concussions and allow one subdural hematoma, is it worth it? I can't tell you that would be the trade-off, but you've got to basically be really sure that change wouldn't adversely affect something else."

Some experts, both within and outside Nocsae, question why helmets still are not required to handle the less violent impacts believed — although not scientifically proven — to cause concussions. Blaine Hoshizaki, director of human kinetics at the Neurotrauma Impact Research Lab at the University of Ottawa, said he lobbied Nocsae to strengthen its standard five or six years ago but, "It was like punching a balloon; they, yeah, understand, and then do nothing."

"They say they don't know what the thresholds are; O.K., but I can tell you that less angular acceleration is better than more," said Mr. Hoshizaki, referring to the forces that cause the head to rotate suddenly. "To suggest we have no idea so we'll do nothing is not an excuse to me. This has become a serious impediment to making a safer football environment."

Helmet companies say they are making inroads on their own, pursuing improvements that they say decrease the number of concussions that players receive.

Riddell has gained the largest share of the overall helmet market in part because of the 2002 introduction of its Revolution model, which the company markets aggressively as having features, like thicker jaw padding, that reduce concussion risk by 31 percent compared with previous helmets. Riddell's president, Dan Arment, said: "We think we've taken great strides to improve the protective features of our helmets, and we're not done. We see it as an open frontier."

Outside experts have criticized Riddell for overselling the protective properties of the Revolution and its successors. Dr. Cantu noted that the 31 percent figure — derived from a study conducted by researchers at the University of Pittsburgh Medical Center and a Riddell vice president — resulted from reports of concussions among high school players, which are notoriously inaccurate, and compared new Revolution helmets with old helmets of unknown age and condition.

Dave Halstead, the technical director of Nocsae, said: "It's a good helmet. But I don't believe that 31 percent for a Yankee minute."

Schutt, which runs a close second to Riddell in market share, has unveiled helmets with plastic-based cushioning that its Web site says are "designed with the intent to reduce the risk of concussions" and feature "breakthrough technology providing maximum protection to athletes." No scientific information is provided, although Schutt's YouTube channel has a video demonstration in which a head-sized watermelon bearing the plastic does not break when struck by a 15-pound bowling ball.

"That was meant to be a parody," Robert Erb, Schutt's chief executive, said. "I don't believe that there's any single one test that will tell you whether a helmet can stop a concussion. We communicate with coaches, equipment managers and other people in the football community. We have years of experience, test different conditions, temperatures, putting the helmets through a variety of contexts to see if it has superior dampening ability for a range of impacts."

Helmets produced by Adams U.S.A., worn by about 650,000 high school and younger players, are focused on meeting the Nocsae skull-fracture standard, David Wright, the chief executive of

Adams, said. “Once we see evidence that says we can reduce these types of injuries,” he said, referring to concussions, “then we’ll do it. We haven’t seen that.”

Art Chou, vice president of Rawlings, agreed: “We’re not in the standards-making business. We make equipment focused on standards given to us.” Chou also serves on the Nocsae board.

Along with Riddell, the company most emphasizing concussion safety is Xenith, whose X1 model is making inroads among high schools, colleges and the N.F.L. The X1 features a radical new design: air-filled shock absorbers that attempt to withstand a wider range of forces than traditional foam. Xenith’s founder and president, the former Harvard quarterback Vin Ferrara, said the Nocsae standard had discouraged innovation among other companies and was “wholly inadequate” for modern football.

“The fact that there’s only one standard for everything, designed 30 years ago for a different problem, indicates how far off the industry is right now from having an acceptable standard,” Mr. Ferrara said.

Dangerous Misconceptions

The fact that helmets are held to no standard regarding concussions surprised almost every one of dozens of people interviewed for this article, from coaches and parents to doctors and league officials. Even one member of the Nocsae board, Grant Teaff — who represents the American Football Coaches Association — said he was unaware of it.

“Obviously if you’re protecting against skull fracture, you’re protecting against any type of concussion,” Teaff said, incorrectly.

Nocsae receives no oversight from any independent agency, such as the Consumer Product Safety Commission or the Occupational Safety and Health Administration. Its 16-member board features five representatives of the helmet industry, six volunteer doctors, two athletic trainers, two equipment managers and one coach.

Nocsae’s annual budget of about $1.7 million is funded mostly by sporting-goods manufacturers whose products bear the Nocsae seal of approval. The largest share of that comes from football helmet makers and reconditioners.

“That’s pretty scary,” said Dr. David Price, who is heavily involved with youth football as a sports medicine physician for Carolinas Medical Center in Charlotte, N.C. “You would think there would be some sort of third-party oversight.”

Mr. Oliver, Nocsae’s longtime president, said that helmet companies do not unduly influence the

organization's policies. Dr. Cantu agreed, but said that the board has become as concerned about legal liability as about child safety. If Nocsae were to supplement its helmet standard in an attempt to address concussions, it could open itself to lawsuits brought by players saying that their helmet did not prevent the injury.

"I have been calling for a new standard to be written for football helmets for years, and Nocsae has been sitting on their duffs," Dr. Cantu said. "Everyone's afraid of being sued, because if you say that certain helmets are better, you're saying that millions of them out there now aren't safe."

Nocsae officials insisted that the organization does not mandate adherence to its standard; it is merely used, voluntarily, by every level of football from Pop Warner to the N.F.L. Nocsae goes so far as to state in its testing instructions that its standard "does not purport to address all of the safety problems, if any, associated with its use."

One use of the standard often emerges after a young player sustains a head injury and sues a school district or helmet manufacturer. In the 42 lawsuits in which he has testified as an expert, Mr. Halstead of Nocsae said, the primary (and usually successful) defense is that the helmet met the Nocsae standard.

"Manufacturers and schools, equipment managers and the coaches — the whole football industry — don't want to go after or even criticize the security blanket of Nocsae," said Sander Reynolds, Xenith's vice president for product development. "If there's a lawsuit, they all look to Nocsae to say, 'Hey, see, the product met the set standards.' They're all ultimately on the same side when it comes to liability. Nocsae exists for two reasons — to avoid skull fractures, and to avoid liability."

USA Football, which oversees tackle football among players ages 6 to 14, requires only that helmets have a Nocsae seal of approval. In the slightly more explicit rule book of the National Federation of High Schools, before several paragraphs that regulate the size of uniform numbers, decorative stripes and the like, helmets are required only to have "met the Nocsae test standard at the time of manufacture."

This has allowed thousands of older youth helmets to be re-used — particularly in poorer, rural communities — that would not even meet the Nocsae standard if they were examined critically through an industry procedure called reconditioning.

To the extent that 1.7 million helmets do undergo reconditioning each year, they encounter procedures and practices that industry experts described as laughable if they didn't compromise the safety of children's brains.

Borrower Beware

Everyone with experience in youth football has his favorite horror story. The helmet with socks inserted where the padding should have been. The helmet with a nail holding parts together. Hundreds of cracked helmets with detached foam that had no business being worn at all.

At Stadium System, a family-operated business in northern Connecticut that for decades has been the primary helmet reconditioner for New England schools and youth leagues, the owners Mike and Ken Schopp shook their heads last August at one typical rack of helmets awaiting work. One youth helmet had torn ear padding that compromised safety for who knew how many games or seasons. Another's inflatable air liner was ripped and useless. Another high school helmet, covered with skull-and-crossbones stickers, had padding that was switched from front to back and placed upside down, probably because it was itching the player's neck.

"That's a fairly common thing for kids to do — and the kid's wondering why he has a bloody forehead," Mike Schopp said. Ken, his brother, added, "And it would probably pass the Nocsae test no problem."

Only about 10 to 20 percent of football players of high school age or younger wear a new helmet, which can cost from $150 to $300. The vast majority of headgear is handed down for years and at various points undergoes a reconditioning process that costs about $25 to $45. Most get reconditioned every one or two seasons, which most experts recommend. But data closely held by the National Athletic Equipment Reconditioners Association, Naera, indicated that about 500,000 young players this fall were wearing helmets that had not undergone this basic safety check, which encounters glaring failures of its own.

About 25 facilities are authorized by Nocsae to recondition helmets and recertify them as meeting the original testing standard. The dozen-step process involves removing and washing all padding, inspecting parts for cracks and other deformities, washing and repainting the shell, and reassembling the helmet with either used or new parts. About 15 percent of helmets are deemed unfixable and discarded.

Nocsae's sole means of quality control is to require each reconditioning facility to perform the Nocsae drop test — in which a helmet is placed on a fluid-filled polyurethane head-form and dropped along wires from a height of 60 inches — on a random sample of about 3 percent of their helmets to see if they still absorb enough force to protect against skull fracture. The test is designed to help identify the rare helmet model that requires recall, not to pinpoint individual helmets that need replacement.

The test is failed by about 1 in 300 reconditioned helmets, according to Naera reports. All of the

passing helmets — along with the vast majority that undergo no testing at all, just a visual assembly-line inspection — receive a sticker that indicates they continue to meet Nocsae standards, and are returned to the league or school.

This largely faith-based process allows for significant errors. Hundreds if not thousands of supposedly reconditioned helmets emerge still unfit for use, according to interviews with coaches, parents and helmet-industry principals.

This summer two reconditioners, Clean Gear in New Jersey and Maxletics in Hawaii, skipped the drop testing altogether and sent back all its helmets to schools, said Ed Fisher, Naera's executive director and a longtime high school football coach in Washington state. He added that he discovered this only because an athletic trainer happened to complain about the condition of the helmets at a trade show. The helmets were recovered by Nocsae, which terminated the companies' licenses to recertify helmets.

During a tour of Stadium System in Connecticut, Fisher walked into the drop-testing room and found the technician testing helmets that were far too loose on the head-form to be measured correctly. The Schopps said that they were following Nocsae instructions — although those instructions require a "reasonable fit" — and that they had been testing helmets like that for the entire summer, or longer.

"I need to have a critical eye," Fisher said. "And to the people that say they're doing it correctly, I need to have some procedures that will allow me to walk in and be able to say, show me and prove it. We're working on that."

Some helmets are returned to teams with obvious defects. This summer, high schools in California, Wisconsin and several other states received reconditioned helmets (all bearing the Nocsae seal) that had missing harness cables, improperly attached face masks, incorrect padding and other problems that would almost certainly pose a danger to a young player. One of them was received by Jim Rudloff, the coach of Marblehead High School near Boston.

"We're rolling the dice and trusting that these things are done right," Mr. Rudloff said. "There is that blind faith in a lot of towns that you put on whatever they give you."

Mr. Halstead, the technical director of Nocsae, added: "School districts are so strapped that they just go to the cheapest place and hope. They'll always want to fix an old bus rather than find the money to buy a new one. That means they keep using old helmets, and sometimes not recondition them for way too long. For example, I would never let my kid wear a helmet that is more than 10 years old."

Mr. Fisher of Naera and most everyone involved in the helmet industry agreed that helmets

older than about 10 years present an unacceptable safety risk. Riddell and Adams both strongly recommend that their helmets be discarded after 10 years. Schutt sets no such limit.

Naera data indicated that more than 100,000 helmets more than 10 years old were worn by players in the 2009 season, thousands were close to 20 years old.

Helmets made before 1997 could pose an additional safety risk of which few people outside of Nocsae are aware. The standard to which helmets are now held — a drop-test score of less than 1,200 in a measure of force called severity index — had been 1,500 until 1998, when Nocsae lowered it. (This was done because new helmets were easily passing the 1,500 test and would easily pass the new figure, Nocsae officials said.) But helmets produced before 1997 were grandfathered in. So any one of the 70,000 pre-1997 helmets currently in use can test above 1,200 but below 1,500 — a range now agreed by most to be unsafe — and still be certified as meeting the Nocsae standard.

“There’s no scientific evidence that a helmet has to be pulled after 7, 10, 12 years, that there’s some line in the sand,” Schutt’s Erb said. “There are helmets that are out there that are performing fine. Do you want your car manufacturer to tell you that your car, at the end of 10 years, you have to destroy it? That’s a decision for the user.”

Some players at Cooperstown Central High School in New York are wearing helmets made in 1991, the school’s athletic coordinator, Jay Baldo, said. They were Schutt helmets reconditioned this summer by Stadium System.

“Our plan is to replace them next year,” Mr. Baldo said. “The money’s going to have to come from somewhere else. Our whole budget is about $300 for football.”

Only two people have access to the test logs that would determine just how many non-Schutt helmets more than 10 years old are being recertified and used in which areas of the country: Naera’s Mr. Fisher and Nocsae’s Mr. Halstead. They provided data to The New York Times that indicated that the number is minuscule.

Mr. Oliver, Nocsae’s executive director, said he does not receive or consult reconditioning data. Asked if helmets more than 10 years old should be worn by a child, he said: “I can’t say it should or shouldn’t be. All I can go on is how it tests on the standard.”

The Future

Most experts agree that regarding concussions and growing evidence of their health risks — particularly among young athletes — the first order of business is to get players, coaches and parents to recognize the injury and then keep the player away from sports for as long as it takes

to heal. Others added that football leagues and referees must more vigilantly penalize players who lead with their head while tackling. This dangerous maneuver received heightened news media coverage this week given several high-profile injuries, but it occurs in almost every game at every level.

The Wild West culture regarding helmets must also change, they said. Some call for Nocsae and Naera to set stronger standards and more proactively enforce their rules, but that would almost certainly require greater legal protection, said Dr. Cantu, the Nocsae vice president. Mr. Ferrara, the president of Xenith, called for the industry to receive governmental oversight.

“I want to answer to a higher authority than Nocsae,” Mr. Ferrara said. “I want to answer to the F.D.A.”

After four years of national debate over sport-related concussions as a public-health concern, and after several officials were interviewed for this article, Nocsae decided earlier this month to consider moving on the matter of a concussion-related helmet standard. Strongly pressured by Dr. Cantu, Mr. Oliver scheduled a meeting for Saturday to have experts in the field discuss possible adjustments — specifically a test for the less violent forces believed to raise concussion risks. Even if adjustments begin that day, the process will take at least three or four years.

Meanwhile, and pending more effective industry oversight, young football players will continue to wear helmets whose limitations are obscured by their communities’ love for football. Nowhere was this more clear than here in Norman last August, when fifth-graders lined up to receive their headgear for the season. No one thought to question what helmets are designed to do, how old the helmets were, if and when they had been reconditioned, or whether their sweat-stained and dirty padding retained its safety properties.

One of them, Joseph Kirk, stood at attention as his team, the Punishers, received their primary brain protection for the season. A league volunteer reached into a rack of helmets and chose No. 5045 — a worn white Riddell Little Pro with no known age, no known history and one Nocsae sticker.

“That good, big man?” the volunteer asked as Joseph peered unblinkingly from behind the face mask. The man fiddled with the fit, handed Joseph a leather chin strap and said, “Put this on when you get home.” The entire process took nine seconds.

Joseph shuffled to the next station to get his shoulder pads as the volunteer beckoned, “Next!”