

Face Masks and Basketball: NCAA Division I Consumer Trends and A Review of Over-the-Counter Face Masks

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Objectives/Hypothesis: This study aims to: 1) determine the current consumer trends of over-the-counter (OTC) and custom-made face mask usage among National Collegiate Athletic Association (NCAA) Division I athletic programs; and 2) provide a literature review of OTC face guards and a classified database.

Study Design: Literature review and survey.

Methods: Consumer trends were obtained by contacting all 352 NCAA Division I programs. Athletic trainers present in the office when called answered the following questions: 1) "When an athlete breaks his or her nose, is a custom or generic face guard used?" and 2) "What brand is the generic face guard that is used?" Data was analyzed to determine trends among athletic programs. Also, a database of OTC devices available was generated using PubMed, Google, and manufacturer Web sites.

Results: Among the 352 NCAA Division I athletic programs, 254 programs participated in the survey (72% response rate). The majority preferred custom-made guards (46%). Disadvantages included high cost and slow manufacture turn-around time. Only 20% of the programs strictly used generic brands. For the face mask database, 10 OTC products were identified and classified into four categories based on design, with pricing ranging between \$35.99 and \$69.95.

Conclusion: Only a handful of face masks exist for U.S. consumers, but none of them have been reviewed or classified by product design, sport application, price, and collegiate consumer use. This project details usage trends among NCAA Division I athletic programs and provides a list of available devices that can be purchased to protect the nose and face during sports.

Key Words: Face mask, nasal fracture, orthotic face mask, face guard, over-the-counter face mask.

Level of Evidence: Therapeutic V.

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INTRODUCTION

Sport-related activities account for 6% to 10% of maxillofacial injuries, with the most commonly injured structure being the nose.¹⁻⁵ One study suggests that over half of all high school basketball players experience at least one maxillofacial injury over the course of a season.⁶ In general, basketball players are injured at a rate markedly higher than baseball or football players because roughly between 3.8% and 23.1% of sports-related injuries are attributable to basketball.²⁻⁹ This is highlighted by the fact that basketball players are not required to wear protective headgear, eyewear, or mouth guards, unlike football or hockey players.⁶ In the absence of such mandatory protective gear, career-

detering injuries are usually followed by an extended recovery period and can have adverse physical, psychological, economic, and social sequelae.^{9,10}

A return to athletic activities early during the recovery period increases risk of re-fracture, as well as decreases quality of play in the patient for fear of re-injuring the nose.¹¹ In the event that an athlete is injured and desires to play immediately, prosthetic face guards can allow an athlete to return promptly to competition.¹² Notable professional athletes, such as Kobe Bryant, LeBron James, and Richard Hamilton, used face masks for protection and played immediately following nasal fractures (Fig. 1). Their use of these devices triggered an interest in using facial guards among high school athletes and collegiate players. This effectively removed the stigma and even added a modest amount of cachet to face mask use.

The objective of this study is to: 1) to determine current consumer trends among National Collegiate Athletic Association (NCAA) Division I basketball programs, 2) characterize and classify commercially available face masks. To our knowledge, no other study has pursued this important line of inquiry.

MATERIALS AND METHODS

A database was created to include all Division I NCAA college athletic training departments and contact information. All 352 NCAA Division I athletic departments were contacted,

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Fig. 1. Kobe Bryant wearing a custom-made face mask. Photo courtesy of Jesse Johnson-USA Today Sports.

and 254 athletic trainers participated in the phone survey (72% response rate). Athletic trainers, defined as individuals who are certified in athletic training, employed by the college, and present in the office, answered the following questions: 1) “When an athlete breaks his or her nose, is a custom or generic face guard used?” and 2) “What brand is the generic face guard that is used?” Of note, the head athletic trainer was contacted first for questioning. If unavailable, the head basketball trainer was contacted. If neither the head nor the basketball trainers were available, a trainer familiar with the use of face masks, who was present in the office, responded to the survey. Responses were not recorded from any nontraining personnel or student trainers. The data was recorded from the calls and analyzed in the form of graphs and charts to determine the face mask usage trends. Any extra information provided by the trainers, but not specifically regarding the questions, was also recorded and used for discussion.

To compile a database of current face mask products, an electronic literature search was conducted by using 1) PubMed with key words “broken nose guard,” “face shield,” “orthotic face shield,” “face protector,” and “nose protector”; and 2) the Internet via Google search with the same terms. Information to create a database of products was acquired directly from the manufacturers. The information gathered by the literature search was then compiled into a database, which was classified by product design, sport applicability, and price.

RESULTS

Ten products were identified and categorized into four groups based on their designs (Fig. 2) (Table I). Four products were classified as “cage with chin support” (2A), three were classified as “polycarbonate H-Design with cushion”(2B), two were classified as “polycarbonate H-Design without cushion” (2C), and one was classified as “full facial padding” (2D). The least expensive were the SafeTGard one-size-fits-all H-design with cushion and the 1800 Sports Safety Mask (cage design with chin support) by Bangerz Sports (\$35.99). The most expensive was WFK martial arts specific H-design without cushion facial guard (\$69.95). The average price for each category was: \$52.97 (polycarbonate

without cushion), \$45.98 (polycarbonate H-design with cushion), \$45.83 (cage design with chin support), and \$67.00 (full facial padding).

Trainers from 254 out of the 352 NCAA Division I programs responded (n = 254, 72% response rate). All 32 NCAA Division I athletic conferences were represented in the study (Table II). Figure 3 illustrates the breakdown of respondents’ face mask preferences: custom, generic, both, or neither. The majority of the respondents (46%) indicated the sole use of custom-made facial guards. However, due to the slower turnaround time for customized face masks, 30% of the respondents preferred the combined usage of over-the-counter (OTC) and custom-made face masks; the injured athletes would use OTC products while waiting for the custom-made masks. Twenty percent of the respondents claimed that they strictly used generic brands due to costliness. Although less expensive, respondents noted that athletes complained about the reduction in peripheral vision, discomfort with fit, and inadequate coverage for complex maxillary fractures. Finally, 4% did not provide any face mask options for injured athletes and had players refrain from play until fully recovered.

Conferences were further divided into groups of eight by their 2014 power ranking, which is determined through numbers of wins, losses, and game statistics.¹³ Figure 4 illustrates the face mask preference among conferences broken down by power ranking groups (rank group 1–8, 9–16, 17–24, and 25–32). Overall the differences between groups were statistically insignificant, but there seemed to be general associations between power rank and face mask preference. For example, the lower ranked conferences demonstrated a tendency to

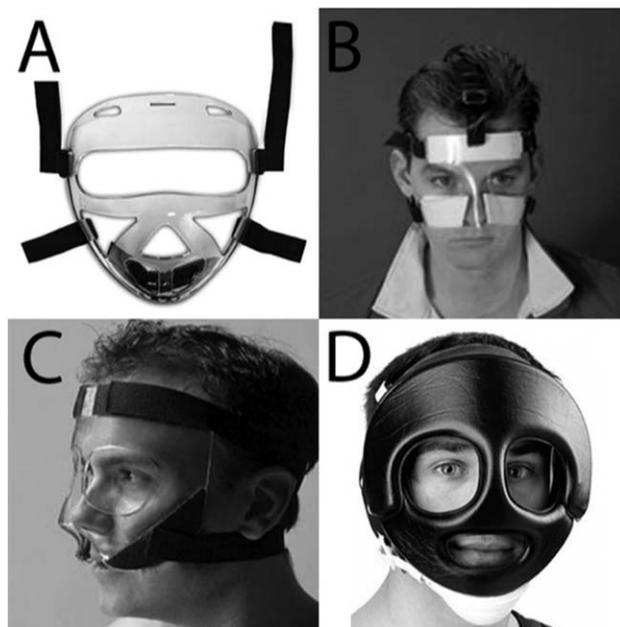


Fig. 2. Photo database of the four main over-the-counter face mask design groups: (A) cage with chin support, (B) polyacrylamide H-design with cushions, (C) polyacrylamide without cushions, (D) and full facial padding. All images were provided by and copied with permission by the manufacturers.

TABLE I.
Database of Over-the-Counter Generic Face Masks.

Number	Name	Company	Price	Product Design	Sports
1	WKF Face Mask	AWMA: Philadelphia, PA	\$69.95	Polycarbonate without cushion	Martial arts and combat sports
2	SK-023A Face Guard	Sports Knight Inc. Ottawa, ON, Canada	\$35.99	Polycarbonate without cushion	All sports
3	SafeTGard Nose Guard Model 950B	SafeTGard: Lakewood, CO	\$45.96	Polycarbonate H-design with cushion	All sports
4	HS-1500 Nose Guard	Bangerz Sports: Gloversville, NY	\$44.99	Polycarbonate H-design with cushion	All sports
5	Mueller 14501	Mueller Sports Medicine: Prairie Du Sac, WI	\$46.99	Polycarbonate H-design with cushion	All sports
6	1800 Sports Safety Mask	Bangerz Sports: Gloversville, NY	\$35.99	Cage design with chin support	Baseball/softball
7	Macho Dyna Rival Clear Face Shield	Macho: Sebastian, FL	\$49.95	Cage design with chin support	Martial arts
8	Universal face shield	Masterline: Santa Fe Springs, CA	\$57.44	Cage design with chin support	Martial arts
9	SKLZ Field Shield	SKLZ: Carlsbad, CA	\$39.99	Cage design with chin support	Baseball/softball
10	Cliff Keen Wrestling Face Guard Model FG3	Cliff Keen: Ann Arbor, MI	\$67.00	Full facial padding	Wrestling

Ten over-the-counter products were found and classified into four categories based on design: cage with chin support, polyacrylamide H-design with cushions, polyacrylamide without cushions, and full facial padding. Pricing ranges between \$35.99 and \$69.95.

utilize solely generic brands when compared to the higher-ranked conferences.

Finally, Figure 5 demonstrates conference rank groups organized by face mask preference. In general, all conferences have teams that use generic and custom face masks in some capacity. Although statistically insignificant, the majority of conferences have teams that only use custom-made products, with the second most prevalent being the use of both generic and custom face masks in tandem. Only a minority of teams in all conferences, with the exception of the American East Conference where it is the majority, solely uses generic brands. In addition, preference breakdown seems to have no obvious geographical determinant, as depicted in the map of the United States illustrating the breakdown of face mask preference by state (Fig. 6).

DISCUSSION

The use of facial guards by high-profile athletes has significantly reduced the stigma, and among younger athletes has even been viewed as a badge of honor, particularly in basketball. Even the nonelite athlete will wear a face mask because it facilitates early return to competition and reduces hesitancy for aggressive play. This is a relatively recent trend, and there is limited information on their use and whether custom or generic devices prevail. Much of the current literature on protective maxillofacial prosthetics in sports injury prevention focuses on the role of intraoral mouth guards. The American Dental Association estimates that up to 200,000 injuries are prevented annually among high school and collegiate athletes by wearing mouth guards.¹⁴⁻¹⁹ Less characterized are face masks. Face masks redistribute the forces that cause injury and primarily protect the player's nasal, zygomatic, and periorbital regions to

allow the player to continue play even during the acute recovery period.¹⁰

Preventative face mask use in high-contact sports, such as ice hockey, has been widely studied and has resulted in a significantly decreased risk of maxillofacial fractures. Several studies by Benson et al. have shown that full face masks are significantly better at preventing facial fracture and concussion in athletes compared to face masks that only cover half of the face.²⁰⁻²² However, widespread use of protective facial masks for protection postinjury is a relatively recent trend. Prior to their introduction, athletes would have to compete knowing that an acute trauma to the same region could result in a season ending reinjury. Most facial sports injuries (other than teeth) are nasal fractures; with a face mask, play can resume once acute swelling around the nose and orbit has resolved and airway patency is reestablished.⁹⁻¹² With zygomaticomaxillary, orbital, and midfacial fractures, complexity of the injury is greater, and it is unclear what the role of an face mask may be. Fortunately, these are less common.

In the present study, we detail usage trends among NCAA Division I athletic programs, as well as identify, categorize, and compare OTC face masks with regard to product design, sport applicability, price, and customer reviews. This latter effort provides physicians, who manage trauma, with a database in which to select and choose products; athletic trainers may not know the extent of products available nor the exact advantages and disadvantages of each mask.

In the past, nasal and facial fractures were participation-preventing injuries. Players who incurred such accidents would have to sit out until deemed fit to play, or play with the risk of sustaining even greater injury. Now, with lower production costs and better products, recovery time has decreased and players are able to play during the acute recovery period with the

TABLE II.
NCAA Division I Basketball Conferences Arranged in Order by Power Ranking With Breakdown of Face Mask Preference.

Power Rank	NCAA D I Conference	Total	Response	Generic	Custom	Both	Neither
1	Big 12	11	73%	0%	36%	36%	0%
2	Big Ten	13	77%	0%	46%	31%	0%
3	Big East	10	70%	0%	40%	20%	10%
4	Atlantic Coast	15	67%	20%	33%	13%	0%
5	Pacific-12	12	67%	17%	33%	17%	0%
6	Southeastern	14	57%	0%	36%	21%	0%
7	West Coast	10	80%	30%	40%	10%	0%
8	Missouri Valley	21	81%	19%	48%	10%	5%
9	Mountain West	11	73%	18%	36%	9%	9%
10	Atlantic 10	15	67%	7%	20%	27%	13%
11	American Athletic	11	82%	0%	55%	27%	0%
12	Mid-American	12	83%	0%	42%	33%	8%
13	Horizon	9	67%	0%	56%	11%	0%
14	Conference USA	14	93%	14%	36%	36%	7%
15	Big West	9	100%	33%	33%	33%	0%
16	Sun Belt	11	73%	27%	18%	27%	0%
17	Ivy League	7	71%	14%	29%	29%	0%
18	Big Sky	12	67%	17%	25%	25%	0%
19	Colonial Athletic	10	60%	10%	20%	30%	0%
20	Atlantic Sun	7	71%	0%	14%	57%	0%
21	The Summit League	8	38%	13%	25%	0%	0%
22	Ohio Valley	12	67%	25%	8%	33%	0%
23	Metro Atlantic Athletic	11	64%	9%	45%	0%	9%
24	Patriot League	10	60%	20%	20%	20%	0%
25	Western Athletic	7	86%	29%	43%	14%	0%
26	American East	8	88%	50%	0%	38%	0%
27	Big South	11	73%	0%	36%	18%	18%
28	Southern	10	100%	50%	30%	10%	10%
29	Southland	9	67%	0%	44%	22%	0%
30	Mid-Eastern Athletic	13	62%	8%	38%	15%	0%
31	Northeast Conference	9	78%	33%	22%	22%	0%
32	Southwestern Athletic	9	44%	11%	22%	11%	0%
	Independent	1	100%	0%	100%	0%	0%

use of facial guards. In contrast to the NBA, where custom-made masks are universally preferred due to sufficient funds and higher stakes, the choice of generic or custom at the collegiate level is less concrete, potentially due to decreased funding and overall need. Thus, at the collegiate level, trainers are faced with a choice between several OTC options that are affordable, readily available, and functional and custom-made prosthetics that are formfitting, offer increased visibility, and provide more comfort but are expensive and take time to manufacture.

Although several OTC options exist that are affordable, readily available, and functional, the majority of collegiate athletes and athletic trainers prefer a custom-made prosthetic. Respondents communicated that the custom-made prostheses in general fit better, facilitate peripheral vision, and are more comfortable. In contrast, most generic brands come in only three

arbitrary sizes (small, medium, and large); thus they may be less comfortable and reduce the visual field. However, custom-made masks come with several drawbacks, the most significant being price. Because the custom-made masks are fashioned from a mold of the player's face, these models are more expensive and can cost anywhere from \$500 to \$1,200 (prices directly from custom-made face mask manufacturers). Moreover, the turnaround time for molding, constructing, and shipping the custom-made model is much longer than simply obtaining an OTC brand. To account for this delay, many departments use a combination of both custom and generic. Most trainers endorsed using a generic model and outsourced the custom-made model to a local company close to the facility to decrease overall turnaround time (Fig. 2).

Generally, there is little correlation between geography and face mask preference (Fig. 6). Instead, there

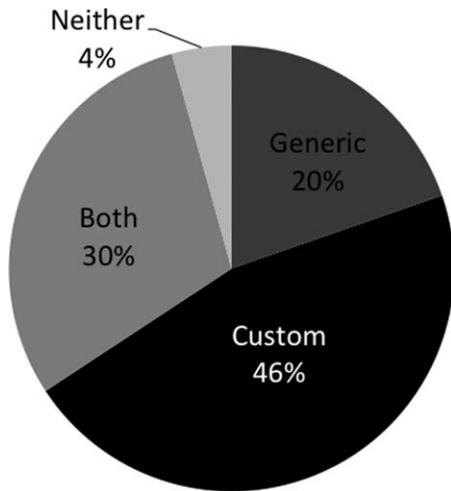


Fig. 3. Face mask preference breakdown. The majority of the respondents (46%) indicated the sole use of custom-made facial guards; 30% of the respondents pointed out that they prefer the usage of combined over-the-counter and custom face guard; 20% of the respondents claimed that they strictly use H-design with cushion generic brands due to costliness; and 4% of departments do not provide any face mask options for injured athletes.

appeared to be a slight relationship, albeit statistically insignificant, between conference power rank and face mask preference (Fig. 4). Teams with lower power ranks were more likely to prefer the sole use of generic face masks. For example, generic mask preference was the majority among teams in the American East and Southern Conferences. These two conferences fall within lowest power-rank quartile (25 thru 32). In con-

trast, custom-made brands were popular among all conferences, especially teams with high-power rankings.

In the present study, we aimed to add to the current research on protective face masks by establishing a baseline for current available OTC face mask models, as well as creating a better understanding of trends among NCAA Division I athletic programs. Because our data was collected from online resources and product Web sites, along with a phone call survey, the study is subject to responder bias. The schools that did not respond either did not have a telephone number listed on the Internet for public use or did not pick up the call. However, overall response bias is minimal, and we were able to maintain a 72% response rate. It is also important to note that this database on OTC models is likely to change due to changes in pricing and companies producing upgraded models each year.

Overall, colleges prefer custom-made facial masks or a mixture of both generic and custom to suit the needs and preferences of the athletes. After surveying the athletic trainers, it became apparent that a main drawback to using custom models, besides high costs, was slow turnaround time. Although generic masks can be acquired and ready to use the same day as the injury, custom-made masks require a more drawn-out process, including making a mold of the player's face, outsourcing production, and waiting for shipping. According to several custom face mask manufacturers, the turnaround time from when a player comes in for a consultation, sends in an impression, and/or measurements can take anywhere from 24 hours (for severe injuries and

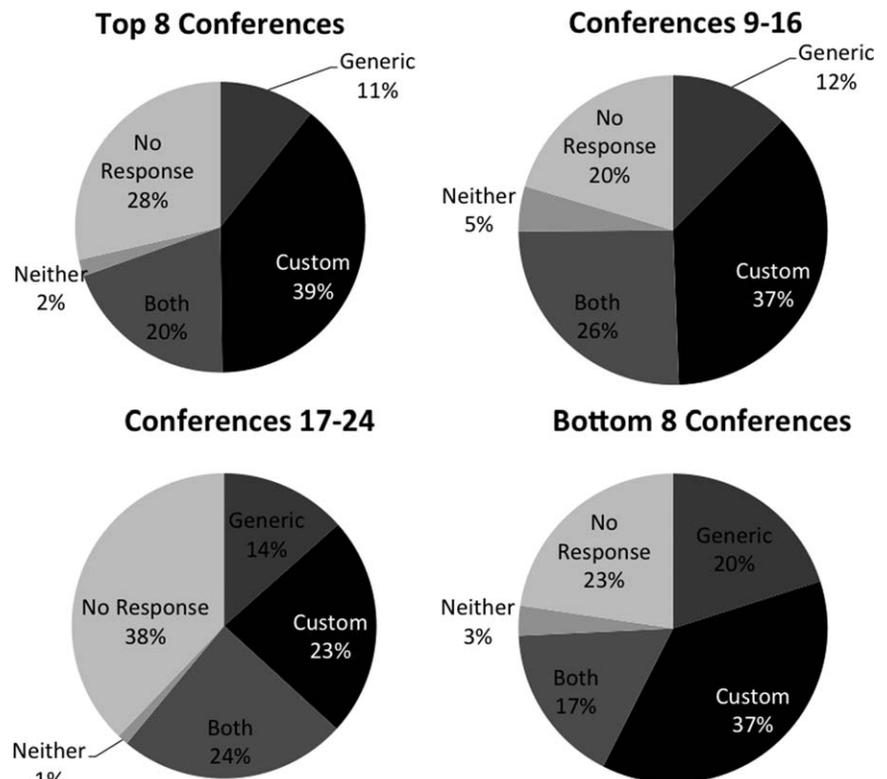


Fig. 4. Face mask preferences among conferences broken down by power rank: top 8 conferences, conferences rank 9–16, rank 17–24, and rank 25–32. In general, all conferences have teams that use generic and custom in some capacity. The majority of conferences have teams that only use custom-made products, with the second majority being the use of both generic and custom-made in tandem.

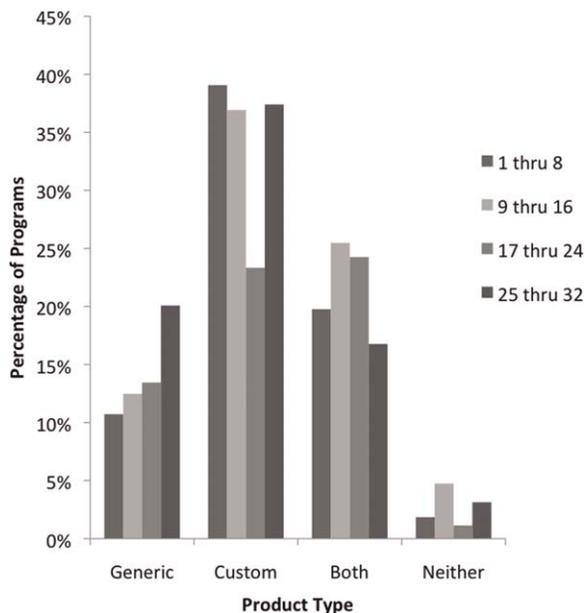


Fig. 5. Conferences arranged by power ranking and organized into groups by face mask preference. In general, teams with lower power rankings utilized generic brands more often than custom-made models.

rush orders at a more expensive price) to 2 weeks. A future area of study will be to further analyze custom face mask workflow in order to increase the efficiency and decrease turnaround time. One such change that would increase efficiency from traditional methods would be to cut out the need for a papier-mâché mold and instead use a real-time three-dimensionally captured imaged of the athlete's face. Athletic trainers and

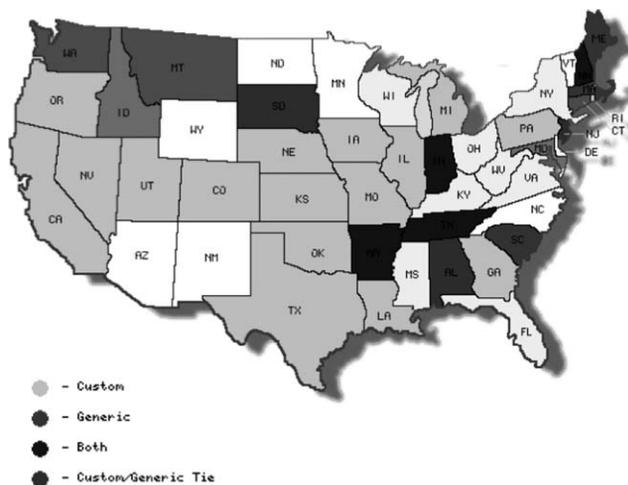


Fig. 6. Face mask preference broken down by state and depicted in the map illustration. Preference breakdown seems to have no obvious geographical determinant because the majority reveals preference toward custom masks. Note that light gray indicates custom mask majority, whereas white indicates no response from schools in that state. Similarly, black, gray, and dark gray are in the minority and indicate majority of both, generic, and a custom/generic tie, respectively.

doctors could use three-dimensional (3D) photogrammetry or 3D graphic imaging (versus a computed tomography scan that would involve unnecessary radiation exposure) to capture an image of the athlete's face post-injury, after swelling has subsided. A 3D image could then be generated in real time, e-mailed to the company, and utilized to create the face mask, ultimately increasing the efficiency of the production process. This would allow for more rapid fabrication of masks, decreasing turnaround time and ultimately more playing time for the athlete.

CONCLUSION

A handful of face mask products exist worldwide for U.S. consumers, but none have been scientifically reviewed or categorized by product design, sport application, price, and collegiate consumer use. This project provides a comprehensive list of devices that can be purchased to protect the nose and face during athletic events, as well as details consumer trends among NCAA Division I programs. In general, custom-made face masks are used among the majority of teams because they offer better visibility and increased comfort. Generic models are less widely used but are sometimes preferred due to costliness and convenient availability.

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