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Ross D. Petty

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Regulation vs. the Market: The Case of Bicycle Safety [Part I]*

Ross D. Petty**

Introduction

The debate on whether the market or government intervention in the market is the most effective way to address particular social problems is as old as it is controversial. Advocates on either side criticize the other approach and then declare their approach to be preferable, often without examining their preferred approach's effectiveness. Seldom, if ever, has anyone compared the approaches simultaneously and independently of one another. This article does so, albeit on the narrow topic of bicycle safety. The market approach to bicycle safety is represented by the development and marketing of the hardshell bicycle helmet.¹ The

* Part II of this article will appear in the Spring issue.

** Ross D. Petty received his B.A. and M.B.A. from the University of Rochester, his J.D. from the University of Michigan, and an M.P.A. from Harvard University. He is an Assistant Professor of Business Law at Babson College.

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¹ The term hardshell bicycle helmet includes the recently developed "no shell" helmets that are constructed of expanded polystyrene as well as similar helmets that also include a hard plastic shell. Both pass helmet safety standards and can be contrasted with "leather hairnets" that offer virtually no impact protection. See *Bike Helmets: Unused Lifesavers*, Consumer Reports 348 (May 1990); Swart, *Hard Facts About Bicycle Helmets*, 1 *Cycling Science* 14 (Dec. 1988); D'Ambrosio, *The Shell Game*, 14 *BikeReport* 13 (Jun. 1988) and sources cited at notes 58-60, *infra*. While a question has been raised concerning whether "no shell" helmets momentarily adhere to the ground on impact thereby increasing the likelihood of neck or spinal injuries, such helmets are too new to have a significant effect on the data presented here. See V. HODGSON, IMPACT, SKID, AND RETENTION TESTS ON A REPRESENTATIVE GROUP OF BICYCLE HELMETS TO DETERMINE THEIR HEAD-NECK PROTECTION CHARACTERISTICS (1990) (finding increased probability of neck injury from no-shell helmets over hardshells at low angle skids), and Martin, *Are Foam*

intervention approach is represented by the Consumer Product Safety Commission's (CPSC) bicycle safety standard.² After this case study is presented, lessons are drawn which contribute to the more general debate on whether allowing the market to function or enacting government regulation is better for addressing perceived problems.

It is appropriate to examine the CPSC here, because the agency itself was formed out of this debate. In 1970, the President's Commission on Product Safety issued its Final Report. It noted that twenty million Americans are injured, and 30,000 die, annually as a result of incidents connected with consumer products. It estimated that the annual cost of product-related injuries may exceed \$5.5 billion.³ The chairman told Congress that an effective agency could prevent as many as four million injuries and as many as 6,000 product related deaths each year.⁴

Only Helmets Safe?, 30 *Bicycling* 28-29 (Feb. 1989). *But see* Zahradnik, *Helmet Buyer's Guide*, 30 *Bicycling* 160-61 (May 1989) (Bell helmets tested foam only helmets on simulated road surfaces and found no appreciable differences with hardshell helmets).

² There are many other, less intrusive, efforts taken by the federal government to promote bicycle safety. These include co-sponsoring conferences, preparing studies and funding projects at the state and local level. *See, e.g.,* Baldwin, *Federal Bicycle Programs and Projects*, 1 *Bicycle Forum* 30 (Spr. 1978), and Baldwin, *Federal Funds for Bicycles*, 2 *Bicycle Forum* 31 (Fall 1978). Even the Federal Trade Commission has contributed to bicycle safety through its acceptance of a consent agreement with a bicycle manufacturer that agreed to cease showing children riding in an unsafe manner in its advertising, and to produce two bicycle safety messages and distribute them to specified television stations across the country. *See* AMF, Inc., 95 F.T.C. 310 (1980).

³ PRESIDENT'S COMMISSION ON PRODUCT SAFETY, FINAL REPORT 1 (1970). More recently, the CPSC has estimated that consumer products are associated with 32 million injuries and 28,000 deaths annually, costing an estimated \$10 billion in emergency room treatment alone. CONSUMER PRODUCT SAFETY COMMISSION, ANNUAL REPORT FOR FISCAL YEAR 1986.

⁴ 36 CONG. Q. 389 (1978). The first Chairman of the CPSC, Richard O. Simpson, testified in 1976 that the "standards-preventable" portion of product associated injuries was between 15 and 25%. *Federal Regulation and Regulatory Reform: Hearings Before The Subcomm. On Oversight And Investigations Of The House Comm. On Interstate And Foreign Commerce*, 94th Cong., 2d Sess. 4

The Final Report was strongly criticized by Walter Oi.⁵ He argued that the Commission's implicit goal of minimizing aggregate costs of injuries related to products is inconsistent with the maximization of consumer welfare. Rather, he suggested that the rational consumer would seek to minimize the sum of accident costs and accident prevention costs. Thus, consumers occasionally choose to purchase risky products even if there are less risky alternatives available. For this reason, Oi strongly opposed any restriction on product choice through bans on unsafe products or safety standards. Oi did admit that the market probably undersupplies safety information and therefore there may be a role for the government in the provision or subsidization of safety information.⁶

The debate continues well after the CPSC's creation, and its actions have fueled the fires of both sides. Only three studies have examined the CPSC's effects on across-the-board product safety. All three are limited because they examine only home accident rates rather than consumer product injuries, and none control for effects from products liability lawsuits. The first, released by the Consumer Federation of America, examined household accidental deaths and injuries data collected by the National Safety Council. It found that, for the nine years prior to the establishment of the CPSC, injuries fell 11% and deaths fell 13%. For the nine years after the CPSC, injuries fell 28% and deaths, 27%.⁷ This study is flawed in several respects: it fails to account for other factors that may account for these trends; it does not analyze the

(1976).

⁵ Oi, *The Economics of Product Safety*, 4 BELL J. ECON. 4 (1973).

⁶ *Id.* See also Viscusi, *Toward a Diminished Role for Tort Liability: Social Insurance, Government Regulation, and Contemporary Risks to Health and Safety*, 6 YALE J. REG. 65, 74-75 (1989).

⁷ Lower, Averyt and Greenberg, *On the Safe Track: Deaths and Injuries Before and After The Consumer Product Safety Commission* 1, 4 (unpublished report of the Consumer Federation of America, Sept. 15, 1983).

statistical significance of the results; and it measures household injuries and deaths rather than product related injuries and deaths. In contrast, a CPSC study found that product related injuries had increased 44% in its first five years of operation.⁸

Kip Viscusi attempted to correct these flaws by performing a multivariate statistical analysis using a simple lagged linear model of factors likely to affect the overall home accident rate as reported by the National Center for Health Statistics. He found that the CPSC dummy variable was not statistically significant, and the largest coefficient he obtained for that variable indicated that the CPSC had only a 4% reduction in the injury rate. He found only two variables to be statistically significant: real per capita consumption and the lagged home accident rate.⁹

Viscusi's study was criticized by Zick, Mayer and Snow.¹⁰ They disagreed with his formulation of a linear model and instead proposed an exponential model that would allow for the effects of the CPSC to increase over time. They also included the unemployment rate to control for certainty of income and two measures of population age: those under 14 and those over 64.¹¹ In contrast, Viscusi controlled only for persons under five.

Zick et al. performed regression analysis on the natural log of their exponential function and found a statistically significant relationship that explained 86% of the total variance.¹² While the unemployment rate

⁸ See EDITORIAL RESEARCH REPORTS ON CONSUMER PROTECTIONS GAINS AND SETBACKS 8 (Feb. 17, 1978).

⁹ Viscusi, *Consumer Behavior and the Safety Effects of Product Safety Regulation*, 28 J. L. & ECON. 527, 531-34 (1985); W. VISCUSI, REGULATING CONSUMER PRODUCT SAFETY 71-73 (1984).

¹⁰ Zick, Mayer & Snow, *Does the U.S. Consumer Product Safety Commission Make a Difference? An Assessment of Its First Decade*, 6 J. CONS. POL'Y. 25, 27-28 (1986).

¹¹ *Id.* at 30-32.

and the proportion of population over 64 were not statistically significant, the other variables, income (which they assert is comparable to Viscusi's consumption variable), proportion of the population under age 14 and the CPSC were statistically significant. The authors conclude that over the 1973–82 period, CPSC accounted for saving an estimated 17,941 lives or about 7% of the deaths caused by home accidents during that time period.¹³ Thus, Viscusi and Zick et al. agree that CPSC has not yet achieved its goal of a 20% reduction in injuries and deaths, but they disagree on whether it has had any significant effect.

There are two interesting differences between these two studies in addition to those discussed above. Viscusi used the national home accident rate as the dependent variable and analyzed data from 1933 through 1981 and 1949 through 1981. He used the lagged home accident rate as an independent variable to avoid serial correlation problems.¹⁴ In contrast, Zick et al. found that national time series data like that used in the other two studies resulted in multicollinearity problems with their control variables. They therefore used accidental home death rates for ten randomly selected states and dummy variables to control for differences between the states.¹⁵ This is a rather unusual solution to multicollinearity.¹⁶ It is not clear how state data solves the problem.

The second interesting difference is the formulation of the CPSC dummy variable. Viscusi used a simple dummy variable which had a value of one from 1973 to 1981 and zero prior to 1973.¹⁷ Zick et al.

¹² *Id.* at 34.

¹³ *Id.* at 34–38. They also conclude that by failing to control for other variables, the Consumer Federation study overestimated the effect of the CPSC by 155%. *Id.* at 36.

¹⁴ Viscusi, *supra* note 9, at 532.

¹⁵ Zick et al., *supra* note 10, at 29 n.1, and 33.

¹⁶ *See, e.g.*, P. KENNEDY, A GUIDE TO ECONOMETRICS 150–52 (1985).

¹⁷ Viscusi, *supra* note 9, at 533.

felt that CPSC effects would increase over time as consumers gradually replaced less safe products with those satisfying CPSC standards. They therefore used an exponential dummy variable. The variable had a value of one in 1973 and ten in 1982.¹⁸ It is far from clear that this relationship is the proper one to account for the CPSC's increased effect over time, but their results are quite robust.

Other studies of the CPSC focus on particular rules. For example, Viscusi examines CPSC rules on mattress flammability, child resistant caps, cribs, swimming pool slides, floor coverings and bicycles. He also discusses cost benefit analyses of CPSC rules on matchbooks, architectural glazing, power lawn mowers, space heaters, and urea formaldehyde foam insulation.¹⁹ In contrast, other authors have praised CPSC rules.²⁰ Lastly, some have criticized amendments to the Consumer Product Safety Act that require the CPSC to rely on voluntary standards where feasible.²¹

None of these analyses compare a CPSC safety standard with a corresponding market effort to address the same problem with the

¹⁸ Zick et al., *supra* note 10, at 31.

¹⁹ W. VISCUSI, *supra* note 9, at 71–101. For other critical analyses of CPSC rules, see also Kafoglis, *Matchbook Safety*, in *BENEFIT-COST ANALYSES OF SOCIAL REGULATION 75* (J. Miller & B. Yandle eds. 1979); Lenard, *Lawn Mower Safety*, in *id.*; and Linneman, *Effects of Consumer Safety Standards: The 1973 Mattress Flammability Standard*, 23 *J. L. & ECON.* 461 (1980).

²⁰ See, e.g., J. CLAYBROOK ET AL., *RETREAT FROM SAFETY* 58–70 (1984); M. GREEN & N. WAITZMAN, *BUSINESS WAR ON THE LAW: AN ANALYSIS OF THE BENEFITS OF FEDERAL HEALTH/SAFETY ENFORCEMENT* 156–67 (1981). These analyses appear to be largely based on the CPSC's own estimates of its rules' benefits and costs. Such estimates have often been criticized as biased. See sources *supra* note 19.

²¹ 15 U.S.C. § 2056(b) (1982). For general criticism see Adler, *From "Model Agency" to Basket Case — Can the Consumer Product Safety Commission Be Redeemed?* 41 *ADMIN. L. REV.* 61, 92–106 (1989). For criticism for reliance on specific voluntary standards including those for all terrain vehicles, cigarette lighters, bunk beds, DEHP, swimming pool covers, and baby pacifiers, see M. FISE, *THE CPSC: GUIDING OR HIDING FROM PRODUCT SAFETY* (Consumer Federation of America, 1987).

possible exception of the mattress flammability analysis. Linneman's analysis of the mattress flammability standard noted that large mattress manufacturers had already reduced flammability by the time the rule became effective. The result of the rule then was simply to force small manufacturers out of business, resulting in only a marginal decrease in flammability.²² Since the rule was under consideration for some time, it is difficult to determine whether the market, without any suggestion of government regulation, would have led to the same result.

General Background on Bicycle Risks

The CPSC's interest in bicycles is based on the fact that bicycles are associated with more consumer injuries than nearly any other consumer product. For example, in 1981, the only "product" associated with more injuries than bicycles was steps and stairs.²³ In 1986, the CPSC Directorate for Economic Analysis estimated the cost of bicycle related injuries and deaths to be \$7.2 billion.²⁴

Each year over one-half million injuries associated with bicycles are estimated to have occurred based on the CPSC's National Electronic Injury Surveillance System. Data is collected for NEISS through hospital emergency rooms. The CPSC further estimates that approximately 610,000 other bicycle related injuries were treated in other medical settings.²⁵

²² Linneman, *supra* note 19, at 474-79.

²³ U.S. CONSUMER PRODUCT SAFETY COMMISSION, ANNUAL REPORT 22 (1982).

²⁴ U.S. CONSUMER PRODUCT SAFETY COMMISSION, 1990 PRIORITY PROJECT RECOMMENDATIONS, section on FY 1990 PRIORITY PROJECTS — Conducting A Bicycle Injury And Exposure Survey (May 9, 1988), cited in, PETITION OF THE CONSUMER FEDERATION OF AMERICA ET AL., TO ESTABLISH A MANDATORY SAFETY STANDARD FOR ADULT AND CHILD BICYCLE HELMETS 7-8 (May 15, 1989) (\$2 million for each death, \$2.3 billion for emergency room treated injuries, and \$2.5 billion for other medically treated injuries).

²⁵ *Id.* Kenneth Cross estimates that because NEISS does not include student health care facilities, it may underestimate the total number of serious bicycle-associated

Contrary to popular fears, most bicycle-associated injuries are not related to motor vehicle collisions. According to the National Highway Traffic Safety Administration (NHTSA), there were only 88,000 police-reported car-bicycle accidents in 1986. 1,000 of these were fatalities, 12,000 were hospitalized and 45,000 received some other medical treatment.²⁶ The National Safety Council estimates from reports by city and state traffic authorities that in 1988 there were 58,000 non-fatal injuries and 1,100 deaths from “pedalcycle”-motor vehicle collisions.²⁷ John Forester estimates that bicycle-motor vehicle and bicycle-bicycle collisions each count for another 18% and the remainder result from collisions with other objects including dogs (14%) or just plain falls (50%).²⁸ Kenneth Cross attributes bicycle-motor vehicle accidents as

injuries by as much as 27%. K. CROSS, BICYCLE-SAFETY EDUCATION — FACTS AND ISSUES 24 (1978).

Those accidents that result in only minor injuries are not reported to medical facilities or to the police or insurance authorities. Thus, the vast majority of bicycle accidents are likely not to be reported at all. A recent study by the Madison, Wisconsin Traffic Engineering Department found that 2,800 adult bicyclists were involved in accidents in 1985. Only 300 or so of those accidents were reported to the police. 12 BikeReport 4 (Oct./Nov. 1986). Similarly, a North Carolina study of 648 accidents reported to hospital emergency rooms in 1985 and 1986 showed that only 10% were reported to the police. J. STUTTS ET AL., BICYCLE ACCIDENTS: AN EXAMINATION OF HOSPITAL EMERGENCY ROOM REPORTS AND COMPARISON WITH POLICE ACCIDENT DATA 10 (Univ. N. Carolina Highway Safety Research Center, 1988).

²⁶ U.S. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, THE NATIONAL ACCIDENT SAMPLING SYSTEM 42-43 (1986)[hereinafter NASS]. Motor vehicle accidents tend to be more severe than non-motor vehicle accidents. See Flora & Abbott, *National Trends in Bicycle Accidents*, 11 J. SAFETY RES. 20, 26 (1979)(7% of the severe accidents involve motor vehicles compared to 3% in the total sample).

²⁷ NATIONAL SAFETY COUNCIL, ACCIDENT FACTS 73 (1988). Pedalcycles include sidewalk bicycles and tricycles which are not included in the NHTSA figures.

²⁸ J. FORESTER, BICYCLE TRANSPORTATION 84 (1983). STUTTS ET AL., *supra* note 25, at 3, review reported hospital emergency room studies from around the country and indicate that the proportion of bicycle related injuries occurring from motor vehicle collisions ranges from 13-50%. Australian figures show 70-80% of bicycle crashes do not involve motor vehicles. Boughton & Broadbent, *Bicycle Safety*

causing only 5.5% of all bicycle-related injuries and Dan Burden suggests that such accidents cause only 1% of all bicycle related accidents.²⁹ The differences in these estimates may result from the base number of accidents. If minor, unreported falls are included, bicycle-motor vehicle accidents account for a much smaller proportion of accidents than they do as a proportion of serious accidents.³⁰

The primary cause of bicycle-associated injuries is operator error. Forester estimates that one-half of all bicycle accidents result from this.³¹ A recent survey, at the University of Kansas Medical Center, of 492 bicyclists involved in accidents reported that 59% considered themselves to be at fault.³² Even simple misjudgments can cause significant falling injuries because bicycles are inherently unstable and provide little protection to operators.³³

Despite the relatively large number of annual bicycle-associated injuries, only about 1 in 500 emergency room-treated injuries is a fatality.³⁴ The NHTSA counted 949 police-reported bicyclist fatalities

Current Knowledge in BIKESAFE 86 CONFERENCE PROCEEDINGS 15, 29 (Fed. Dept. of Transportation ed. 1987).

²⁹ K. CROSS, *supra* note 25, at 22 and Burden, *Bicycle Accident Facts*, 1 Bicycle Forum 12, 13 (Spr. 1978).

³⁰ In contrast to the cause of accidents, most bicycle injuries are caused by impact with the ground. Even in bicycle-motor vehicle accidents, 60% of the most severe bicyclist injuries are caused by impact with the ground. NASS, *supra* note 26, at 42.

³¹ J. FORESTER, *supra* note 28, at 84.

³² Kiburz et al., *Bicycle Accidents and Injuries Among Adult Cyclists*, 14 AM. J. SPORTS MED. 416 (1986), reported in 28 *Bicycling* 22-3 (Apr. 1987). See also Flora & Abbott, *supra* note 26, at 25 (Of 581 serious injury cases investigated by the CPSC, 51% were primarily caused by operator error).

³³ P. HILL, BICYCLE LAW AND PRACTICE §§ 1.4 & 1.5 (1986). Cf. DeLong, *Bicycle Stability*, 13 *Bicycling* 12 (May 1972) and Jones, *The Stability of the Bicycle*, *Physics Today* 34 (Apr. 1970).

³⁴ Interestingly, there is a negative correlation between the annual number of NEISS bicycle injuries and the annual number of NHTSA bicycle related deaths. The Spearman correlation coefficient is -0.66 and is significant at the 98% confidence

in 1986 from bicycle-motor vehicle collisions.³⁵ The National Safety Council estimated 1,100 pedal cyclist fatalities occurred from motor vehicle collisions in that year.³⁶ The National Center for Health Statistics counts 92 pedal cyclist fatalities from non-motor vehicle accidents.³⁷ In contrast to non-fatal injuries, about 90% of all bicycle-associated fatalities occur from automobile collisions.³⁸

Moreover, head injuries appear to be the major cause of fatalities. In an early study, Dr. Daniel Fife et al. examined 173 fatally injured bicyclists in Dade County, Florida between 1956 and 1979. They found that the head and neck region was most seriously injured in 86% of the cases.³⁹ Similarly, the Calgary study found that 67% of bicycle fatalities were caused by head injuries, and an Australian study estimates that 80-85% of all bicycle fatalities are caused by head injuries.⁴⁰ Of

level. One possible explanation for this relationship is the inaccuracy of NEISS or of both systems.

³⁵ U.S. NATIONAL HIGHWAY SAFETY TRAFFIC ADMINISTRATION, THE FATAL ACCIDENT REPORTING SYSTEM Ch. 8 at 9 (1987) [hereinafter FARS].

³⁶ NATIONAL SAFETY COUNCIL, *supra* note 27, at 73 (1988).

³⁷ U.S. DEPT. OF HEALTH AND HUMAN SERVICES, VITAL STATISTICS OF THE UNITED STATES, VOL. II, MORTALITY, PART A at 198 (1986) (10 pedestrians and 8 unspecified people were also killed in pedalcycle accidents not involving motor vehicles).

³⁸ Cf. K. CROSS, *supra* note 25, at 21 (82%). In Australia, 87% of bicyclist fatalities involve motor vehicle collisions. Boughton & Broadbent, *supra* note 28, at 24.

³⁹ Fife et al., *Fatal Injuries to Bicyclists: The Experience of Dade County, Florida*, 23 J. TRAUMA 745, 746 (1983). None of the bicyclists were wearing helmets, and all were injured from a collision with a car.

⁴⁰ Guichon & Myles, *Bicycle Injuries: One Year Sample in Calgary*, 15 J. TRAUMA 504-6 (1975), and N. GILLIES, HELMETS FOR USE BY BICYCLE RIDERS 5 (Traffic Accident Research Unit, Department of Motor Transport, New South Wales March 1980). According to the NHTSA, 70% of all motorcycle fatalities are caused by head injuries. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, STATE AND COMMUNITY PROGRAM AREA REPORT, MOTORCYCLE SAFETY 1984-85 at 3 (1985), When the requirement that states enact mandatory motorcycle helmet use laws was repealed in 1976, motorcycle fatalities increased 48% in four years — from 3,312 in 1976 to 5,144 in 1980. NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, A

course, not all head injuries are fatalities — or even serious. A recent study of 100 bicyclists with head injuries in Great Britain found that only 11 were admitted to a hospital for treatment and only one died.⁴¹

As Table 1⁴² shows, annual bicycle injury and fatality rates per participant in the U.S. are comparatively low. Still, non-fatal injuries are quite frequent. Some estimate that one in every 20 bicyclists is injured annually.⁴³ A bicyclist can expect a minor injury every three years and a more serious one every fifteen.⁴⁴

In Part II, this article will provide further background on the CPSC safety standard and hardshell bicycle helmets. Then it will present a regression model for analyzing the safety effects of the standard and the use of helmets. Following the presentation of the results of such an analysis, it will discuss and compare these results for both regulation and the market, as well as draw conclusions.

REPORT TO CONGRESS ON THE EFFECT OF MOTORCYCLE USE LAW REPEAL — A CASE FOR HELMET USE at IV-2 (1980).

⁴¹ Worrell, *Head Injuries in Pedal Cyclists: How Much Protection Will Help?* 78 INJURY 56 (1987).

⁴² Data is derived primarily from NATIONAL SAFETY COUNCIL, *supra* note 27, at 83. That for smoking and mountaineering are from Morrall, *A Review of the Record*, 10 REGULATION 25-27 (1986). Data for bicycling and all terrain vehicles are derived from other sources. *See supra* notes 24 and 35; *infra* notes 79 and 109

⁴³ 28 Bicycling 23 (Apr. 1987). This estimate is consistent with data in Table 1 under the assumption that it represents only 10% of all injuries.

⁴⁴ 1 Bicycle Forum 45 (Spr. 1978).

Table 1

Annual Fatalities and Injuries					
<i>Activity</i>	<i>MMParticipants</i>	<i>Fatalities</i>	<i>F/IP</i>	<i>Injuries</i>	<i>I/P</i>
Smoking	145	345,000	3,000	—	—
Mountaineering	0.06	34	567	—	—
Hang Gliding	0.03	13	433	—	—
Parachuting	0.11	30	269	—	—
Hunting	1.69	280	166	2,200	7.67
Scuba Diving	1.6	70	43.8	—	—
All Accidents	2,360	92,911	39.3	—	—
ATVs	6.7	240	35.8	86,400	12,900
Boating	38.2	1,066	27.9	2,847	75
Swimming	102	2,300	22.5	96,934	950
Driving	2,400	47,900	19.9	—	—
Bicycling	85	1400	16.5	525,027	6,176
Boxing	0.5	4	8	5,668	11,340
Football	12	12	1	362,016	30,200
Basketball	21.2	7	0.3	418,989	19,763
Baseball	13.9	2	0.14	395,073	28,400
Soccer	8.2	1	0.012	103,212	12,600

