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Active Surveillance of Sudden Cardiac Death in Young Athletes by Periodic Internet Searches

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Abstract

Objective—We hypothesized that prospective, systematic Internet searches could identify occurrences of sudden cardiac death (SCD) in athletes, and would be useful to establish a system of active surveillance.

Methods—Weekly advanced Google searches of the Internet were conducted for cases of SCD in young athletes over a 12-month period (2007–8). Athletes aged 11 to 30 years who collapsed during a game, practice, or within an hour of exercise were included. Individuals with known histories of cardiac issues and events occurring outside the United States were excluded. Verification of SCD was by autopsy reports and death certificates from county coroner offices and vital record agencies.

Results—A total of 71 events were initially identified. Verification of the cause of death by coroner reports was possible in 45 cases, of which 43 (96%) were confirmed to be SCDs. Sixty-nine individuals, 11 to 30 years of age (mean 17 ± 5), died suddenly from cardiovascular causes while participating in 15 different organized sports and a variety of non-organized physical activities. The most common cause of death was hypertrophic cardiomyopathy (30%), followed by coronary artery anomalies (9%), and myocarditis (9%). The incidence of athlete SCD, types of sports involved, and cardiac causes of death in our study were comparable to previous reports.

Conclusions—Readily available Internet searches have the potential to be a powerful tool for identifying occurrences of athlete SCD. An active surveillance system using Google searches followed by coroner report verification can provide important epidemiologic and clinical information.

Keywords

epidemiology; surveillance; athlete; sudden death; cardiac

The vast majority of non-traumatic sports related sudden deaths in youth can be attributed to underlying cardiovascular pathology, which is often congenital but undiagnosed (Corrado et al., 2009; Maron, 2003). With no systematic and mandatory reporting of sudden cardiac deaths (SCD) in young athletes in the United States, the exact incidence is unknown and

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epidemiology data come mostly from fragmentary sources. In a Minnesota study of 1.4 million student athletes over a 12-year period, the incidence of SCD occurred at 1 in 200,000 per year (Maron et al., 1998). The precise frequency of SCD in young athletes remains unresolved (Maron, 2003; Maron et al., 2007). It is estimated that approximately 50–100 SCD cases may occur each year in the United States due to athletic participation (Bar-Cohen and Silka, 2012; Maron et al., 2009).

Event-based biosurveillance has been used extensively for the monitoring and early detection of outbreaks of infectious diseases (Hartley et al., 2010; Nelson et al., 2007). Given that athlete SCD events are often highly publicized and appear in various forms on the Internet, we hypothesize that SCD occurrences could be identified through periodic, systematic Internet searches. Once possible events are identified, verification can be done through coroner reports or death certificates, which are publicly available in many states. In this study, we examined the utility of Internet search to actively ascertain relevant SCD events reported on the Internet -- and in the process, developed a system for active surveillance for these rare events.

METHODS

Internet Searches of Athlete SCD

This study was approved by the Institutional Review Board. Advanced Google searches were conducted every Friday from April 2007 to March 2008 for SCD events in young athletes. The searches were conducted by manually typing the key words into Google search. Different combinations of key words were used to conduct the searches (Table 1).

Inclusion criteria for SCD events were: (1) collapse of the athlete during a game, practice, or immediately after (i.e., within an hour of engaging in exercise); (2) occurrence in the U.S.; (3) an age between 11 and 30 years; and (4) occurrence between April 1, 2007 and March 31, 2008. Exclusion criteria were: (1) a known history of cardiac disease; (2) involvement of trauma, injury, or commotio cordis; (3) occurrence outside of the U.S.; (4) death during sleep; and (5) possible drug or alcohol involvement.

Google search results were listed in reverse chronological order, with the most recent events on top. Results included websites of newspapers (local, regional, or national) and TV stations, discussion forums, and blogs (not including Facebook or Twitter). The first 200 search results were carefully examined by a pediatric cardiologist (R.K.C.), in order to identify events that could potentially represent a SCD. Once a SCD event was identified, a more detailed search of the specific event was conducted to gather additional information to determine if the case should be included based on the inclusion and exclusion criteria detailed above. Web pages of specific events that fulfilled the criteria were printed and saved. Data recorded and compiled for analysis were: demographics, location of the event, and cause of death, if available. In recording demographic information, while gender and age were always directly reported in these sources, race/ethnic data were compiled using what were reported in the media, coroner's reports, as well as inference from photographs of the athletes. After an SCD event was identified and further documented as described above, repeated specific searches of the event were conducted one week and 3 months later, in order to determine if additional information had become available, such as a confirmed cause of death and autopsy findings.

Verification by Coroner's Reports and Death Certificates

Autopsy reports and death certificates of the deceased athletes were obtained by contacting county coroner offices and state vital records agencies, based on where SCD events took place. Laws regarding public access to vital records vary widely in the U.S. Because of the

policies and regulations of different states on privacy and availability of coroner's reports, we waited 3 years or more before contacting county and state agencies for records. Autopsy reports and death certificates were used to verify the data found through Google searches, as well as to supply missing information for each of the SCD events.

Data Analysis

Continuous variables were presented as means $\pm$ standard deviations, and comparisons were made by unpaired *t*-tests where appropriate. Comparisons of categorical data were made by the chi-square or Fisher's exact test. A *P*-value of <0.05 was considered statistically significant.

RESULTS

Our initial Google searches identified a total of 71 SCD events among individuals 11 to 30 years of age who died suddenly from unrecognized cardiovascular causes during the 12-month period from April 2007 through March 2008. A total of 45 (63%) autopsy reports and/or death certificates could be retrieved. Based on information from autopsy reports and death certificates, 2 cases were excluded, because deaths were determined to be due to non-cardiovascular abnormalities (i.e., heat stroke and a brainstem lesion). Figure 1 summarizes the processes involved in case selection.

The remaining 69 SCD cases were the focus of our analysis. In the initial and follow-up Google searches, the specific cardiovascular causes of death could be found on the Internet for 29 (42%) cases. Of these 29 cases, the autopsy report or death certificate could be retrieved in 16, to verify the accuracy of the cause of death reported on the Internet. Based on death certificates and/or autopsy reports, 13 of the 16 (81%) had the correct cause of death reported on the Internet, and the remaining 3 were partly correct. These partly correct causes of death were for cases that had multiple causes of death listed in the autopsy report, but only one cause of death was reported on the Internet. By use of death certificates and autopsy reports (41 reported specific cardiovascular causes of death, 2 reported "inconclusive" causes of cardiac arrest) as well as information obtained via Google searches, specific cardiovascular causes of death could be determined in 54 (81%) of the 69 cases.

Demographics

Of the 69 SCD events, 55 (80%) occurred in males, and 14 (20%) occurred in females. Ages ranged from 11 to 30 years at the time of death, with a mean of 17 ± 4 years. Forty-eight (70%) cases occurred at 17 years, and 60 (87%) cases occurred at 20 years. The mean age at death for male athletes was 18 ± 5 years, compared to 14 ± 2 for females ($P < 0.001$). All female deaths occurred at 18 years (Figure 2).

The race/ethnic distribution of the athletes was 39 white (56%), 24 black (35%), 3 Hispanic, 2 Asian, and 1 multi-racial. There was no significant difference between the average age at death for white athletes (18 ± 1 years) versus non-white athletes (16 ± 0.7 years; $P = 0.3$).

Circumstance of SCD

All 69 SCD cases involved individuals engaged in physical exertion at the time of the event. Fifteen different sports were represented among 52 (75%) SCD events. The most frequently involved sports were basketball [$n=18$ (34%)], football [$n=10$ (19%)], track and field [$n=5$ (10%)], soccer [$n=3$ (6%)], marathon racing [$n=3$ (6%)], and cross country running [$n=3$ (6%)]. Of these 52 SCD events, 32 (62%) took place during practice sessions, and 20 (38%) were during competition. The remaining 17 (25%) SCD events were during physical exertion, but not while participating in organized sports. Most of these cases [$n=11$ (64%)]

occurred at the gym, and smaller numbers occurred during other physical training [n=2 (12%)] or while running [n=2 (12%)].

SCDs related to organized sports tended to occur at older ages, compared to those that did not involve sports (mean 18 ± 4 versus 14 ± 3 years; $P < 0.001$). Thirty-five percent (6 SCDs) of the cases not involving a sport were in females, compared to 15% (8 cases) for sports-related events ($P = 0.09$). There was no difference in race/ethnic distribution between those individuals who experienced SCD while involved in a sport and those who were not ($P = 0.73$). The comparisons of SCDs that occurred in organized sports vs. outside organized sports are listed in Table 2.

Level of Athletic Participation

The 69 SCD cases reported here represented athletic activity at all levels of participation. Almost half of all the cases [n=33 (48%)] were high school students, and of these, 29 (88%) were in organized sports and 4 (12%) were not. Fifteen (22%) were middle school students, mostly not in organized sports [10 cases (67%)]. There were 14 (20%) college students, only 1 (7%) of whom was not taking part in an organized sport. We also found 2 (3%) individuals who participated in professional sports, and 2 (3%) involved in amateur athletics (marathon and triathlon). Finally, there was 1 elementary school student and 1 army recruit (2% each) -- neither in organized sports.

Location

Forty-five (65%) of the 69 SCD events occurred at school. Of the 45 school events, 23 (51%) took place at the track and field area -- involving both individuals running the track or using the field area. The remainder of the school events took place at either the gym [n=15 (33%)], a basketball court [4 (9%)], or another campus location [n=3 (7%)]. The remaining 24 (35%) SCD events did not take place at a school, but instead at various locations, including: outdoor running areas [n=4 (17%)], gyms [n=3 (13%)], basketball courts [n=2 (8%)], and home [n=2 (8%)].

States with the greatest numbers of SCD events were Texas (n=6), California (n=5), Tennessee (n=5), Massachusetts (n=5), and Florida (n=5).

Causes of Death

Among these 69 cases, a definitive cause of death was established in 54, through autopsy reports, death certificates, and information found via Google search. Hypertrophic cardiomyopathy was the most common cause of death [n=16 (30%)]. Next were myocarditis [n=5 (9%)], coronary artery anomalies [n=5 (9%)], mitral valve prolapse [n=4 (7%)], and probable dysrhythmia [n=4 (7%); indicated by lack of pathology at autopsy]. Another 7 (13%) cases had more than one cardiac autopsy finding that could have contributed to sudden death. Table 3 compares the identified causes of death for all SCD events and SCD events that occurred in organized sports.

DISCUSSION

We used Internet searches of local news reports, special discussion forums, and blogs, as a method for initial identification of SCD events in young athletes in the U.S. After initial identification, more information was obtained by focused searches and then confirmed by coroner reports and death certificates, which were available for roughly two-thirds of the cases. Differences in state laws on public access to vital records were reasons behind the inability to retrieve coroner reports or death certificates for one-third of the cases. However, cardiovascular causes of death were available on the Internet for 42% of the cases.

Moreover, the causes of death as reported on the Internet were frequently accurate (80%) or partly accurate (20%). The numbers of SCD events found by this method were very similar to numbers in the report by Maron et al, (Maron, et al., 2009) which used a comprehensive, multi-source approach, and consistent with the recent estimates by Bar-Cohen and Silka (Bar-Cohen and Silka, 2012). Therefore, we propose that developing an athlete SCD database by systematic Internet searches followed by coroner reports or death certificates verification could provide a method for active surveillance of SCD events in young athletes.

Comparison of Current Study with Published Data

Incidence rates of athlete SCD vary widely by studies and are dependent on the methodology and criteria for data collection. Reported athlete SCD incidences range from 1:28,000 (Corrado et al., 2006) to 1:300,000 (Van Camp et al., 1995). In a study using a more comprehensive approach for data collection, Maron et al gathered SCD data from multiple sources, including the LexisNexis archival informational database, news releases, Internet searches, and information submitted directly to their registry (Maron, et al., 2009). While there is no “gold standard” to benchmark with, we compared our study with the study by Maron et al (Maron, et al., 2009) to determine if our methodology yielded results similar to the multi-source approach used by Maron et al (Maron, et al., 2009).

Over a 26-year period (1980 – 2006), Maron et al (Maron, et al., 2009) recorded 1,866 sudden deaths of athletes, of which 1,049 had cardiovascular etiologies. Of these, 844 (80%) occurred during physical exertion and 205 (20%) were non-exertional. To compare with our results, we used the most recent year from the Maron study (Maron, et al., 2009), which included 76 SCDs in 2005–2006, and estimated that 61 cases were exertional (80% of 76). It is important to note that we did not include non-exertional SCDs and SCA survivors, which made up 80% and 5%, respectively, of the sample obtained in the Maron study. On the other hand, we included SCD events outside of organized sports (17 SCDs during school physical education classes). The age range for our study was 11 to 30 years whereas in the Maron study, it was up to 39 years (Maron, et al., 2009). Despite these differences, the numbers of athletes dying of SCDs during exertion per year and the types of sports involved were very similar between this study and the proposed Internet search methodology. Similar to Maron's study, we also found hypertrophic cardiomyopathy to be the most common underlying cardiovascular disorder in sports related SCDs, accounting for roughly a third of cases.

The approach of using Internet search for the surveillance of athlete SCD has been used by Parent Heart Watch, a public charity incorporated in 2005 as a national network of parents, families and partners dedicated to reducing SCA in youth. The Parent Heart Watch maintains a SCD/SCA database by weekly Internet searches with popular search engines, such as Google and Yahoo. While Parent Heart Watch has not published the details of its methodology used to build the SCD/SCA database or research findings from the database, Harmon et al cross referenced the database with the National Collegiate Athletic Association (NCAA) database and concluded that 56% of SCD cases in NCAA athletes were identified in public media reports (Harmon et al.). Our results could not be compared directly with the Parent Heart Watch database because the methodologies used for data collection and verification were quite different.

Prevention of SCDs in Athletes

SCD cases involving organized sports occurred primarily in high school and college, whereas cases outside of organized sports occurred mainly in middle school and high school. Thus, the younger age for SCD cases outside of organized sports is partly due to middle school cases. Studies that do not include exertional SCD events outside of organized

sports may underestimate the incidence of SCDs in middle school, where there may be fewer school-sanctioned sports. Given that the mean age at death for female athletes was significantly younger than that of male athletes, it is possible that studies that do not include exertional SCD events outside of organized sports would also underestimate the prevalence of SCD in female athletes. This could potentially be explained by relatively less female sports participation at higher grade levels when compared to their male counterparts.

Cardiopulmonary resuscitation (CPR) with automated external defibrillators (AEDs) has been shown to improve survival after SCA, when compared to CPR alone (Hallstrom et al., 2004). The key determinant of survival is the response time between arrest and defibrillation. Thus, schools are now advised to have AEDs that can be accessed within five minutes of an SCA. Many schools still do not have an AED (Drezner, 2005) or trained personnel, despite consensus on their importance (Rothmier et al., 2007). The occurrence of 65% of SCD cases at schools in our study is a reminder of the importance of AEDs in schools. These devices may be most needed at track and field areas, in gyms, and beside basketball courts, according to our findings.

Debate continues over ECG screening in athletes (Schoenbaum et al., 2012) with salient arguments for and against (Maron, 2012; Sharma, 2012). An active, ongoing surveillance system for athlete SCDs through Internet searches may be very helpful in identifying the demographic groups and types of sports associated with the highest risks for SCDs.

Study Limitations

The inclusion criteria used in our study could be different from criteria used by others. We excluded SCA survivors and SCDs that were non-exertional, due to previously known cardiac defect, or due to commotio cordis. We included SCDs occurring outside of organized sports, because such events are as important as those related to organized sports. SCDs outside of organized sports occur mostly in middle schools, a topic which has not been adequately investigated. Furthermore, we restricted the age range to 11 to 30 years, which might have missed some SCDs cases in very young children and older adults.

Due to sealed records laws in many of the states with SCD events, autopsy reports and death certificates could be obtained for 62% of the cases. States in which autopsy reports and death certificates could not be attained included: Iowa, New York, South Carolina, Missouri, Mississippi, Oregon, Louisiana, New Hampshire, and the District of Columbia. There were 2 additional cases that occurred in states with open records laws, but for which no autopsy record could be found. Overall, the cause of death was determined for 81% of the SCD cases, if we included cause of death information from the Google search results.

Given the difficulty of attributing pathology seen on autopsy to the cause of death in some cases, relying on post-mortem diagnosis to determine the cause of death may be imprecise. This difficulty is reflected in the 7 cases reported as having >1 cardiac cause of death in our series. In addition, dysrhythmias causing SCD often have few or no pathological findings and are difficult to diagnose without prior clinical or ECG evidence. Thus, the assignment of dysrhythmia as the cause of death, as reported in 4 SCD cases in our series, would be a diagnosis made only when other conditions associated with SCD could be excluded at autopsy.

In the absence of mandatory SCD reporting in the United States, it is impossible to know if systematic internet searches or any other methodology reliant upon voluntary reporting of events can capture all SCD events in order to attain a comprehensive analysis of SCD. Of note, we did not include emerging social media at the time of data collection, such as Facebook and Twitter, which have now become much more popular. We speculate that

surveillance of athlete SCDs by utilizing the Internet could become even more powerful with the use of social media.

Conclusions

In an initial attempt to determine if a biosurveillance system could be applied to rare occurrences of SCD in athletes, we have found that Internet searches followed by verification through coroner reports and death certificates can be very helpful. While the current study used labor-intensive manual searches, the system of standardized Internet searches can be automated once the methodology is further validated and refined. In view of the lack of mandatory SCD reporting, such a biosurveillance system has the potential to be an efficient and cost-effective tool for active surveillance of SCD in athletes in the U.S. Given the continued controversy over mandatory ECG screening for athletes and recommendations for AEDs in public locations, an active biosurveillance system for athlete SCD may be useful for developing and refining public health recommendations and policies.

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REFERENCES

- Bar-Cohen Y, Silka MJ. The pre-sports cardiovascular evaluation: should it depend on the level of competition, the sport, or the state? *Pediatr Cardiol.* Mar; 2012 33(3):417–427. [PubMed: 22327181]
- Corrado D, Basso C, Pavei A, et al. Trends in sudden cardiovascular death in young competitive athletes after implementation of a preparticipation screening program. *Jama.* Oct 4; 2006 296(13): 1593–1601. [PubMed: 17018804]
- Corrado D, Migliore F, Bevilacqua M, et al. Sudden cardiac death in athletes: can it be prevented by screening? *Herz.* Jun; 2009 34(4):259–266. [PubMed: 19575156]
- Drezner JA. Practical guidelines for automated external defibrillators in the athletic setting. *Clin J Sport Med.* Sep; 2005 15(5):367–369. [PubMed: 16162998]
- Hallstrom AP, Ornato JP, Weisfeldt M, et al. Public-access defibrillation and survival after out-of-hospital cardiac arrest. *N Engl J Med.* Aug 12; 2004 351(7):637–646. [PubMed: 15306665]
- Harmon KG, Asif IM, Klossner D, et al. Incidence of sudden cardiac death in national collegiate athletic association athletes. *Circulation.* Apr 19; 123(15):1594–1600. [PubMed: 21464047]
- Hartley D, Nelson N, Walters R, et al. Landscape of international event-based biosurveillance. *Emerg Health Threats J.* 3:e3. [PubMed: 22460393]
- Maron BJ. Counterpoint: Mandatory ECG screening of young competitive athletes. *Heart Rhythm.* 2012; 9(10):1646–9. [PubMed: 22426152]
- Maron BJ. Sudden death in young athletes. *N Engl J Med.* Sep 11; 2003 349(11):1064–1075. [PubMed: 12968091]
- Maron BJ, Doerer JJ, Haas TS, et al. Sudden deaths in young competitive athletes: analysis of 1866 deaths in the United States, 1980–2006. *Circulation.* Mar 3; 2009 119(8):1085–1092. [PubMed: 19221222]
- Maron BJ, Gohman TE, Aeppli D. Prevalence of sudden cardiac death during competitive sports activities in Minnesota high school athletes. *J Am Coll Cardiol.* Dec; 1998 32(7):1881–1884. [PubMed: 9857867]
- Maron BJ, Thompson PD, Ackerman MJ, et al. Recommendations and considerations related to preparticipation screening for cardiovascular abnormalities in competitive athletes: 2007 update: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism: endorsed by the American College of Cardiology Foundation. *Circulation.* Mar 27; 2007 115(12):1643–1455. [PubMed: 17353433]

- Nelson NP, Yang L, Reilly AR, et al. Event-based Internet Biosurveillance: Relation to Epidemiological Observation. *Emerg Themes Epidemiol*. Jun 18.9(1):4. [PubMed: 22709988]
- Rothmier JD, Drezner JA, Harmon KG. Automated external defibrillators in Washington State high schools. *Br J Sports Med*. May; 2007 41(5):301–305. discussion 305. [PubMed: 17289857]
- Schoenbaum M, Denchev P, Vitiello B, et al. Economic evaluation of strategies to reduce sudden cardiac death in young athletes. *Pediatrics*. Aug; 2012 130(2):e380–389. [PubMed: 22753553]
- Sharma S. Point/Mandatory ECG screening of young competitive athletes. *Heart Rhythm*. 2012; 9(10): 1642–5. [PubMed: 22426153]
- Van Camp SP, Bloor CM, Mueller FO, et al. Nontraumatic sports death in high school and college athletes. *Med Sci Sports Exerc*. May; 1995 27(5):641–647. [PubMed: 7674867]

Figure 1.
Summary of the processes of case selection.

Figure 2. Distribution of SCD cases by age of death and gender. Average ages of death were 18 ± 5 years for males and 14 ± 2 years for females.

Table 1

Combinations of key words used in Internet searches for athlete SCD events.

Subject	What happened	Modifiers	Heart related terms	Activities	Time	Place
student	collapsed	unexpectedly	heart	exercise	game	school
athlete	died	suddenly	heart disease	exertion	practice	college
boy	fainted		heart attack	sports	warm up	field
girl	unconscious		enlarged heart	gym class	cool down	gym
young men			cardiac	PE class		
young Women			cardiac arrest	football		
			CPR	basketball		
			AED	baseball		
			defibrillator	soccer		
				running		

Table 2

Characteristics of SCD cases in the Internet search study.

		All SCD Cases (n=69)	SCD in Organized Competitive Sports	SCD Outside of Organized Sports
Total per year		69	52	17
Age, years *		17 ± 5	18 ± 4	14±3
Sex	n (%) male	55 (80%)	44 (85%)	6 (35%)
	M:F	3.9 : 1	5.5 : 1	1.6 : 1
Race, n (%)	White	39 (56%)	30 (58%)	9 (53%)
	Black	24 (35%)	21 (40%)	3 (18%)
	Other	6 (9%)	1 (2%)	5 (29%)
Level of Participation, n (%)	Middle school	15 (22%)	5 (10%)	1 (6%)
	High school	33 (47%)	29 (55%)	4 (23%)
	College	14 (20%)	13 (25%)	10 (59%)
	Other *	7 (11%)	5 (10%)	2 (12%)

*“Other” included professional sports, recreational sports and individual exercise.

Table 3

Comparison of causes of death in all SCD events vs. SCD in organized sports.

Cause of death, n (%)	All cases (n=54)	Organized sports cases (n=40)
Hypertrophic cardiomyopathy	16 (30%)	13 (32%)
Coronary artery anomaly	5 (9%)	2 (5%)
Myocarditis	5 (9%)	3 (7%)
Mitral valve prolapse	4 (7%)	1 (2%)
Dysrhythmia condition	4 (7%)	4 (10%)
Coronary artery disease	3 (6%)	2 (5%)
Aortic rupture	3 (6%)	2 (5%)
Dilated Cardiomyopathy	2 (4%)	2 (5%)
Aortic stenosis	1 (2%)	1 (3%)
>1 Cardiac disease	7 (13%)	7 (18%)
Other	4 (7%)	3 (8%)