

BRIEF REPORT

Failure to Participate in Sports: An Evaluation of Preparticipation Physicals in a Local School District

Namita Bhardwaj, MD, MS, MPH, Grant S. Pierre, MD, Alexandra P. Halloran, DO, Taylor C. Alexander, MD, MBA, Stacy H. Leung, MD, MBA, Yu Lu, PhD, and Kendall M. Campbell, MD

Purpose: To determine the incidence of the documentation of athlete failure of preparticipation sports physicals.

Methods: This was a retrospective observational study that involved review of preparticipation examination physical form documentation from multiple clinicians for all student athletes who participated in athletics during the 2018 to 2019 academic year at Galveston Independent School District (GISD). We collected the reasons for failure to pass the preparticipation physical examination.

Results: Of the approximately 800 student athlete forms reviewed, 183 forms indicated individual athletes failed the visual acuity or cardiovascular portions of the preparticipation physical examination.

Discussion: Athlete failures of the preparticipation physical examination may cause delays in sports participation, and time and monetary costs to students and their parents. Inconsistencies in guidelines used to clear athletes as well as variation in form completion impacts whether athletes reportedly failed or passed the examination. Mass participation screening becomes a safety net for communities for athletes who may not have primary care providers to encourage follow-up with a regular clinician for previously undiagnosed medical issues and standardizing guideline use and form completion across clinicians who do these exams may improve numbers of athletes who are cleared to play sports.

Conclusion: Focusing on preventable and addressable preparticipation examination failures may help clinicians who perform these exams, while also establishing a safety net for previously undiagnosed medical conditions. Instituting yearly vision checks, addressing cardiovascular issues, and encouraging yearly follow-up with primary care clinicians can more readily address physical and mental health issues and will provide more comprehensive care to student athletes. (J Am Board Fam Med 2023;00:000–000.)

Keywords: Adolescence, Athletes, Community Medicine, Exercise, Preparticipation Physical Examination, Screening, Sports Medicine, Students

Introduction

The preparticipation physical evaluation (PPE) is a key component of participating in school

sanctioned sports. The purpose of the PPE is to identify conditions which may impact an athlete's ability to participate safely in sports.¹ Specifically, goals of the PPE include: 1) Determine general physical and psychological health; 2) Evaluate for conditions that may be life-threatening or disabling; 3) Evaluate for conditions that may predispose to injury or illness; 4) Provide an opportunity for discussion of health and lifestyle issues; and 5) Serve as an entry point into the health care system for adolescents without a health care home or medical home.¹ Completing a PPE involves taking a detailed health

This article was externally peer reviewed.
Submitted 14 March 2023; revised 12 July 2023; accepted 24 July 2023.

This is the Ahead of Print version of the article.

From the Department of Family Medicine, The University of Texas Medical Branch, Galveston, TX (NB, TCA, SHL, KMC), Department of Orthopaedic Surgery and Rehabilitation, The University of Texas Medical Branch, Galveston, TX (NB), Department of Family Medicine, University of Massachusetts, Worcester, MA (GSP), Department of Pediatrics, The University of Texas Medical Branch, Galveston, TX (APH), Department of Health and Exercise Science, University of Oklahoma, Norman, OK (YL).

Funding: The authors received no funding for the conduct of this study.

Conflict of interest: The authors have no conflicts of interest to declare.

Corresponding author: Namita Bhardwaj, MD, MS, MPH, 301 University Boulevard, Galveston, TX 77555-1123 (E-mail: nabhardw@utmb.edu).

history and performing a physical examination to include an extensive musculoskeletal evaluation.² The health history typically includes whether there is a history of sudden cardiac death, Marfan's Syndrome, or any other relevant cardiac history in the athlete's family that may impact whether they can be cleared to play.² An athlete being cleared to play sports means that a clinician has determined that risks that may harm an athlete during play have been identified and addressed; those risks do not outweigh the benefits of sports participation. The PPE monograph serves to guide individuals who are performing PPEs about how to identify potential at risk athletes.

How PPEs are performed and documented may vary from state to state and from school to school. PPEs can be conducted as part of routine well child examinations or as mass participation event evaluations, either sponsored by a health system or school district. Frequency and timing of PPEs varies by state, along with who can perform the examination.¹ PPEs are typically performed by clinicians, including physicians, advanced practice providers, and/or chiropractors. Clinicians may also use different sets of guidelines in determining if an athlete is cleared to participate.

Our study site, Galveston, Texas, is an island off the Texas coast that has 1 high school and 3 middle schools for a total of 6500 students enrolled in all levels as part of GISD. There are approximately 800 student athletes within GISD per school year. Athletes participate in a wide variety of sports with football, boys' basketball, boys' and girls' soccer, and boys' track and field being the most popular. The University Interscholastic League (UIL) is the sponsoring body for athletics in Texas and is responsible for the development and implementation of the form used to document the PPE.⁴

There are many indicated reasons for an athlete to fail the PPE including orthopedic injuries, mental health, and cardiovascular concerns.⁵⁻⁸ The purpose of this study is to review preparticipation physical forms used to capture and document these reasons. Our hypothesis is that most student athletes are not cleared due to vision or cardiac causes.⁹

Methods

We designed a retrospective observational study using data from completed preparticipation physical

examination forms stored at Ball High School in Galveston, Texas. These forms were approved for use by the Galveston Independent School District (GISD) and the UIL. Forms reviewed included forms from middle and high school athletes that were housed in folders in separate drawers for each graduating class. We evaluated each of the 4 classes enrolled for the academic year. As PPEs in Texas are conducted from seventh grade onward, some athletes may have had up to 6 forms in their file. Approximately 800 student files were evaluated. The authors manually reviewed all available unique student athlete preparticipation physical forms to capture and document reasons the examining clinician concluded that an athlete failed the examination. All prior and current school years of participation for all student athletes who participated in athletics during the 2018 to 2019 academic year at GISD were reviewed. All individual student athletes whose preparticipation physical form indicated that they were cleared to play by the examining clinician were excluded from the study. Of the approximately 800 preparticipation forms identified and reviewed, 183 athletes who had failed at least 1 preparticipation physical examination were included in the study. The reasons 5 student athletes failed their physical exams were not documented so the forms for these 5 athletes were excluded from the analysis, resulting in completed forms for 178 athletes. By author consensus, it was decided that categories for athlete failures would be: heart, orthopedic, vision, medical or multiple (ie, more than 1 category of reasons reported). Data on reasons for examination failure were entered into a Microsoft Excel table, along with gender information, which was later exported into SPSS for analysis. This study was determined to be exempt from review by the University of Texas Medical Branch Institutional Review Board.

Results

Of the 178 student athlete forms reviewed, 95 (53.4%) were males, 75 (42.1%) were females, and 8 (4.5%) gender unknown (ie, gender was not recorded by the examining clinician).

The reasons for an athlete failing the preparticipation physical examination are shown in Table 1. A 1-sample Chi Square test suggests the proportions of the 5 categories for examination failure are

Table 1. Reasons for Non-Clearance (n = 178)

	Frequencies n (%)
Vision	72 (40.4%)
Cardiovascular	45 (25.3%)
Medical	21 (11.8%)
Orthopedic	31 (17.4%)
Multiple Reasons	9 (5.1%)

unequal ($\chi^2 = 66.16$, $P < .001$), with higher proportions of student athletes failing the examination due to vision or cardiovascular reasons.

As shown in Table 2, although Chi-square test of independence found the 5 categories for examination failure did not differ by gender overall ($\chi^2 = 2.19$, $P = .14$), post hoc analysis suggests a significantly higher proportion of female (25.3%) than male student athletes (12.6%) failed due to orthopedic reasons.

Within the vision category, approximately 38.0% the student athletes did not bring their prescription eyeglasses, which resulted in the need for retesting while wearing their glasses. We performed a Chi-square test of independence to test if there was a gender difference for

the vision reasons reported, but no significant difference was detected ($\chi^2 = 2.19$, $P = .14$).

Some athletes (32.6%) had elevated blood pressure. When examining elevated blood pressure and other cardiovascular issues by gender, a significant difference was identified ($\chi^2 = 9.11$, $P < .01$) in that a larger proportion of males (50.0%) than females (5.9%) were failed the examination due to elevated blood pressure, whereas a larger proportion of females (94.1%) than males (50.0%) fails the examination due to other cardiovascular issues. Other causes of examination failure include heart murmurs, syncopal episodes, and family history of sudden cardiac death.

Discussion

Our study sought to determine why student athletes in GISD failed their PPE, by reviewing PPE forms that were completed by various clinicians and housed at the local high school. Most student athletes failed their examinations due to problems with vision or cardiac reasons. Several athletes (n = 27) did not bring their corrective eyewear which resulted in them failing their PPE. After being retested by their athletic trainer with their glasses, athletes passed the examination if their corrected

Table 2. Reasons for Non-Clearance, Stratified by Gender

		Gender		
	Total N (%)	Female N (%)	Male N (%)	χ^2 /Fisher's Exact Test
Reasons for Non-clearance (n = 170)				
Vision	71 (41.8%)	29 (38.7%)	42 (44.2%)	2.19, $P = .14$
Heart	43 (25.3%)	17 (22.7%)	26 (27.4%)	
Orthopedic	31 (18.2%)	19 (25.3%) ^a	12 (12.6%) ^b	
Medical	17 (10.0%)	8 (10.7%)	9 (9.5%)	
Multiple Reasons	8 (4.7%)	2 (2.7%)	6 (6.3%)	
	Total N (%)	Female N (%)	Male N (%)	χ^2 /Fisher's Exact Test
Subcategory Analysis for Vision Reasons (n = 71)				
Vision Non-Glasses Related	44 (62.0%)	15 (51.7%)	29 (69.0%)	2.19, $P = .14$
Vision Due to Glasses	27 (38.0%)	14 (48.3%)	13 (31.0%)	
	Total N (%)	Female N (%)	Male N (%)	χ^2 /Fisher's Exact Test
Subcategory Analysis for Heart Reasons (n = 43)				
Cardiac	29 (67.4%)	16 (94.1%) ^a	13 (50.0%) ^b	9.11, $P < .01$
Blood Pressure	14 (32.6%)	1 (5.9%) ^a	13 (50.0%) ^b	

Notes: The reported % are column percentages. ^asignificantly different from males at 0.05 level based on post hoc Bonferroni test, ^bsignificantly different from females at 0.05 level based on post hoc Bonferroni test.

vision was less than 20/50. The main cardiac reason for failure of the examination was elevated blood pressure which impacted a larger percentage of male athletes. Elevated blood pressure in athletes may be an indicator of target organ disease and secondary causes of hypertension, such as kidney disease, should be ruled out. Per Flynn et al. (2017), elevated blood pressure in children and adolescents, most common in boys, has increased in prevalence since 1988 has also been found to correlate with subsequent development of hypertension in adults.¹⁰ There is also correlation between hypertension and obesity.¹⁰ It is recommended that athletes with stage 2 hypertension should avoid high static sports that can cause acute elevations in diastolic pressures.¹⁻³ Earlier diagnosis and treatment, may result in improved health outcomes later in life.¹¹

Females failed the examination due to orthopedic reasons more frequently than their male counterparts. This finding is consistent with literature demonstrating that females have a higher rate of certain orthopedic injuries (anterior cruciate ligament, for example) compared with males.¹²

Our study is not without limitations. Perhaps the biggest limitation is that this study reviewed existing PPE form documentation that was performed by varying clinicians using differing guidelines and different approaches to form completion. Because differing guidelines for vision and blood pressure were used, inconsistency could be introduced across the data set based on clinician practice style, experiences and bias. This study would have been stronger if the design would have been a prospective cohort with us as family medicine physicians doing the physical exams and following our own data set. In addition, because the storage of the forms in a file cabinet at the local high school caused potential redundancy of forms for students, making the total number of failures not on an individual athlete basis. Other limitations of this study include that data were collected from a single school district. Perhaps if this study were conducted across several districts, over varying socioeconomic strata, results would have been different, especially what we found with vision. In communities where athletes may have greater access to primary care clinicians, there may be greater opportunity for health screening and intervention, as literature has shown that primary care physicians reduce health costs and improve health outcomes.¹³ In essence, results could be skewed due to location and school population.

GISD is located an underserved area and health care disparities can also play a major role in failures for preparticipation physicals. Access to vision or health insurance could skew our data, and otherwise might not be a problem in schools with a less underserved population. In addition, due to limited and inconsistent documentation on the PPE form, we were not able to identify athlete participation in individual sports. For a few instances, we were also not able to identify specific causes for failure of the examination. PPEs can vary from state to state and from school to school and there is a variation on how the examination is performed and documented. Previous work has shown that PPE are not performed in the same manner and with utilization of the same standards.¹⁴ PPE forms were completed by a variety of clinicians who may have used varying guidelines for determination of clearance.^{14,15} For example, for the cardiovascular examination, some clinicians may have used Eighth Joint National Commission (JNC-8) guidelines instead of American Academy of Pediatrics (AAP) guidelines.¹ The standard for sports medicine physicians are 2 measurements of the systolic blood pressure or diastolic blood pressure greater than the 90th percentile based on age, sex, and height noted by The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents which is concurrent with the American Academy of Pediatrics guidelines.¹ These are the guidelines by which patients were cleared or not cleared for elevated blood pressure. Future research to consider is evaluating if there is a correlation between elevated BMI and clearance for blood pressure. In addition, performers of PPEs, may want to evaluate which screening guideline to use given disparate guidelines between JNC-8 and AAP as JNC-8 might not capture all the athletes that need further evaluation, but AAP might send many to specialists that are not necessarily indicated.

Conclusion

Very few studies have looked at PPE data for failure of the PPE. A 2000 meta-analysis by Stickler identified blood pressure, heart murmur, hernia, or undescended tests as the primary medical issues that came up in PPEs, but many without serious positive findings.⁹ Our study showed a small number of student athletes failed their PPE due to medical or orthopedic issues. Most failures occurred due to a vision

deficit, which could be addressed by encouraging parents to have their children undergo yearly vision screenings and partnering with the local community for resources to assist in not only screenings but access to corrective lenses. In a more holistic perspective, increasing the number of students receiving yearly vision screenings and follow ups with primary care clinicians can more readily address physical and mental health issues and will provide more comprehensive care to our young athletes.

This research was previously presented as an oral research poster presentation at AMSSM 2021. The authors thank Heather Greer, MS, ATC, LAT, for her assistance in procuring data. The authors thank Christen Walcher for her assistance in editing the manuscript.

To see this article online, please go to: <http://jabfm.org/content/00/00/000.full>.

References

1. PPE: Preparticipation Physical Evaluation. American Academy of Pediatrics; 2019. Available at: <https://www.aap.org/en/patient-care/preparticipation-physical-evaluation/>.
2. Miller SM, Peterson AR. The sports preparticipation evaluation. *Pediatr Rev* 2019;40:108–28.
3. Pedraza J, Jardeleza JA. The preparticipation physical examination. *Prim Care* 2013;40:791–9, vii.
4. League TUI. Preparticipation physical evaluation - medical history [form]. Available at: https://www.uilutexas.org/files/athletics/forms/PrePhysFormRvdsd1_10_20.pdf.
5. Kenny SJ, Critchley ML, Whittaker JL, Kodalore Vijayan VW, Emery CA. Association between preparticipation characteristics and risk of injury amongst pre-professional dancers. *Phys Ther Sport* 2021;52:239–47.
6. Petek BJ, Baggish AL. Current controversies in pre-participation cardiovascular screening for young competitive athletes. *Expert Rev Cardiovasc Ther* 2020;18:435–42.
7. Sarac N, Sarac B, Pedroza A, Borchers J. Epidemiology of mental health conditions in incoming division I collegiate athletes. *Phys Sportsmed* 2018;46:242–8.
8. Long A, Bickett A, Price D. Prevalence of depressive symptoms in adolescent athletes. *J Surg Orthop Adv*. Fall 2022;31:193–8.
9. Stickler GB. Are yearly physical examinations in adolescents necessary? *J Am Board Fam Pract* 2000; 13:172–7.
10. Flynn JT, Kaelber DC, Baker-Smith CM, et al; Subcommittee on Screening and Management of High Blood Pressure in Children. Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics* 2017;140:e20171904.
11. Yano Y, Reis JP, Colangelo LA, et al. Association of blood pressure classification in young adults using the 2017 American College of Cardiology/American Heart Association Blood Pressure Guideline with cardiovascular events later in life. *JAMA* 2018; 320:1774–82.
12. Edison BR, Pandya N, Patel NM, Carter CW. Sex and gender differences in pediatric knee injuries. *Clin Sports Med* 2022;41:769–87.
13. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83:457–502.
14. Wingfield K, Matheson GO, Meeuwisse WH. Preparticipation evaluation: an evidence-based review. *Clin J Sport Med* May 2004;14:109–22.
15. Kennedy M, Comer F, Young JA, Valasek AE. Increasing primary care follow-up after preparticipation physical evaluations. *Pediatr Qual Saf* 2020; 5:e358.