

Are Yearly Physical Examinations in Adolescents Necessary?

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Background: Recommendations regarding the frequency of routine physical examinations for adolescents have varied from one examination every 2 to 3 years to yearly evaluations. Because none of these recommendations was based on studies regarding the usefulness of such examinations, it was pertinent to review the results of published studies.

Methods: All series of routine school and preathletic examinations of adolescents published in the English literature from 1943 to 1995 were reviewed. Only reviews of examinations by physicians with or without supervised health professionals were included.

Results: Findings included weight, blood pressure, visual acuity, innocent heart murmurs, scoliosis, referral for further testing, and serious abnormalities unknown before examination. A total of 20,047 examinations by 12 different groups of investigators was abstracted. Only 2 adolescents had major, previously unknown findings: 1 boy was blind in one eye and the other had mitral insufficiency. Elevated blood pressures were found in 0.1% to 1.6% of adolescents. Minor findings included acne, caries, myopia, and minor orthopedic problems, but they did not prevent participation in school or sports.

Conclusions: Yearly physical examinations in adolescents are not cost-effective and have practically no value in finding important pathologic conditions. This conclusion would not apply to sexually active teenagers. The value of an examination for health education or detection of mental problems has never been tested in this population. For entrance to school and camps or for sports participation, the review of a questionnaire and screening examinations by allied health providers should be the method of choice unless future studies justify repeated yearly examination of adolescents. (J Am Board Fam Pract 2000;13:172-7.)

With increasing emphasis on control of cost of medical care, there is a need to reexamine the effectiveness of yearly examinations of adolescents by physicians. Practices without shown benefits need to be challenged.

Reasons to question the need for yearly examinations of adolescents include low yield of finding previously unknown abnormalities, limited time with adolescents in a medical setting that should be spent wisely, lack of challenge to the physician, and cost. Gould¹ first suggested regular physical examinations as a means for screening for disease in adults in a presentation to the American Medical Association in 1900. For the same reason, Gallagher² examined 910 adolescent boys, aged 13 to 19 years at Phillips Academy in Andover, Mass, in 1943.

Recommendations regarding the need and frequency for periodic health examinations of adolescents were based on the opinions of various committees or groups and not on the findings in published series. This fact prompted this review of published series on yearly physical examinations in adolescents.

Methods

The English literature from 1943 to 1995 regarding yearly routine physical examinations and preathletic examinations of adolescents was reviewed. MEDLINE and the Scientific Citation Index were searched using the key words: "school medical examinations," "routine physical examinations in adolescents," "sports examinations in adolescents," and "preparticipation physical examinations." Older contributions were found by reviewing the references mentioned in the more recent articles. Twenty-three papers were found. Twelve reports were used because they were clear about who examined the adolescents and contained detailed data rather than opinions. This survey was

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Table 1. Findings of Routine Physical Examination by Physicians.

Findings	Gallagher ²	Rogers & Reese ³	Grant et al ⁴
Adolescents, No.	910 M	488 M 497 F	3788 M 2270 F
Increased blood pressure, %	0.1	None	0.4 M 0.2 F
Abnormal heart, %	0.2 (congestive heart disease) 0.7 (rheumatic heart disease)	? organic heart murmur: 0.5 M, 1.0 F	—
Hernia, %	0.3	0.0	0.3
Undescended testis, %	0.5	0.0	0.0
Serious positive findings, %	Not stated in those terms	4, known before examination	3.8, unknown before examination

M = male, F = female.

primarily concerned with determining the prevalence of serious abnormalities that required further observation, referral, or treatment found during these examinations.

Results

Results of 7953 school examinations²⁻⁴ are tabulated in part in Table 1. Not listed are defects of vision, hearing, dentition, nutrition, and skin that were picked up by simple screening procedures not requiring a physician. The most detailed evaluations were found in the study by Rogers and Reese,³ done at a high school in Dormont, Penna. Referable abnormalities were detected in 3.8% to 4% of examinations, but most of these abnormalities were known already. A quote from Rogers and Reese³ is interesting:

While procedures such as ophthalmoscopic inspection of the optic fundus, test of pupillary response to light and accommodation, auscultation and percussion of the chest, tests of the deep tendon reflexes, measurement of chest circumference, counting of resting and postexercise pulses, determination of blood pressure, palpation of breasts, and palpation of the abdomen failed to reveal important disease in approximately 1000 examinations, it is not possible to say that they never would have value in the health appraisal of the presumably well adolescent.

Screening tests primarily revealed conditions such as acne, reduced visual acuity, short stature, obesity, and dental caries. All turned out to be minor problems. In these three series, not a single serious abnormality was detected, and in two stud-

ies not even minor abnormalities that were not known before were found. In the series examined by Grant et al,⁴ 13.4% previously unknown findings were recorded, but these were abnormalities primarily detected by simple screening procedures.

Table 2 summarizes 12,094 preathletic examinations recorded by nine different groups.⁵⁻¹² Only two major previously undetected abnormalities were found. One was mitral valve insufficiency, and the other was unilateral blindness. Other previously known findings included 1 student with a single hydronephrotic kidney, 1 with a meniscus tear, and 3 with a single testis.

The percentage of students referred for further testing varied from 1.2% to 13.5%, with the highest percentage coming from the series by Goldberg et al,⁵ the earliest study reviewed. Goldberg et al called it a false-positive rate, because all these students eventually were allowed to participate in sports. The other larger studies had an average referral rate of about 3%, but the permanent exclusions were not higher than 0.15% to 1.7%, with an average of 0.7%.

Goldberg et al⁵ found that seven of nine disqualifying conditions had been noted after reviewing the history. Risser et al^{9,10} found 16 medical problems; all but one had been mentioned in the history. Minor orthopedic findings were noted in 1.8% to 16.8% of students. Higher rates were listed when the examinations were done by orthopedic residents or physical therapists. Diagnoses included tight hamstring muscles, patellofemoral syndrome, ankle instability, mild scoliosis, flatfoot, previous injury, neck pain, and hip pain usually not leading to exclusion from sports.

Table 2. Findings from Presports Examinations.

Findings	Goldberg et al ⁵	Tennant et al ⁶	Linder et al ⁷	Thompson et al ⁸	Risser et al ⁹	Risser et al ¹⁰	DuRant et al ¹¹	DuRant et al ¹¹	Briner & Farr ¹²
Adolescents, No.	447 M, 254 F	2719	1268	1789 M, 881 F	1560 M, 554 F	563 M, 200 F	170	752	622 M, 315 F
Race	Not stated	Not stated	White 64%, African-American 35%, other 0.7%	Not stated	White 96.1%, African-American 1.3%, Hispanic 2.6%	White 70.5%, African-American 26.6%, Hispanic 2.9%	White 32.2%, African-American 66.9%, Asian 0.9%	—	Not stated
Examiner	Physician	1 physician, 4 nurse practitioners	Physicians	Physicians, (12 orthopedic and 3 medical residents)	Pediatricians, orthopedists, athletic trainer	2 pediatrician, pediatric nurse practitioner	Physicians	Screening stations, multiple examiners	Sport physicians
Abnormal blood pressure, %	Diastolic >95 mm Hg 0.17	Diastolic >90 mm Hg 1.61	—	0.08	Mild hypertension 0.19	—	Not mentioned	—	0.42
Diminished visual acuity, %	2.56	—	—	1 blind in one eye	11 blind in one eye, 10 known before	—	4.1	4.4	0.42
Probable organic heart murmur, %	0.42 M, known before, 0.28 F, known before	—	—	0.15 M, 0.11 F	1 evaluated, known before, not excluded	—	—	—	1 with atrioseptal defect, 1 with mitral valve prolapse
Abnormal genitalia, %	Single testis 0.14, known before	Hernia 0.33	—	Hernia 0.17, varicocele 0.17, cryptorchidism 0.17	2 with single kidney	—	—	—	1 with possible inguinal hernia
Scoliosis (mild), %	2.7 M	—	—	0.11 M, 0.19 F	1 F	—	0.6 M	4.3 M	2.7 M
Referred for further testing, %	13.5 (all later cleared)	1.2	5.04	1.2	3.4	2.1	2.4	6.4	1.7 (all age-groups)
Excluded for medical reasons, %	1.3	Not stated	0.15	1 (mitral insufficiency requiring surgery)	0.28	0.28	None	0.4 (2 single testis, 1 congenital heart disease)	—
Comments	False-positive rate 13% Minor orthopedic findings 8.6%	Minor treatable conditions 8%	Reason for referral: minor problems with mouth and teeth, cardiovascular system, genitalia, lower extremities	Minor musculoskeletal problems 9.6%: tight hamstrings, patellofemoral syndrome, ankle instability, reflecting orthopedist's bias, rehabilitated proteinuria 0.37%	Of 33 with medical problems, 22 known before Of 38 orthopedic problems, 24 known before	All 3 excluded athletes had known diagnosis Cost per major finding \$4,137	Multiple examiners noted significantly higher percentage of abnormalities in 6 areas	All abnormalities known before	—

M = male, F = female.

The most frequent medical finding was a heart murmur that proved to be unimportant, with the one exception mentioned above (the student who was found to have mitral insufficiency), or some congenital heart defects, which had been known before. The rate of diagnosis of hypertension varied between 0.1% and 1.6%. The definition of hypertension varied, however. The diastolic pressure was considered to be abnormal if it was higher than 90 or 95 mm Hg. In four series acne was noted in 2.6% to 7.1% of adolescents. Dental caries and decreased visual acuity were frequent findings.

Cost analysis was done by Risser et al¹⁰ in 1985, and at that time the cost per important finding was \$4537. They also compared the examination by 1 physician with the so-called station method, in which the athletes were screened at various stations. They found the station method to be less expensive. When Risser et al¹⁰ compared the referral rate from a student population, primarily affluent white, with that from mostly indigent African-Americans, there was no difference in the referral rate for serious problems.

Discussion

Several factors limit the usefulness of this review. The examinations were done by different physicians and paramedical teams. Some studies were done by individual physicians; others used the team or station approach. The definition of abnormality varied, particularly what constituted important disease. Nurses and physical therapists showed a tendency toward overreferral. Most examinations were done in students interested in sports participation, perhaps a group a little healthier than all students in a specific age-group.

Rowland¹³ reviewed some of the same data surveyed in this study and came to the conclusion that periodic health examinations are not helpful for the discovery of unknown disease processes. He stated, however: "Commitment of time during the preparticipation examination for education of the athlete regarding health-related aspects of sports participation may serve as one of the most useful components of the evaluation."¹³ He has not tested this proposition, nor is there any evidence in the literature that it is being tested or has ever been investigated.

The value of periodic examination of younger children in schools was questioned by Yankauer

and Lawrence¹⁴⁻¹⁶ in a series of studies between 1955 and 1973. In 1956, they concluded "that periodic school medical examinations, during the first 4 years of elementary school are of little value from a case-finding standpoint."¹⁵ In 1961, Yankauer et al¹⁷ pointed out that based on a questionnaire study, these encounters with a physician have no educational value to parents.

On the other hand, DeAngelis and associates¹⁸ reported on the results of mass screenings and some physical examinations of 12,997 students done by 15 nurse practitioners in five different rural settings. The age-groups were not detailed specifically, but high school students were included. They noted 51.6 problems per 100 physical examinations and 4.7% on mass screening. Most of the problems found were the same as those reported in other studies, such as vision problems, hearing problems, scoliosis, increased blood pressure, height or weight problems, dental and skin problems, and heart murmurs. The authors did not state whether any of the heart murmurs were based on true organic heart disease, except for coarctation of the aorta (the number was noted). The referral of a total of 1477 students at least once to a specialist seems inordinately high; no data are available about the number of problems confirmed by the specialist. The rate of false-positive examination results was not given. It would have been particularly interesting to know how many cases of scoliosis were confirmed and treated. The authors stated that only 14.2% of all problems found during physical examinations would have been discovered by mass screening.

The medical profession is left with a dilemma. Conventional wisdom and the opinion of several learned bodies suggest that the prophylactic health examination has a place in the care of adolescents.

Recommendations regarding the need for and frequency of health evaluation vary and are not based on any of the data accumulated in this article. In 1952 Shaffer¹⁹ suggested examinations of persons aged 5 to 18 years every 2 to 3 years. The Commission on Public Health and Scientific Affairs of the American Academy of Family Physicians recommended one examination in adolescents between the age of 13 and 18 years.²⁰

In 1989 McKeag²¹ reviewed some of the studies on preathletic examinations and suggested an elaborate scheme for screening, using a detailed questionnaire and physical examination. These should

take place before entrance into sports at the elementary school, junior high school, high school, and college levels. He noted that such preparticipation screening might not be cost-effective.

Cromer et al²² recommended that routine examination of adolescents include screening for height, weight, and sexual maturity; vision test with Snellen chart; complete blood cell count; transferrin saturation rating; dental history and oral examination; assessment for scoliosis (Adam test); blood pressure measurement; thyroid gland examination; psychosocial history; and immunization review (booster dose of measles-mumps-rubella vaccine).

For selected population groups, they suggested a tuberculin test, sickling test, mean corpuscular volume, urine culture (clean voided specimen), testicular self-examination after age 18 years in male patients who had cryptorchidism, cholesterol measurement in children with a positive family history of myocardial infarctions, and pure tone audiometry if there is a positive history or chronic exposure to firearms or loud machinery. They mentioned what not to do routinely: screen for hearing problems, tuberculosis, and glucose-6-phosphate dehydrogenase deficiency; urinalysis; and breast self-examination instruction. They are in favor of yearly evaluations. These authors, however, had not taken note of the studies reviewed here.

Morris Green was the editor of *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents* from the National Center for Education in Maternal and Child Health published in 1994.²³ In the "Adolescence Periodicity Schedule," examinations were recommended every year from age 11 to 21 years. There were no references in the bibliography critical of the value of school or preathletic routine examinations.

The Board of Trustees of the American Medical Association stated in 1994,²⁴ regarding athletic preparticipation examinations for adolescents: "The usefulness of the examination to identify adolescents at risk for sudden cardiac death or who have previously undiagnosed medical disorders is not substantiated by the research literature. The identification of orthopedic problems is maximized by the station approach."

Based on this review, we can say that routine physical examinations in adolescents yield few really important, previously unknown findings. These examinations are costly and are not chal-

lenging to the physician. For preathletic examinations, as a new standard we suggest a review of the student's history and several screening tests using the station approach (eg, recording of weight, height, and visual acuity; measurement of blood pressure; and an inspection of the back for scoliosis). This type of examination might be all that is necessary to determine the student's ability to participate in sports. The participation of paramedical personnel increases the number of false-positive findings, yielding a higher referral rate.

Conclusion

Healthy adolescents do not need yearly physical examinations. The chance of finding major disease previously unknown is small, and annual examinations are not cost-effective. We agree with Rowland's suggestion¹³ of one thorough evaluation done in early adolescence. The history is recorded, including the status of immunizations, using a questionnaire. Screening for height, weight, vision, and blood pressure and a physical examination are part of the evaluation. At entry to high school, start of an athletic program, and before college, a new questionnaire is filled out, and screening tests plus inspection for scoliosis are repeated. This screening can be done in a physician's office or at school by using the station approach. Instruction about breast self-examinations, hearing tests, dental examinations, and laboratory tests are not necessary. If there are any questionable findings or the student has symptoms of illness, referral to the appropriate physician should be arranged.

Special risk groups, such as sexually active adolescents or students with known substance abuse, need to be examined more often. Sudden cardiac death in adolescents during sports events cannot be prevented by the current methods of preathletic examinations.²⁵

An argument could be made that a yearly examination of adolescents would allow the physician to discuss such matters as diet, sex, drugs, and smoking. The time allotted for such examinations is usually short, however, and would not permit sufficient coverage of these complex issues. Health education should be a part of the school curriculum or offered in group meetings arranged in medical facilities for adolescents.⁴ Regarding the detection of emotional problems, Grant et al⁴ stated, "Generally a routine examination by physician is a poor

way to screen for these problems. A more efficient method would be to train teachers and school nurses to be sensitive to the child with emotional and learning, as well as physical problems, and refer them to appropriate care." Emotional problems probably are better recognized by parents, teachers, and counselors, leading to proper referral.

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