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Childhood Fitness: What Is Happening? What Needs to Be Done?[1,2]

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Background. There is some controversy as to the fitness levels of U.S. school-age youth. Some experts claim that U.S. youth are fit. Others feel that there has been a decline, despite a recent adult fitness boom.

Methods. The purpose of this article is to examine the research conducted on the cardiovascular endurance and body composition levels of U.S. youth. Research studies noting the activity patterns of youth outside and during physical education are presented. The frequency and duration of physical education requirements are also reviewed. The effects of these patterns and requirements on cardiovascular endurance and body composition are presented.

Results. U.S. youth do not engage in physical activity, within or outside physical education, sufficient to develop cardiovascular endurance. Our youth are, therefore, at risk of developing a myriad of diseases associated with sedentary lifestyles.

Conclusions. Exercise is known to have a prophylactic effect on disease, death, and disability. Young people must be instructed and encouraged to be involved in lifetime fitness activities if we are going to control health care costs, reduce disease incidence, and improve the overall quality of life of our citizens.

INTRODUCTION

There is controversy surrounding the status of youth fitness in the United States. Some experts (1) claim that the youth fitness crisis in the United States is exaggerated. They say our youth are the most active and fit population in the country. Unfortunately, a comparison of youth to adults is not impressive. It is estimated (2) that less than 10% of the adult population (18 and older) get vigorous exercise regularly.

Other experts (3, 4) note that there has been an erosion of youth fitness levels during the past 2 or 3 decades. Unfortunately, the detractors to this point of view say that most of the fitness comparisons have been based on motor skill tests rather than on health-related fitness tests (3).

Regardless of viewpoint, all experts agree that there are two groups of youth in the United States, as there are with adults. That is, there are "haves" and "have nots." The haves are active. The have nots are inactive. Accordingly, the have nots are disenfranchised from physical activity and from the fitness movement. How many children are in each group? Again, there is controversy. Some say one-third are unfit (5). Others say as many as two-thirds are unfit (6).

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MEASURING PHYSICAL FITNESS

One of the basic problems in evaluating fitness levels has been the evolution of the philosophy of physical fitness. Early studies (7–10) emphasized minimum muscular fitness levels (ability to do one repetition) or sport performance (softball throw, shuttle run, etc.). More recently, the emphasis has been directed toward health-related physical fitness models (11–13) (Table 1). This shift in thinking and testing has made comparisons difficult even though national data have been collected since the 1950s (14).

The move to health-related fitness began when studies and experts suggested that improved cardiovascular fitness, body composition, muscle strength, and flexibility are related to reducing disease and disability. For example, a series of studies (15–22) has demonstrated that enhanced cardiovascular endurance means improved physical working capacity, reduced fatigue, and a decreased risk of coronary heart disease. Improved body composition, that is, lower body fat and enhanced lean body tissue, may result in reduced risk of hypertension, coronary heart disease, and diabetes (23, 24). Improved muscle fitness and flexibility can also produce enhanced functional capacity (lifting, carrying) and reduced risk of low back pain (16, 25, 26).

The recent uproar over youth fitness started in the mid-1950s when Dr. Hans Kraus (27), a noted orthopedic physician, presented data showing that the fitness scores of U.S. youth were not as good as the scores of European youth. Comparative studies with other countries (7, 28–30) (Denmark, Switzerland, Austria, Italy, and England) showed that U.S. youth fared poorly. Some of these test comparisons were criticized, since they supposedly favored the gymnastically oriented Europeans, but U.S. children who participated in subsequent studies that used U.S.-designed fitness tests produced similar results (30).

Comparisons of test results from test years 1958, 1965, 1975, and 1985 have been difficult because of the shift in the type of tests given to children. The motor fitness test results have shown little change over the decades—after a slight improvement between 1958 and 1965 (a questionable change since some experts feel that this improvement was due to practice sessions conducted in 1965, but not in 1958) (31). On these data, fitness of U.S. children has stepped sideways or declined since 1965 (3).

More recently, there have been comparisons of cardiovascular, body composition, flexibility and muscle fitness tests. This article examines only the cardio-

TABLE 1
EVOLUTION OF PHYSICAL FITNESS TESTING

1950s test items	1990s test items
1. 50-yard dash (speed)	1. Distance run—¼ to 1½ mile run (cardiovascular fitness)
2. Softball throw (upper body power)	2. Sit and reach (flexibility)
3. Sit-up (muscle fitness)	3. Skinfolds or body mass index (body composition)
4. Long jump (lower body power)	4. Curl-ups (muscle fitness–abdominal)
5. Pull-ups (muscle fitness)	5. Pull-ups (upper body muscle fitness)
6. 600 Yard run (cardiovascular)	

vascular and body composition data. Unfortunately, these data do not go back to 1958. The body composition comparisons reach back to the 1960s and cardiovascular fitness comparisons from the early 1980s.

CARDIOVASCULAR FITNESS

During the past 10 years Updyke and Willett (6) have shown that there has been an approximately 10% decline in the aerobic fitness levels of children as measured by distance runs (¼ mile for 6- to 7-year-olds, ½ mile for 8- to 9-year-olds, ¾ mile for 10- to 11-year-olds, and 1 mile for children 12 and older (Tables 2 and 3). Both boys and girls showed marked declines.

Closely allied to these distance run tests are maximum oxygen uptake tests. There have been a substantial number of international studies using direct measurements of maximum oxygen uptake with children. Unfortunately, only small samples of subjects have been tested. Interestingly, in the youngest age category, scores for the world population are biased upward by a Swedish sample that was probably above the average fitness for that country. The U.S. population data fall well below the world average, although smaller U.S. samples have sometimes matched these figures. Regardless, it appears that U.S. youth have slightly lower maximum oxygen uptake levels (4).

BODY COMPOSITION

Over the past 20 years or so, there appear to have been negative changes with respect to body weight and fat. Again, looking at the Updyke and Willett data (6) presented in Table 4, it is apparent that there has been an increase in body weight between 1980 and 1989. These data, however, do not reveal whether the increase is due to fat, lean body weight, or height increases.

Supporting the contention that the increase in weight may be due to fat, not muscle mass, were comparisons between skinfold data from the National Health Examination Survey (NHES) Cycle 2 (1965) and the second National Health and Nutrition Survey (NHANES) conducted from 1976 to 1980 (32). These comparisons indicate a 54% increase in the prevalence of obesity among children 6–11 years old and a 98% increase in the prevalence of superobesity. Similarly, NHES–Cycle 3 skinfold data for 1966–1970 compared with the NHANES (1976–1980) skinfold data (Table 5) indicate a 39% increase in the prevalence of obesity among children 12–17 years of age and a 64% increase in their prevalence of superobesity (32).

TABLE 2
COMPARISON OF ENDURANCE RUNS (AAU)—1980–1989—BOYS

	Age (years)				
	6–7	8–9	10–11	12–13	14–17
1980	2:20	4:19	6:31	8:22	7:32
1989	2:36	4:49	7:18	9:07	8:38

Source. Ref. (6).

TABLE 3
COMPARISON OF ENDURANCE RUNS (AAU)—1980–1989—GIRLS

	Age (years)				
	6–7	8–9	10–11	12–13	14–17
1980	2:30	4:35	7:22	9:47	9:39
1989	2:41	5:27	7:59	10:28	10:28

Adapted from Ref. (6). Copyright 1989, Chrysler Fund—AAU Physical Fitness Program.

The ethnic differences were substantial (32). Black children, boys and girls, have had the highest increases in obesity and superobesity (Table 6).

Additionally, with regard to 6- to 11-year-olds in 1976–1980, 31% of the white boys, 17% of the black boys, 26% of the white girls, and 27% of the black girls were obese. With regard to 12- to 17-year-olds, 19% of the white boys, 13% of the black boys, 26% of the white girls, and 25% of the black girls were obese. Overall, approximately 27% of all 6- to 11-year-olds and 22% of the 12- to 17-year olds were obese and 12 and 9% of the 6- to 11- and 12- to 17-year-olds, respectively, were superobese (32).

One might argue that the increase in the extremes (obese and superobese) are pulling the average scores upward. The National Children and Youth Fitness Study II (33) suggests otherwise. A comparison of skinfolds between 1963 and 1986 was done. The median triceps and subscapular skinfold scores by age and sex are shown in Fig. 1. Obviously, children are getting fatter, faster.

In short, the weight gains reflected by the Updyke study (6) are probably due to an increase in body fat by all children and not only to the increase in superobese and obese children.

Compounding this problem is that comparisons of U.S. children's body fatness to that of other nations demonstrate that U.S. children are fatter than children of other countries in other eras (4). For example, skinfold readings for American boys, aged 7–19, averaged around 9 to 11 in the years 1985–87, while boys in five European nations during the 1960s and 70s had averaged readings of about 7–8. The same was true for the girls. American females averaged 11–15 between the

TABLE 4
COMPARISON OF BODY WEIGHTS—1980–1989

	Age (years)				
	6–7	8–9	10–11	12–13	14–17
			Boys		
1980	55	66	84	103	137
1989	55	77	90	111	142
			Girls		
1980	51	67	84	105	119
1989	54	70	88	112	126

Adapted from Ref. (6). Copyright 1989, Chrysler Fund—AAU Physical Fitness Program.

TABLE 5
ESTIMATES IN PREVALENCE OF OBESITY AND SUPEROBESITY CHILDREN 6–17 YEARS OF AGE

6–11		12–17	
Group	% Increase	Group	% Increase
	Obesity		
Boys	61	Boys	18
Girls	46	Girls	58
Total	54	Total	39
	Superobesity		
Boys	122	Boys	41
Girls	70	Girls	87
Total	98	Total	64

Source. Ref. (32). Copyright 1987, American Medical Association.

ages of 7–19, while the European girls averaged 6–14. Canadian boys and girls averaged 7–9 and 8–12.5, respectively (4).

In summary, over a period of 20+ years (1965–1986) there has been an increase in the skinfolds and weight (body fat) of U.S. boys and girls. Furthermore, U.S. children may be fatter than children from other countries.

WHY THE DECLINE IN FITNESS LEVELS?

Why the decline or stepping sideways of cardiovascular and body composition fitness levels of U.S. youth despite an adult fitness boom in this country?

One reason may be that children are not active, overall, throughout the day. Dr. Roy Shephard and others (34) conducted a study that examined children's activity patterns on Saturday and Wednesday (Table 7). The children did not report spending much time in physical activity on either day.

The Kuntzleman and Drake study (35) of children's daily activity patterns did

TABLE 6
ESTIMATES IN PREVALENCE OF OBESITY AND SUPEROBESITY WHITE AND BLACK CHILDREN 6–17 YEARS OF AGE

6–11		12–17	
Group	% Increase	Group	% Increase
	Obesity		
White males	62	White males	17
Black males	105	Black males	69
White females	40	White females	54
Black females	120	Black females	96
	Superobesity		
White males	120	White males	44
Black males	306	Black males	36
White females	63	White females	81
Black females	153	Black females	122

Source. Ref. (32). Copyright 1987, American Medical Association.

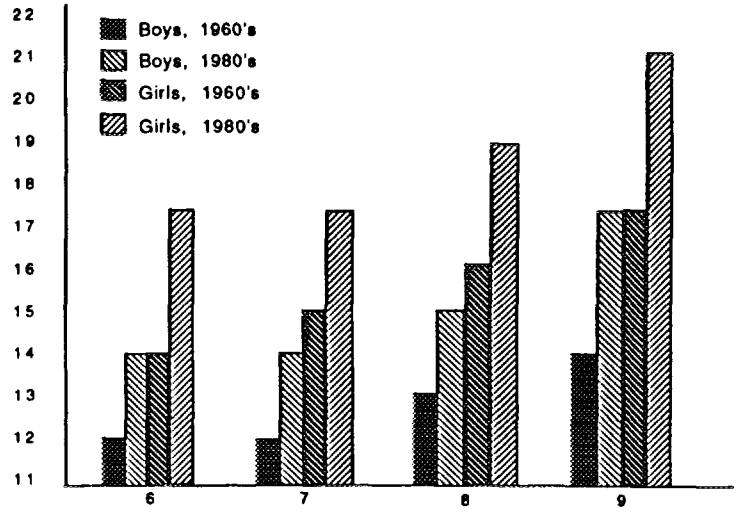

FIG. 1. Comparison of median triceps and subscapular skinfold scores—1960s and 1980s. Source: Ref. (33). (Reprinted with permission, *Journal of Physical Education and Dance*.)

not rely on self-reporting. Instead, Holter monitor devices were used. With the aid of these devices, the children's heart rates were measured minute-by-minute throughout the day. The study results demonstrated that the children engaged in very little physical activity. The average child spent 1% of his or her time (14 min) in vigorous physical activity and 78% of their time (18 hr 40 min) in sedentary activities. [The heart rates of the children were recorded during the school week (January–April) see Table 8.]

Why are children sedentary? The reasons are many. First, over the past 20 years physical education programs have been eroding (36). While 36% of the children get daily physical education, 37% get physical education two or fewer times a week (37). There is also great variance from state to state. For example, Illinois requires daily physical education, kindergarten trough grade 12 (38). Yet, in Michigan, less than 1% of the children in elementary schools get daily physical education (C. R. Ryan, unpublished survey, Williamston, MI, 1988). Furthermore, eight states (Michigan, Arizona, Colorado, Maine, Mississippi, Oklahoma. South Dakota, and Wyoming) have no mandated physical education (38). Across the nation, the mandated physical education requirement averages to less than 12 min or physical activity a day (about 3% of the school day) (38).

Results from the National Child and Youth Fitness Studies I and II have revealed that, although enrollment in physical education positively affects fitness, the nature of the program is of even greater importance (39, 40). School physical education should help increase the physical activity levels of children, and it is hoped their fitness levels as well. Unfortunately, studies indicate that only 27% of class time is spent in actual physical activity; the remaining time is spent in instruction, administrative tasks, and waiting (41). Innovative programming should substantially reduce the time spent in waiting and administrative tasks and approach a desirable level of having the children moving at least 50% of the time.

TABLE 7
ACTIVITY PATTERNS OF RURAL AND URBAN CANADIAN YOUTH

	Wednesday		Saturday	
	Rural (Hr:min)	Urban (Hr:min)	Rural (Hr:min)	Urban (Hr:min)
Sleep	10:05	10:10	10:08	9:34
Sedentary	10:25	9:23	8:29	9:11
Light act.	2:08	3:38	2:35	2:43
Vigorous act.	:58	:10	1:25	:45
Unreported time	:24	:11	1:21	1:47

Source. Ref. (34).

Studies show that most children do not move vigorously even during the active part of the physical education program. Dr. Robert Goode (personal communication, 1983) demonstrated that only 1–2 min of a typical physical education class was devoted to vigorous exercise. A University of Michigan study (42) showed that the average child gets 1–6 min of vigorous activity in the physical education classroom. Another study (35) indicated that the average child in a typical education period that is 30 min in length rarely gets his/her heart rate up to training intensity. At 10 and 18 min into the physical education class (supposedly the most active time of the class) heart rates reached an average of 125 (second graders), 109 (fifth graders), and 100 (seventh graders).

Just having the children moving does not ensure that their fitness level will improve in physical education. Dr. Gordon Cumming and his associates (43) at the University of Manitoba investigated the effects of increased physical education class time on improved physical fitness levels. Their conclusion: The physical fitness levels of fairly fit children are not likely to change over a school year, no matter how many hours are allotted or facilities are available for physical education. To improve the physical fitness levels of a person requires a training program designed to improve the various fitness components.

Closely allied to this lack of significant activity is that, at times, physical education curricula are vague or nonexistent. For example, only 70% of the school districts in Michigan have written K–12 goals and objectives in physical education. Teacher and program evaluation is dependent on the local school district (44). Administrators frequently do not emphasize physical education. For exam-

TABLE 8
SUMMARY OF 7- TO 12-YEAR-OLDS' HEART RATES THROUGHOUT A 24-HR PERIOD

Heart rate	% 24 Hours	Hours	Min
<100 (Sedentary)	78	18	40
100–129 (Light)	18	4	23
130–159 (Moderate)	3		43
≥160 (Vigorous)	1		14

Source. Ref. (35).

ple, classes frequently are too crowded. In too many instances, 60–100 students are in one gymnasium, or teaching area, with or without an additional certified teacher (45).

Juxtaposed with this casualness on the part of administrators is that elementary school children receive less physical education instruction than middle-school and ninth-grade children. According to the Michigan Department of Education Physical Education Survey Report for 1989–1990 (44), students receive an average of 50 min of physical education per week in kindergarten through second grade, 74 min in grades 3–6, 79 min in grades 7–9, and 143 min in grades 9–12. Interestingly, after ninth grade, the number of Michigan school districts requiring physical education declines dramatically. Post-ninth-grade students are required to take physical education in only 13% of the school districts in Michigan.

Additionally, parents and federal/state officials have abandoned physical education. Since 1977, three-fourths of physical education teachers in the state of California have been eliminated. Between 1978 and 1983 there were substantial declines in physical education specialists in cities such as Boston (46).

It may be that physical education is out of the mainstream of contemporary thought. A 1983 survey (C. T. Kuntzleman, unpublished) conducted in John Naisbitt's "bell weather" states demonstrated a substantial erosion of programs. In this poll of state physical education directors in California, Washington, Colorado, Connecticut, Florida, and Michigan there was an indication that physical education was eroding. When the directors were asked if there were any bright spots in their state, each state director said any school that emphasized fitness or wellness seemed to be flourishing.

There has also been a substantial decline in recreation due to federal and state cut-backs. The curtailment has been extensive. Today, only one-third of the recreation leaders are on the playgrounds compared with that seen in the 1970s. The city of San Diego, in 1977, had 96 school sites with after-school recreation specialists. Today there are none (46).

Parents also contribute to the sedentariness of children. Parents encourage their children to watch TV. It is the nation's biggest babysitter—whether Mom or Dad is home or not. The average child watches television 25–27 hr a week (47) and video games burn up a large segment of children's time. To compound the problem, parents are oblivious to the problem. They associate the vigor of youth with fitness. Nine of 10 parents think that their children are fit (48) when, as the previous discussion demonstrates, that is not so. In addition, many parents suffer from a sports mentality. Their thinking goes something like this: "My child plays sports and, therefore, he or she is fit." Or, they think that it is good that competition is emphasized. However, research (49) shows that competition is a turn-off to children.

Regardless of the acknowledged importance of lifetime physical activities, the average student spends more time on lifetime physical activities outside the physical education class (60%) than within it (50). The portion of the physical education curriculum devoted to lifetime fitness in 5th through 12th grades is only 48%—45% for boys and 50% for girls. To a large extent, relays and informal

games for younger children and competitive sports for older children are still the mainstays of physical education (51).

Despite this dismal report, there are bright spots. The federal government's Public Health Service in *Healthy People 2000* (2) says that there are a myriad of diseases associated with sedentary lifestyles. These include coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus, osteoporosis, obesity, depression, and anxiety. In addition, this same document states that increased activity has been associated with lower rates of colon cancer and stroke and fewer back injuries. Furthermore, active people tend to outlive their inactive brothers and sisters. Active people also maintain their functional independence longer than sedentary people. This same report says that physical education can be used to start children on the road to an active lifestyle.

Physical education and recreation are needed. Physical fitness is demanded if we are going to control health care costs, reduce the incidence of disease, and keep our citizens functioning longer.

The implications are more profound when one recognizes that the seeds for these diseases are planted in childhood. Evidence shows that children present an alarming number of risk factors. Research done by Macek and Vavra (52), Wilmore and McNamara (53), and Gilliam *et al.* (54) demonstrate that children have an appalling number of risk factors. Over 60% of children have at least one risk factor, and almost 20% have three or more. Fortunately, it appears that these risk factors may be modified or at least slowed in children (35). The modification of these risk factors is important since extensive research in Bogalusa, Louisiana, under the direction of Gerald Berenson (55–57) clearly shows a link between children's risk factors and the early progression of heart disease. Children with higher blood cholesterols and blood pressures have more arterial damage than those children with more normal values.

THE TURNAROUND

How do we turn around the deterioration of youth fitness programming? Physical education must move into the mainstream of education. This means that physical educators must decide what the profession entails. Does the discipline center on developing physical fitness, movement skills, sport skills, sportsmanship, or some combination thereof? The profession probably only has time to improve fitness, teach children how to become fit for now and in the future, and develop basic motor skills. These are reasonable goals.

There are many barriers to providing adequate physical activity in physical education programs.

- It is difficult for children, parents, and teachers to see the immediacy of children being involved in preventing a disease that may not manifest itself for several decades.
- Most children appear to be quite healthy, vigorous, and energetic.
- The school culture often confuses children. They may be taught healthy living patterns through lectures, discussion, reading, and physical education, but

they are served unhealthful lunches, provided little opportunity for aerobic exercise, and often placed in physical education programs that are highly competitive and selective.

- School districts under economic pressure frequently eliminate physical education programs.
- Many individuals teaching physical education do not have the technical training to implement quality physical education programs.
- Schools frequently evaluate the effectiveness of their physical education program based on the success of their athletic program—that is, they allow 10% of the children dictate what the other 90% should do.
- Many people teaching physical education are coaches first and physical education teachers second. Consequently, physical education is given less attention than interscholastic programs. Also, teachers who are focused on coaching tend to emphasize team sports in physical education rather than life-long activities such as running, walking, aerobics, bicycling, racquet sports, and the like.
- Some physical educators do not have a high regard for their profession. Consequently, they do not articulate a positive message regarding physical education.
- Teachers and administrators frequently view physical education as competing for time, space and resources in academic subjects (34).
- Parents frequently fail to see the relevance of physical education in the school setting.

Until now, rhetoric has been the primary thrust of fitness advocates. The American College of Sports Medicine (58) and American Academy of Pediatrics (59) have each issued position statements on the need for quality youth fitness programs. The U.S. Congress (60) has called for daily physical education. These are strong endorsements. The vision is clear. It is time to turn the rhetoric into the action steps recommended by the Michigan Department of Public Health in Promoting Cardiovascular Health in Michigan (45):

- Departments of education should require daily physical education for all students to promote lifelong fitness and cardiovascular health. Optimally, physical education should be taught 5 days a week by a physical education teacher. As a minimum, physical education should be offered 2 days a week under the supervision of a physical education teacher and 3 days a week under the supervision of a classroom teacher/aide who has been given appropriate instruction.
- Departments of education should encourage schools to provide 30 min of moderate to vigorous exercise each school day or at a minimum 30 min of light to moderate exercise a day. In schools that are moving toward these goals, departments of education should encourage schools to offer 5-min exercise breaks and walking and/or running activities during noon time or recess. Other extracurricular activities, which have vigorous movement, are to be encouraged.
- Departments of education should provide demonstration projects to develop a model physical education program that could be used throughout the state.
- Departments of education should recommend that fitness testing be performed on all children to identify cardiorespiratory, flexibility, and muscle and

body composition fitness levels and then recommend physical activities for correction of fitness deficiencies. Retests should be performed to determine the effectiveness of the physical education program and provide documentation to parents that their children are doing satisfactorily or need help in fitness development. The testing is also to be used to inform teachers how well they are educating children. Under no circumstances should children be graded according to their physical fitness levels.

- Universities and colleges should evaluate their professional physical education curricula to review and revise content so that it emphasizes fitness and motor skill development that will instill lifelong habits toward reducing disease risk and ensuring healthy lifestyles.
- Universities and colleges should include retraining seminars for current physical education instructors to emphasize current recommendations for fitness in schools and strategies for implementation.
- School districts should be encouraged to hire individuals who have appropriate courses in physical education training, thereby enhancing the program and reducing the vulnerability of school districts to liability.
- Departments of education should expand school physical education programs to include more active parental involvement.

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