

Health-Related Fitness of Children Who Are Visually Impaired

Lauren J. Lieberman and Elaine McHugh

Abstract: This study tested 46 children with visual impairments (26 girls and 20 boys) on the Fitnessgram health-related fitness test. It found that fewer than 20% of the children with visual impairments passed at least four items on the Fitnessgram, compared to 48%–70% of the sighted children.

Regular physical activity has benefits for both physical and psychological health, including the reduced risk of heart disease, diabetes, high blood pressure, obesity, and stress-related illnesses (U.S. Department of Health and Human Services, 1996). Contrary to the popular belief that children are “naturally” active, American children do not engage in levels of activity that are sufficient to maintain adequate fitness (U.S. Department of Health and Human Services, 1996). In fact, the percentages of children and adolescents who are overweight are at an all-time high (Nicklas, Webber, Johnson, Srinivasan, & Berenson, 1995; Sallis & Patrick, 1994). Children with visual impairments (both those who are blind and those with low vision) have consistently exhibited lower levels of fitness than have their sighted peers (Blessing, McCrimmon, Stovall, & Williford, 1993; Buell, 1973; Hopkins, Gaeta, Thomas, & Hill, 1987; Jankowski & Evans, 1981; Kobberling, Jankowski, & Leger, 1991; Meek &

Maguire, 1996; Shindo, Kumagai, & Tanaka, 1987; Short & Winnick, 1986; Sundberg, 1982; Winnick & Short, 1985). Yet the need to be fit is even greater for individuals who are visually impaired, since activities of daily living demand increased energy when performed with impaired vision (Arnhold & McGrain, 1985; Buell, 1973; Dawson, 1981; Kobberling, Jankowski, & Leger, 1989; Nakamura, 1997). This article documents the low health-related fitness levels of a group of children with visual impairments and presents program objectives for remedying them.

Previous research

Previous research on the fitness of children with visual impairments is limited. In a review, Skaggs and Hopper (1996) reported only 11 studies published between 1950 and 1993 that addressed physical fitness. In these studies, many different methods were used to assess cardiovascular endurance, muscular strength and endurance, and body composition; the degree of visual impairment of the participants varied widely among the studies; and not all researchers precisely defined the participants' visual status. Because of these variations, comparisons of the results are problematic.

The authors thank Robin Roberts and Michele Carron for their assistance with the data collection, Brian Jersky for his assistance with the statistical analysis, and Kathy Charmaz and the Faculty Writing Group at Sonoma State University for their valuable feedback.

Accepted July 11, 2000.

Furthermore, sample sizes were frequently low. Nevertheless, with the exception of body composition scores in two studies (Kobberling, Leger, & Jankowski, 1989; Short & Winnick, 1986), the participants who were visually impaired consistently exhibited lower fitness than did their sighted peers.

On the other hand, many researchers have clearly demonstrated that visually impaired people who engage in regular physical activity improve their fitness and exhibit levels of fitness comparable to those of sighted people (Blessing et al., 1993; Gleser, Margulies, Nyska, Porat, & Mendelberg, 1992; Lee, Ward, & Shephard, 1985; Ponchillia, Powell, Felski, & Nicklawski, 1992; Williams, Armstrong, Eves, & Faulkner, 1996). Skaggs and Hopper (1996) and Short and Winnick (1986) also pointed out that the fitness levels of children in schools for students with visual impairments are higher than those of children in mainstream schools, which may be attributed to less effective programming for students with visual impairments in mainstream schools. Given the movement to include students with disabilities in general education classes, educators cannot ignore the implications of this observation: They must foster the implementation of appropriate physical activity interventions and programming in all educational settings.

The purpose of this study was to evaluate the health-related fitness of children with visual impairments who attended a summer sports camp. An additional objective was to identify ways in which the fitness of children with visual impairments can be improved.

Method

PROCEDURES

Forty-six children with visual impairments (26 girls and 20 boys; one boy and one girl were also deaf) aged 9–19 performed items from the Fitnessgram health-related fitness test (Cooper Institute for Aerobics Research, CIAR, 1994). This test covers four areas: cardiovascular endurance, muscular strength and endurance, flexibility, and body composition. Items used in this study included the one-mile walk/run (cardiovascular endurance); sit-ups and push-ups (muscular strength and endurance); the sit and reach, back extension, and shoulder stretch (flexibility); and the body mass index (BMI, body composition). Since the Fitnessgram is criterion referenced, a child must meet designated standards of performance (a range of values for each item) to pass. The cutoff scores for passing items on the Fitnessgram are set at a level deemed the minimum necessary for a healthy lifestyle (CIAR, 1994). The Fitnessgram has been deemed a valid test utilizing concurrent, construct, and logical validity on all items. Reliability was determined using test-retest reliability on all items. Further information on this test can be found in the Fitnessgram technical reference manual (Cureton, 1994).

The parents' and children's permission was obtained prior to testing, which took place on the athletic fields and track at a university campus. The testers were the principal investigators (adapted physical education professionals with expertise in assessment) and graduate students in adapted physical education who were trained by one of the principal investigators. The testers demonstrated test tasks, allowed

two practice trials, gave feedback, and confirmed that the children were performing the tasks correctly over a period of three days. The children were then tested over a two-day period.

DATA ANALYSIS

The number of children who achieved the criterion for passing each item was determined. Passing percentages (rates) were then calculated for the following groups: all girls, all boys, girls and boys with low vision (some usable vision) combined, and girls and boys who were totally blind combined. The passing rates of the girls versus boys and of the participants with low vision versus those who were totally blind were then compared. In addition, the passing rates of the girls and boys in the sample were compared with those of sighted children reported in Looney and Plowman (1990). The latter analyzed data were collected from two National Children and Youth Fitness Surveys and included Fitnessgram scores from 4,678 boys and girls aged 6–9 and 8,810 boys and girls aged 10–18. The items tested were the one-mile walk/run, pull-ups, sit-ups, sit and reach, skinfold measures of body fat percentages, and the BMI. The normal approximation to the binomial test for comparison of proportions was used to analyze all comparisons of passing rates for statistical significance. Although the test analyzed nine test items, the comparison to the sighted peers used five test items.

Results

The children with visual impairments, both those who were totally blind and those with low vision, were more similar to one another than to the sighted children. Comparisons

among children in the sample showed no significant differences. On the other hand, comparisons with the sighted children revealed several significant differences.

GIRLS VERSUS BOYS WITH VISUAL IMPAIRMENTS

The passing rate for the boys exceeded that for girls by 17% in the one-mile walk/run, and the passing rates for the girls exceeded those for the boys in push-ups (15%), curl-ups (14%), the BMI (27%), and shoulder stretch (right, 35%, and left, 16%) (see Figure 1). However, when the Bonferroni adjustment for multiple comparisons was applied, none of these differences reached statistical significance. (It should be noted that because the Bonferroni adjustment is so conservative, the lack of overall statistical significance for some of these differences is probably due to the relatively small sample sizes.) Passing rates for the sit and reach and back extension differed by less than 10%.

Despite the lack of significant differences for the boys' and girls' rates, the patterns of differences are worth noting when compared to those for the sighted boys and girls. Differences between the boys and girls with visual impairments were in the expected direction (favoring the boys) for the one-mile walk/run (that is, they were in the same direction as the comparisons of the sighted girls and boys). For the sit and reach, however, the visually impaired boys slightly outperformed the visually impaired girls, whereas among the sighted children, the girls performed slightly better than the boys.

The most notable differences in patterns appeared for curl-ups, push ups, and the BMI. Sighted boys typically perform better

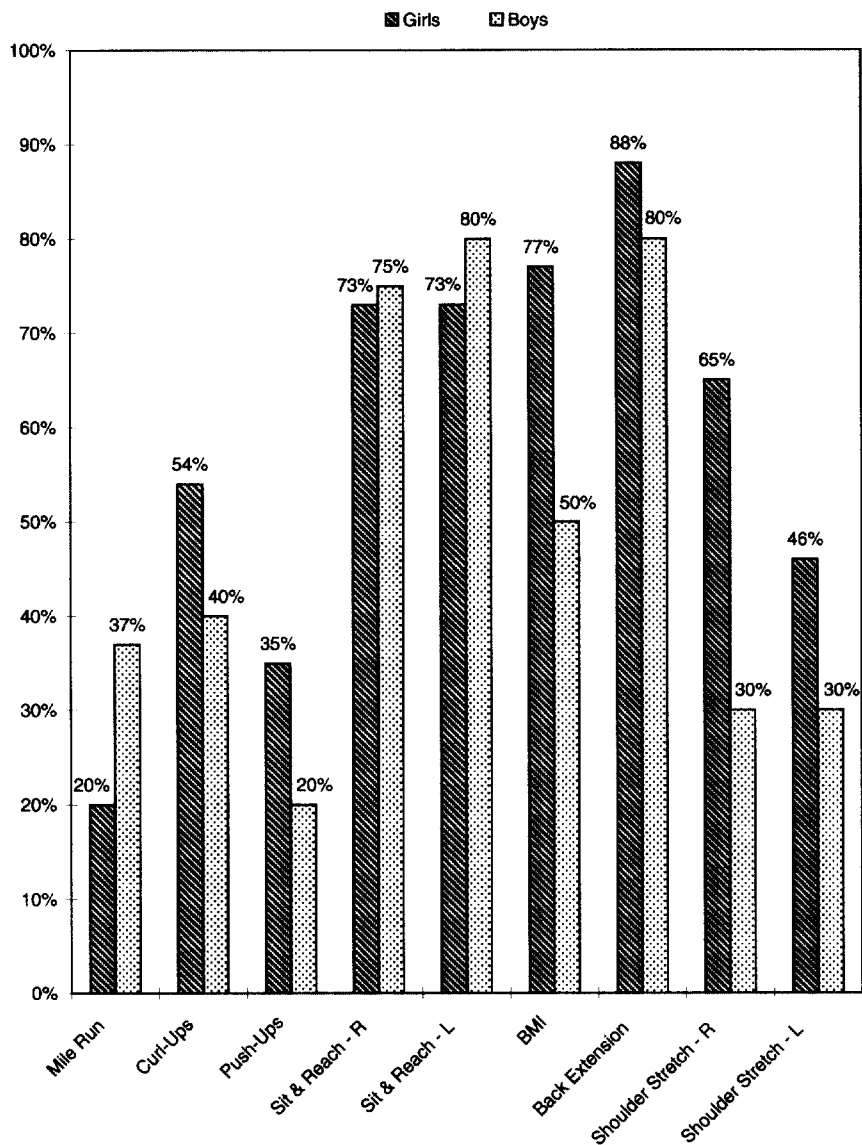


Figure 1. Comparison of passing rates of girls and boys with visual impairments.

than sighted girls in tests of arm/shoulder strength and endurance; in Looney and Plowman's (1990) study, differences for pull-ups ranged from 30% to 53% (with differences getting larger with age). In contrast, for the visually impaired children, the girls' rates for push-ups exceeded the boys' by 15%. Likewise for curl-ups, the rates for

sighted boys exceeded the sighted girls' in nearly all age groups by 3%–19%, whereas the visually impaired girls' rates exceeded the visually impaired boys' by 14%. In addition, for the BMI, the rates for the sighted boys were slightly higher than those for the sighted girls (88% versus 85%), whereas the rates for the visually impaired

girls exceeded those for the visually impaired boys by 27%.

PARTICIPANTS WITH LOW VISION VERSUS PARTICIPANTS WHO WERE BLIND

The participants with low vision had higher passing rates on five of the nine items: curl-ups (11%), sit and reach-right (5%), BMI (29%), back extension (14%), and shoulder stretch-right (5%). For push-ups and sit and reach-left, the scores were comparable. For the one-mile walk/run and the shoulder stretch-left, the passing rates of the participants who were blind were 13% and 22% higher, respectively, than those of the participants with low vision. None of these differences reached statistical significance (see Figure 2).

VISUALLY IMPAIRED VERSUS SIGHTED CHILDREN

Of the 26 girls with visual impairments, 3 passed all five items (11.5%) and 2 passed four of the items (7.7%). Comparable percentages from Looney and Plowman's (1990) study were 17% and 30.9%, respectively (see Figure 3). Of the 20 boys with visual impairments, 2 passed all five items (10%) and 1 passed four items (5%). The comparable percentages from Looney and Plowman's study were 41.4% and 30.2%, respectively (see Figure 4). Thus, almost 50% of the sighted girls passed four or five items, while only 19.2% of the girls with visual impairments did so. Furthermore, over 70% of the sighted boys passed four or five items, compared with only 15% of the boys with visual impairments.

A significantly smaller proportion of the boys with visual impairments than of the sighted boys passed the criterion in the one-mile walk/run, BMI, and arm/shoulder

strength and endurance. (For the last item, Looney and Plowman, 1990, reported data for pull-ups, whereas the participants with visual impairments performed push-ups.) Looney and Plowman did not report data for the shoulder stretch or back extension, so no comparisons could be made on those items. Significant differences also appeared in favor of the sighted girls in the one-mile walk/run and sit and reach. For the BMI, 20% more of the sighted girls than of the girls with visual impairments passed the criterion. However, when the Bonferroni adjustment for multiple comparisons was applied, differences on this item did not reach statistical significance.

Discussion

SUBTEST COMPARISONS

One-mile run

As in numerous other studies (Hopkins et al., 1987; Kobberling et al., 1991; Shindo et al., 1987; Short & Winnick, 1986; Sundberg, 1982), this study found that the cardiovascular endurance of children with visual impairments is lower than that of sighted children. Like the findings of this study, differences between males with visual impairments and sighted males in Kobberling et al.'s (1991) study were statistically significant, but unlike the current findings, the differences between female groups were not significant. However, Kobberling et al. did not specify whether any of their participants were totally blind; if all the participants had low vision, fewer differences between the sighted and visually impaired groups would be expected. For example, Williams et al. (1996) discovered no significant differences in VO_2 max (maximum oxygen consumption used as a

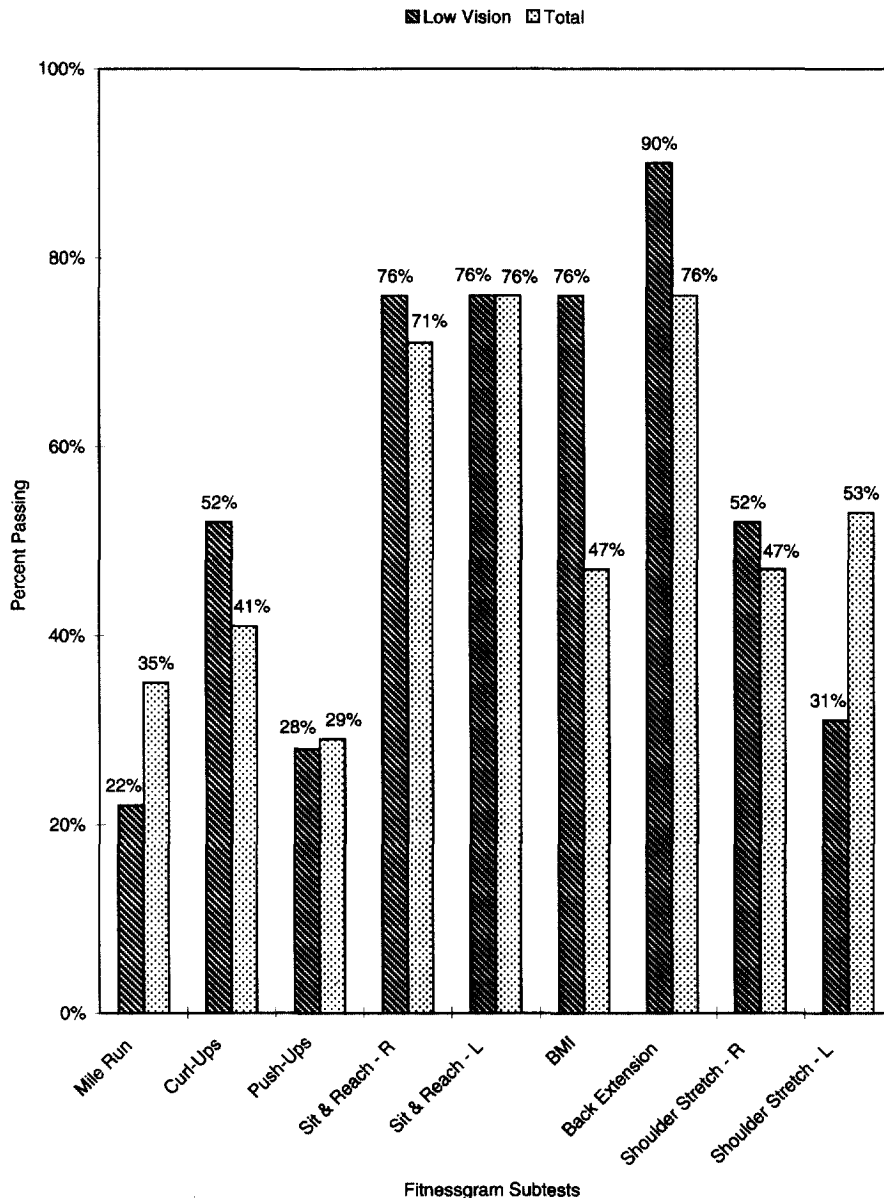
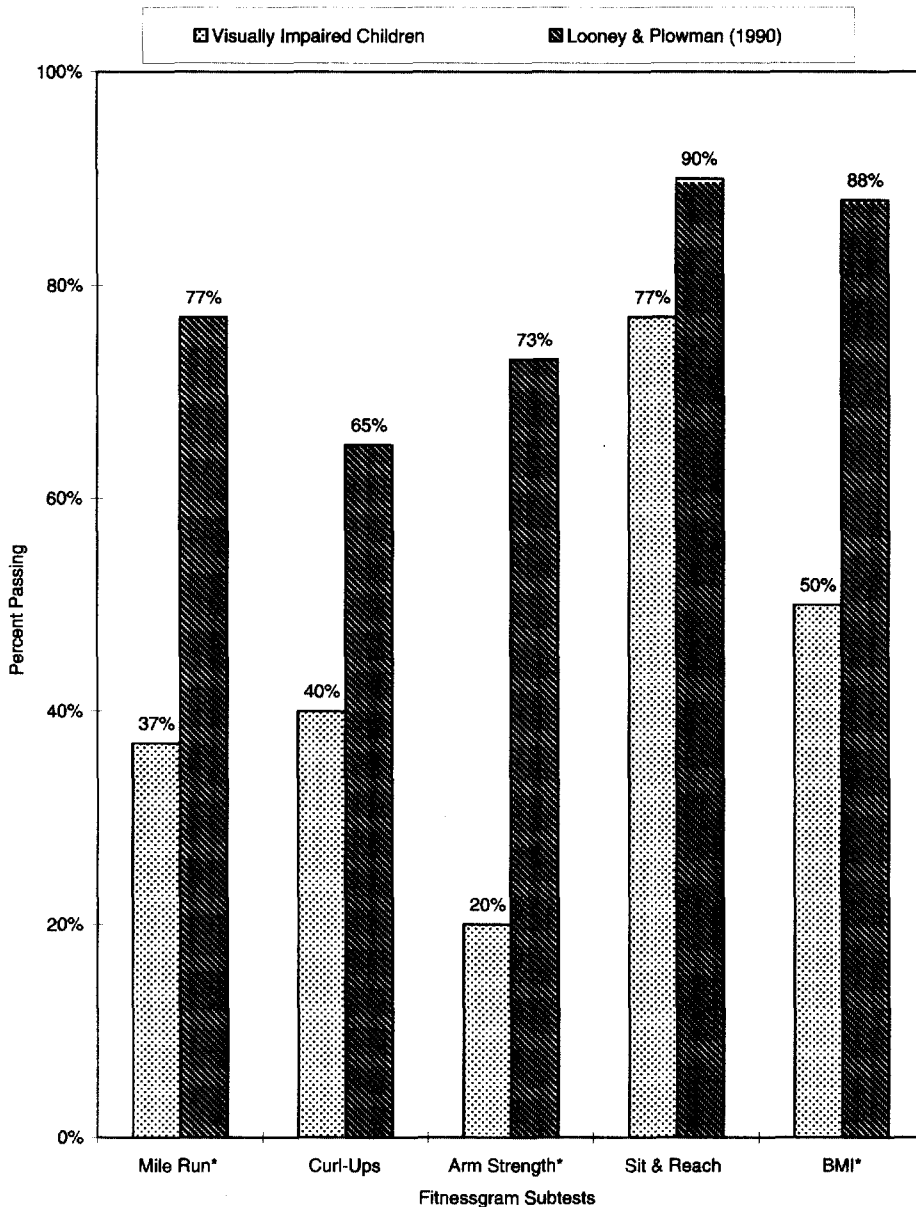


Figure 2. Comparison of passing rates of children with low vision and those who were totally blind.

measure of cardiovascular endurance) between girls with low vision and sighted girls, and Singh and Singh's (1993) sample of adolescents and adults with visual impairments who were active in recreational activities were not significantly dif-

ferent from their sighted peers. Thus, it may be concluded that the significantly lower scores among children with visual impairments in cardiovascular endurance in the current study and other studies mentioned earlier reflect the children's lower levels of



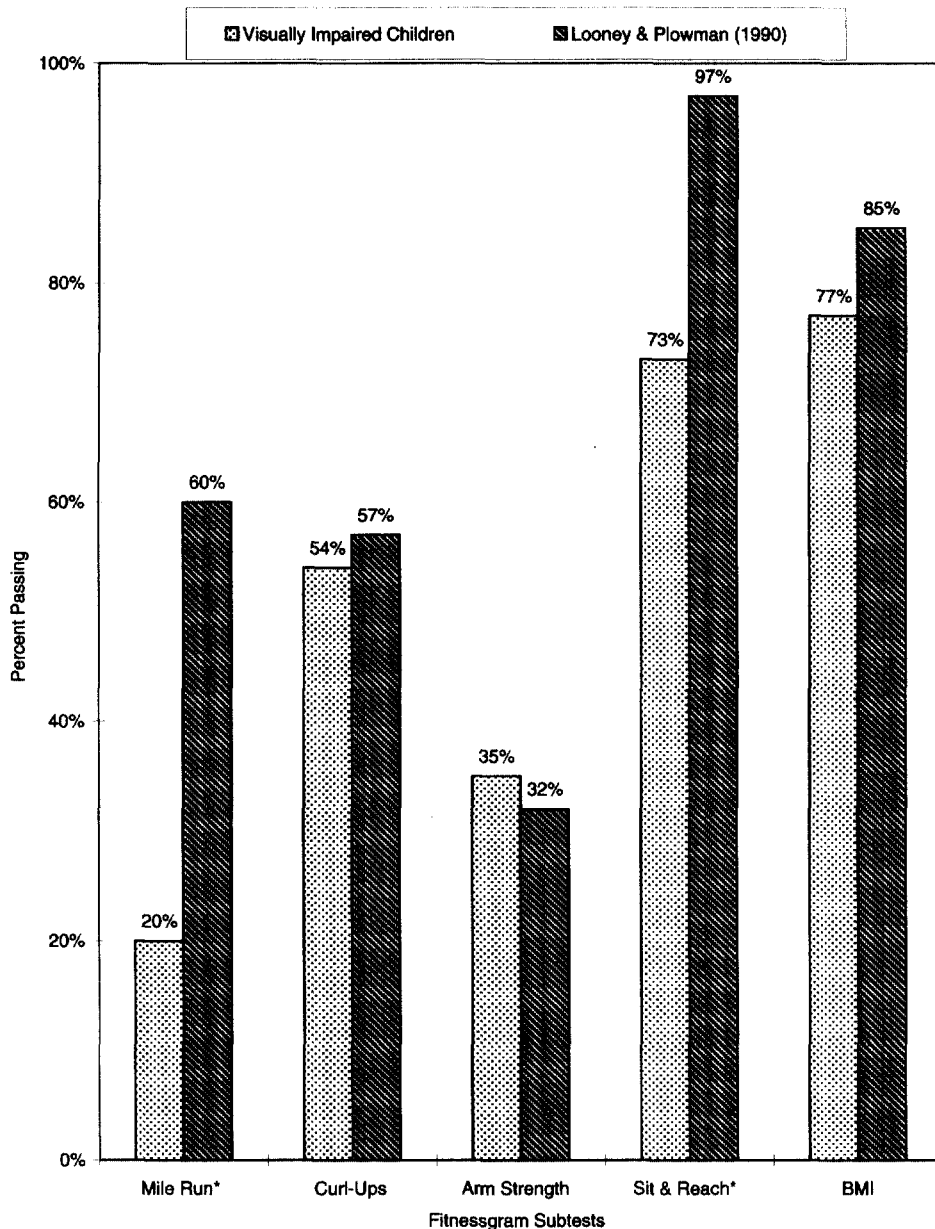
* $p < .0001$

Figure 3. Comparison of passing rates of girls with visual impairments and sighted girls.

physical activity, as documented by Hopkins et al. (1987) and Kobberling et al. (1991).

With regard to cardiovascular fitness, some researchers (Longmuir, 1998; Skaggs & Hopper, 1996; Titlow & Ishee, 1986) have questioned the validity of cer-

tain tests. For example, poor locomotor efficiency may affect scores on tests that involve running (Arnhold & McGrain, 1985; Dawson, 1981; Kobberling, Jankowski et al., 1989; Nakamura, 1997), and difficulty with dynamic balance may affect scores on step tests (Titlow & Ishee,



* $p < .0001$

Figure 4. Comparison of passing rates of boys with visual impairments and sighted boys.

1986). In both cases, the cardiovascular endurance of children with visual impairments may be underestimated. These factors (locomotor efficiency and balance) would also explain why one would expect children with low vision to perform better

on the one-mile walk/run than children who are totally blind. However, in this study, the differences between these two groups favored children who were totally blind by 13%. A possible explanation for this finding lies in the scoring criterion for

9 year olds, coupled with the age distribution of the sample. The criterion for 9 year olds is completion of the distance (no time standards). All the 9 year olds completed the distance, although several had extended times (such as 15–25 minutes). Because there was a larger proportion of 9 year olds in the totally blind group (5 out of 17) than in the low vision group (2 out of 29), passing rates for the totally blind group were higher.

BMI

The children with visual impairments had lower passing rates than did the sighted children (significantly so for the boys), and the children with low vision had a much higher (29%), although nonsignificant, passing rate than did the children who were totally blind. A high BMI is associated with reduced levels of physical activity and an increased incidence of hypokinetic diseases (Payne & Isaacs, 1999). The results of several studies have shown that children with visual impairments have a higher percentage of body fat (as measured by skinfolds) than do sighted children (Blessing et al., 1993; Hopkins et al., 1987; Jankowski & Evans, 1981). One study, Short and Winnick (1986), revealed no significant differences between the skinfold measures of children who were blind and those who were sighted, but significantly higher skinfold measures among children with low vision. However, two other studies found that children who were blind had higher skinfold measures than did children with low vision and sighted children (Hopkins et al., 1987).

In the current study, some of those who did not have passing rates on the BMI had a lower body mass than is recommended (one

girl with low vision and one who was blind; two boys with low vision and three who were blind). A low BMI may indicate a low percentage of body fat or lower weight for height as a result of reduced lean body weight. Similarly, Wyatt and Ng (1997) discovered lower lean body mass in the legs of children who were blind or had low vision compared to the sighted controls, and Lee et al. (1985) established that their participants who were blind were shorter and lighter than the sighted participants. In the current study, the larger gap between the passing rates of the visually impaired and sighted boys (versus corresponding groups of girls) seems to reflect a disproportionately negative effect on boys of reduced levels of activity, as seen in other areas of fitness performance.

Arm strength (push-ups/pull-ups)

No other studies using pull-ups or push-ups to compare the arm strength of children with visual impairments and sighted children were located in the literature. Short and Winnick (1986) evaluated the grip strength of children with visual impairments, who demonstrated significantly lower scores than did their sighted peers. Among sighted children, the boys in Looney and Plowman's (1990) study performed substantially better than did the girls. In this study, the girls with visual impairments performed better than did the boys with visual impairments. It is interesting to note that the girls with visual impairments performed at a passing rate comparable to that of the sighted girls; that is, the boys with visual impairments passed at rates significantly below the passing rates of the sighted boys. As for the BMI and cardiovascular endurance, this finding may

mean that reduced levels of activity and fewer opportunities for sports for children with visual impairments have a bigger impact on boys than on girls.

The fact that the tests for arm strength in this study (push-ups) and in Looney and Plowman's (1990) study (pull-ups) were not identical may or may not have been a factor in this finding. Generally, pull-ups are considered a more challenging test than push-ups; however, without more information about the criterion scores, it is not known whether the passing criterion for one is harder to achieve than the other.

The girls with visual impairments and the sighted girls had similar passing rates in this area, reflecting similarly poor upper-body strength. One possible explanation is that both low societal expectations for girls in this area and low levels of participation in activities that demand upper-body strength transcend even the negative effects of visual impairment for girls.

Sit and reach

The data corroborate limited evidence from the literature that children with visual impairments score lower than do sighted children in this area (Short & Winnick, 1986; Meek & Maguire, 1996). In this study, the visually impaired girls differed significantly from the sighted girls in the sit and reach, and the visually impaired boys' rates were 13% below those of the sighted boys (a statistically nonsignificant difference). Lower passing rates for this item may reflect the lack of participation in activities that demand lower back and hamstring flexibility (Haywood, 1993).

Curl-ups

Both the boys and girls with visual impairments had scores for curl-ups that were not significantly different from those of their sighted peers. This finding is similar to Hopkins et al.'s (1987) finding of no significant correlations between abdominal strength/endurance measures and visual status, cardiovascular endurance, level of activity, or body composition. On the other hand, Short and Winnick (1986) and Meek and Maguire (1996) discovered reduced performance in abdominal strength and endurance for children with visual impairments.

The findings of this study are difficult to explain, unless the abdominal strength required for postural control in everyday activities is sufficient to meet the minimum criterion for this task. Another possible explanation is that curl-ups are frequently performed in physical education classes and are an activity that children with visual impairments can perform successfully, since they are stationary, do not involve balance, and require little coordination. Although not significantly different, the much lower scores (25% lower) for the boys with visual impairments compared to the sighted boys again illustrate the disproportionately poorer scores of boys versus girls compared with their sighted peers.

SIGNIFICANCE OF POOR PHYSICAL FITNESS

Fewer than 20% of the children with visual impairments passed at least four items on the Fitnessgram, compared to 48–70% of the sighted children. This finding is alarming for at least two reasons. First, it indicates that children with visual impairments are less fit than what some consider to be an already poorly fit popula-

tion of sighted children. Fitnessgram criterion scores are "intended to be attainable by the majority of the student population" who participate in regular physical activities (Looney & Plowman, 1990, p. 215). However, Looney and Plowman discovered only small differences in passing rates among subsamples of active and inactive children; in fact, most inactive students passed most items. They concluded that the Fitnessgram criteria, contrary to the claims of its authors, may not differentiate active versus inactive children. (Looney and Plowman acknowledged, however, that their methods of classifying participants were not precise; hence, the data should be regarded with caution.) Thus, low passing rates for children with visual impairments mean that these children are performing below the levels of sighted children who *do not* engage in regular physical activity—and the effects are more pronounced for boys than for girls. This finding supports the view (espoused by McHugh, 1995, for example) that the activity levels of children with visual impairments fall below the levels of casual, incidental activity that are characteristic of sighted children as they engage in everyday tasks.

Second, children with visual impairments have a greater need to be fit because engaging in everyday tasks demands more energy than for sighted persons (Arnhold & McGrain, 1985; Buell, 1973; Dawson, 1981; Kobberling, Jankowski, et al., 1989; Nakamura, 1997). For example, performing activities of daily living without sight requires additional attention to directional orientation, safety, and location of objects in space (Buell, 1973). Several studies have determined that the energy cost of running and walking for children with visual

impairments is significantly higher than for sighted children because of biomechanical inefficiency when running, such as backward lean, decreased stride length, and "guarded posture" (Arnhold & McGrain, 1985; Dawson, 1981; Kobberling, Jankowski, et al., 1989; Nakamura, 1997). In addition, individuals with visual impairments demonstrate increased metabolic demands for motor tasks, presumably because of increased stress and tension from the lack of visual feedback (Buell, 1973; Hladky et al., 1996; Shephard, 1990; Stamford, 1975; Titlow & Ishee, 1986). These increases in metabolic demand, mechanical inefficiency, and energy expenditure for daily tasks may, in turn, contribute to an inactive lifestyle (Auxter, Pyfer, & Huettig, 1997; Short & Winnick, 1986), adversely affecting health and quality of life. Thus, a vicious cycle is apparent: Reduced levels of activity because of fewer opportunities lead to poor fitness, which leads to a decreased ability to perform daily tasks and even lower levels of fitness.

REASONS FOR REDUCED ACTIVITY LEVELS

To break this cycle of reduced activity, poor fitness, limited functional abilities, and still poorer fitness, professionals must address the reasons for lower activity levels among individuals with visual impairments. Skaggs and Hopper (1996) suggested that the reasons for lower activity include limited expectations, the lack of or inadequate programming, poor professional preparation, concerns about liability, and ignorance of potential.

Limited expectations by parents (Nixon, 1988; Sherrill, 1998), teachers (Sherrill, 1998; Winnick, 1985), and the children

themselves (Longmuir, 1998) affect what opportunities are made available to individuals with visual impairments, as well as the level of performance that is expected. For example, children with visual impairments are applauded merely for participating in some activities, rather than for achieving the high standards of performance set for sighted children of the same age.

The lack of or inadequate programming refers to physical education classes that focus primarily on team and ball sports, like basketball, football, soccer, baseball, and hockey—activities that are the most difficult for children with visual impairments to participate in without modifications. This focus de-emphasizes more accessible sports, such as running, track and field, swimming, aerobics, goal ball, cycling, weight training, beep baseball, bowling, golf, and archery, that are more conducive to active participation without modifications. In addition, in some cases, children with visual impairments do not participate (either fully or at all) in physical education classes or extracurricular sports because of fears about their safety and the higher priorities for academic or other specialized services, like orientation and mobility (O&M), than for physical activities (McHugh, 1995; McHugh & Pyfer, 1999).

Poor professional preparation refers to teacher preparation programs in both physical education and vision programs that do not regard physical activity for children with sensory impairments as an essential subject area. In professional preparation programs in physical education, the time spent on how to include children with visual impairments is minimal; typically, the emphasis is on simulations, not on instructional strategies, activity adaptations, and

opportunities to engage in sports. In vision programs, physical activity is most often coupled with discussions of O&M or transition programs and is not presented as a separate and indispensable subject area.

As was mentioned previously, many physical education teachers, other teachers, and administrators fear that a child with a visual impairment will get hurt during physical education classes or extracurricular activities or that the other children in the class will get hurt participating with the child with a visual impairment. In many cases, this fear overrides the child's need for (and legal right to) physical activity, and the child is left out or excluded (Lieberman & Houston-Wilson, 1999). In a well-planned activity program with trained professional instruction and supervision, risks for children with visual impairments are no greater than for sighted children.

Finally, many teachers, parents, and children do not know what children with visual impairments can do and think that these children are not capable of successfully engaging in physical activities. In some cases, these children's token presence in physical education classes becomes the end goal, as opposed to the development of skills and the achievement of specific learning objectives (Sherrill, 1998; Winnick, 1985).

CHILDREN WITH DEAF-BLINDNESS

Two participants in the study were deaf-blind; that is, they had hearing impairments in addition to their visual impairments. One would expect that children with deaf-blindness would experience the same low level of health-related fitness as children with only visual impairments for many of the same reasons. In addition, deaf-

blindness exposes these children to even greater risks for inactivity and inadequate programming (Lieberman, 1999). For example, poor hearing may hamper communication and interactions with teachers and peers and impede the transmission of instructions, auditory signals, and incidental information. These constraints compound the consequences of the children's visual impairments and thus further limit full participation in physical education and extracurricular physical activities and sports. The educational emphasis for children who are deaf-blind is usually on O&M training, speech and communication, and braille, with little or no focus on physical activity.

Recommendations

Given the preceding barriers for children with visual impairments in achieving a high level of involvement in physical activity, the following target goals are recommended:

Require involvement in early intervention movement programs. The groundwork for optimal motor development begins in infancy (Haywood, 1993; Payne & Isaacs, 1999), and differences in the amount and intensity of physical activity of children who are visually impaired appear early in life (McHugh, 1995; McHugh & Pyfer, 1999). Thus, early motor interventions are critical.

Teach children at an early age what they can do in the area of physical activity and sports. Research has shown that the effects of lower levels of physical activity surface as early as age 8 and may last a lifetime (Sundberg, 1982; Williams et al., 1996; Wyatt & Ng, 1997). Therefore, appropriate activities need to be taught to young chil-

dren who are visually impaired to establish healthy patterns early on. These activities must be of adequate duration and intensity to improve fitness, and they must be activities that children can engage in independently or with minimal assistance or supervision.

Promote activities that increase cardiovascular endurance, upper body strength, and flexibility. The greatest gaps between children who are visually impaired and sighted children appear in these areas. In addition, cardiovascular fitness is closely related to a healthy body composition (measured by the BMI in this study), an area in which there were significant differences between the visually impaired and sighted children.

Educate parents, vision professionals, physical education teachers, and community professionals about the abilities of children with visual impairments. Unless the adults who are closely involved with children with visual impairments have high expectations of the children's abilities, changes will not take place. Professional preparation programs in both physical education and vision must emphasize instructional strategies, activity adaptations, and opportunities to engage in sports. Knowledge of the importance of appropriate physical activities and a commitment to provide them are essential for improving the fitness and quality of life of children who are visually impaired.

Promote athletes with visual impairments as role models for all children. Children with visual impairments need to know that involvement in sports and physical activity can be rewarding and fulfilling. Role models with visual impairments will give

them inspiration to achieve high levels of skill and fitness.

Promote involvement in recreational activities. Teaching children with visual impairments healthy, enjoyable recreational activities to do in their free time will ensure that they have the potential for a high quality of life. Involvement in active recreational pursuits for sighted and blind children will contribute to an increased fitness level that may result in the higher stamina needed to maintain full-time jobs as adults.

Promote involvement in sports for the lifetime. Children with visual impairments have a fundamental right to have the same experiences and exposure to a variety of sports and recreational activities as do sighted children. Involvement in sighted and blind sports and recreational activities will give them an adequate variety of activities to choose from in the future to live healthy, active lives.

Conclusion

As has been found in research, including the current study, children with visual impairments are not maintaining a healthy physical activity level. Research has also shown that this situation can be remedied with appropriate training (Blessing et al., 1993; Gleser et al., 1992; Lee et al., 1985; Marley & Beverly-Mullins, 1997; Ponchillia et al., 1992; Shindo et al., 1987; Singh & Singh, 1993; Williams et al., 1996). These children are born with the same potential as are sighted children for achieving a healthy level of physical fitness. However, they are often held back by the lack of opportunities for physical activities, limited expectations, and the absence of informed and trained adults, all of which result in developmental delays, fears, and

lack of confidence (di Natale, Lee, Ward, & Shephard, 1985; Jankowski & Evans, 1981; Shephard, Ward, & Lee, 1987; Wyatt & Ng, 1997). Including children with visual impairments in physical activities contributes to a high quality of life by empowering them to achieve maximum independence in activities of daily living, including sports and recreational activities (Gleser et al., 1992; Marley & Beverly-Mullins, 1997). The opportunity to be involved in developmental motor skills, fitness, aquatics, sports, and recreation is a fundamental right of all children, including those with sensory impairments, no matter how great the impairment.

References

- Arnhold, R. W., & McGrain, P. (1985). Selected kinematic patterns of visually impaired youth in spring running. *Adapted Physical Activity Quarterly*, 2, 206–213.
- Auxter, D., Pyfer, J., & Huettig, C. (1997). *Principles and methods of adapted physical education and recreation* (8th ed.). Madison, WI: Brown & Benchmark.
- Blessing, D. L., McCrimmon, D., Stovall, J., & Williford, H. N. (1993). The effects of regular exercise programs for visually impaired and sighted schoolchildren. *Journal of Visual Impairment & Blindness*, 87, 50–52.
- Buell, C. E. (1973). *Physical education and recreation for the visually handicapped*. (ERIC Document Reproduction Service No. E.D. 079288)
- Cooper Institute for Aerobics Research. (1994). *The Prudential Fitnessgram*. Dallas: Author.
- Cureton, K. J. (1994). Aerobic capacity. In J. R. Morrow, H. B. Falls, & H. W. Kohl (Eds.), *The Prudential Fitnessgram technical reference manual* (pp. 33–35). Dallas: Cooper Institute of Aerobic Research.
- Dawson, M. L. (1981). A biomechanical analysis of gait patterns of the visually impaired. *American Corrective Therapy Journal*, 35, 66–71.
- di Natale, J. D., Lee, M., Ward, G., & Shephard, R. J. (1985). Loss of physical condition in

- sightless adolescents during a summer vacation. *Adapted Physical Activity Quarterly*, 2, 144–152.
- Gleser, J. M., Margulies, J. Y., Nyska, M., Porat, S., & Mendelberg, H. (1992). Physical and psychosocial benefits of modified judo practice for blind, mentally retarded children: A pilot study. *Perceptual and Motor Skills*, 74, 915–925.
- Haywood, K. (1993). *Life span motor development*. Champaign, IL: Human Kinetics.
- Hladky, A., Blazkova, V., Frantik, E., Hlavkova, J., Kozena, L., & Prochazka, B. (1996). Cardiovascular response indicates a higher stress from the journey to work in blind people. *Homeostasis*, 37, 204–208.
- Hopkins, W. G., Gaeta, H., Thomas, A. C., & Hill, M. (1987). Physical fitness of blind and sighted children. *European Journal of Applied Physiology*, 56, 69–73.
- Jankowski, L. W., & Evans, J. K. (1981). The exercise capacity of blind children. *Journal of Visual Impairment & Blindness*, 75, 248–251.
- Kobberling, G., Jankowski, L. W., & Leger, L. (1989). Energy cost of locomotion in blind adolescents. *Adapted Physical Activity Quarterly*, 6, 58–67.
- Kobberling, G., Jankowski, L. W., & Leger, L. (1991). The relationship between aerobic capacity and physical activity in blind and sighted adolescents. *Journal of Visual Impairment & Blindness*, 85, 382–384.
- Kobberling, G., Leger, L., & Jankowski, L. W. (1989). Physical capacity in visually impaired persons. *Science et Motricite*, 7, 38–41.
- Lee, M., Ward, G., & Shephard, R. J. (1985). Maximizing the working capacity of sightless adolescents. *Developmental Medicine and Child Neurology*, 27, 767–774.
- Lieberman, L. J. (1999). Physical fitness and adapted physical education for children who are deafblind. *Deafblind training manual*. Logan, UT: SKY-HIGH Institute Press.
- Lieberman, L. J., & Houston-Wilson, C. (1999). Overcoming barriers to including students with visual impairments and deafblindness into physical education. *Re: View*, 31, 129–138.
- Longmuir, P. (1998). Considerations for fitness appraisal, programming, and counselling of individuals with sensory impairments. *Canadian Journal of Applied Physiology*, 23, 166–184.
- Looney, M. A., & Plowman, S. A. (1990). Passing rates of American children and youth on the Fitnessgram criterion-referenced physical fitness standards. *Research Quarterly for Exercise & Sport*, 61, 215–223.
- Marley, W. P., & Beverly-Mullins, J. M. (1997). The value of physical fitness for a young man who is visually impaired with multiple medical disorders. *Journal of Visual Impairment & Blindness*, 91, 341–346.
- McHugh, B. E. (1995). The development of stereotypic rocking behavior among individuals who are blind: A qualitative study. *Dissertation Abstracts International*, 57 (01A), 0151. (University Microfilm No. 9615490).
- McHugh, B. E., & Pyfer, J. (1999). The development of rocking among children who are blind. *Journal of Visual Impairment & Blindness*, 93, 82–95.
- Meek, G. A., & Maguire, J. E. (1996). A field experiment of minimum physical fitness of children with visual impairments. *Journal of Visual Impairment & Blindness*, 90, 77–80.
- Nakamura, T. (1997). Quantitative analysis of gait in the visually impaired. *Disability and Rehabilitation*, 19, 194–197.
- Nicklas, T. A., Webber, L. S., Johnson, C. C., Srinivasan, S. R., & Berenson, G. S. (1995). Foundations for health promotion with youth: A review of observations from the Bogalusa Heart Study. *Journal of Health Education*, 26 (Suppl. 2), S18–S26.
- Nixon, H. L. (1988). Reassessing support groups for parents of visually impaired children. *Journal of Visual Impairment & Blindness*, 82, 271–278.
- Payne, V. G., & Isaacs, L. D. (1999). *Human motor development: A lifespan approach*. Mountain View, CA: Mayfield.
- Ponchillia, S. V., Powell, L. L., Felski, K. A., & Nicklawski, M. T. (1992). The effectiveness of aerobic exercise instruction for totally blind women. *Journal of Visual Impairment & Blindness*, 86, 174–177.
- Sallis, J. F., & Patrick, K. (1994). Physical activity guidelines for adolescents: Consensus statement. *Pediatric Exercise Science*, 6, 302–314.
- Shephard, R. J. (1990). *Fitness in special populations*. Champaign, IL: Human Kinetics.
- Shephard, R., Ward, R., & Lee, M. (1987). Physical ability of deaf and blind children. In

- M. E. Berridge & G. R. Ward (Eds.), *International perspectives on adapted physical activity* (pp. 155–362). Champaign, IL: Human Kinetics.
- Sherrill, C. (1998). *Adapted physical activity, recreation and sport: Crossdisciplinary and lifespan* (5th ed.). Boston: McGraw-Hill.
- Shindo, M., Kumagai, S., & Tanaka, H. (1987). Physical work capacity and effect of endurance training in visually handicapped boys and young male adults. *European Journal of Applied Physiology*, 56, 501–507.
- Short, F. X., & Winnick, J. P. (1986). The influence of visual impairment on physical fitness test performance. *Journal of Visual Impairment & Blindness*, 80, 729–731.
- Singh, R., & Singh, H. (1993). Anthropometric and physiological profiles of active blind Malaysian males. *Journal of Sports Medicine and Physical Fitness*, 33, 378–382.
- Skaggs, S., & Hopper, C. (1996). Individuals with visual impairments: A review of psychomotor behavior. *Adapted Physical Activity Quarterly*, 13, 16–26.
- Stamford, B. A. (1975). Cardiovascular endurance training for blind persons. *New Outlook for the Blind*, 69, 308–311.
- Sundberg, S. (1982). Maximal oxygen uptake in relation to age in blind and normal boys and girls. *Acta Paediatrica Scandinavia*, 71, 603–608.
- Titlow, L. W., & Ishee, J. H. (1986). Cardiorespiratory testing of persons who are visually impaired. *Journal of Visual Impairment & Blindness*, 80, 726–728.
- U.S. Department of Health and Human Services. (1996). *Physical activity and health: A report of the surgeon general*. Atlanta, GA: National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention.
- Williams, C. A., Armstrong, N., Eves, N., & Faulkner, A. (1996). Peak aerobic fitness of visually impaired and sighted adolescent girls. *Journal of Visual Impairment & Blindness*, 90, 495–500.
- Winnick, J. P. (1985). Performance of visually impaired youngsters in physical education activities: Implications for mainstreaming. *Adapted Physical Activity Quarterly*, 3, 58–66.
- Winnick, J. P., & Short, F. X. (1985). *Physical fitness testing for the disabled: Project UNIQUE*. Champaign, IL: Human Kinetics.
- Wyatt, L., & Ng, G. Y. (1997). The effect of visual impairment on the strength of children's hip and knee extensors. *Journal of Visual Impairment & Blindness*, 91, 40–46.

Lauren J. Lieberman, Ph.D., associate professor, Department of Physical Education, State University of New York at Brockport, 350 New Campus Drive, Brockport, NY 14420-2989; e-mail: <llieberman@brockport.edu>. **Elaine McHugh, Ph.D.**, associate professor, Sonoma State University Department of Kinesiology, 1801 East Cotati Avenue, Rohnert Park, CA 94928. Address all correspondence to Dr. Lieberman.