Why have new standards been developed?

- Fitnessgram is unique (and widely accepted) because the fitness assessments are evaluated using criterion-referenced standards. An advantage of criterion referenced standards (over percentile norms) is that they are based on how fit children and youth need to be for good health. The previous criterion-referenced standards were based on the best available research at the time they were developed. They have been well supported in the scientific literature but some inconsistencies became apparent in several large district and state reports. Discrepancies were most commonly noted in the body composition and assessments.

- With body composition, there was evidence of some inconsistencies in the standards across age, especially when compared with the BMI standards used by the CDC and many pediatricians. Second, in some age groups there was poor classification agreement between the %body fat and BMI values. That is, students could be classified as being in the HFZ by one of the tests, but as "needing improvement" in the other test.

- With aerobic capacity, reports from physical education teachers revealed some classification disagreement between the PACER and one-mile run tests meaning that the same student could be classified in the HFZ with one test, but not the other. Second, studies also noted an excessively high passing rate for young girls (e.g., 10-year old girls) when assessed with the PACER test. These discrepancies were hard to explain so the Fitnessgram Scientific Advisory Board determined that it was important to re-evaluate the standards.

- The availability of nationally representative data on fitness and clinical risk in the National Health and Nutrition Examination Survey (NHANES) provides the best available dataset to evaluate associations between fitness and health risk in youth. A unique advantage of the NHANES dataset is that the data is based on a representative sample of children and youth from across the country. The new analyses using this sample demonstrate that both fitness and fatness have stronger influences on health than previously suggested. The new standards reflect levels of fitness and fatness that provide protection against health risks associated with excess body fatness or inadequate fitness. The new standards have also resolved the previously mentioned problems with the previous standards.

What health criterion was used to represent "good" health?

- Both body composition and aerobic capacity have important influences on health. Both body composition and aerobic capacity have been related to a variety of risk factors (e.g. blood pressure, cholesterol, etc.), but they are also related to each other. People that are physically active will generally have higher levels of aerobic fitness and lower levels of fatness. However, it is possible for youth to be overweight and still be aerobically fit and for youth to be of normal weight and be aerobically unfit.

- Aerobic capacity does not directly impact body composition, but body composition is a critical factor in the exercise performances used to estimate aerobic capacity. Individuals who carry more body fat will often perform more poorly than if they had less body fat. Therefore, the two dimensions are related, but still independent. Individuals with low aerobic capacity should be encouraged to be more active to improve their aerobic capacity (and possibly their body composition). Individuals with unhealthy body composition are also encouraged to be more active, but a healthy low calorie diet is also important for changing body composition.

- Common health indicator. Because body composition and aerobic capacity are clearly linked it was important to use a common health indicator and preferably one that reflected an

overall indicator of health. The presence of metabolic syndrome was selected as the primary outcome variable for determining appropriate body composition and standards. Metabolic syndrome is considered as a group of risk factors that collectively promote the development of cardiovascular disease and increases the risk of diabetes. These risk factors include:

- high fasting glucose,
- high waist circumference,
- high triglycerides,
- low high density lipoprotein cholesterol and
- high blood pressure

- Metabolic syndrome is clinically recognized and the prevalence of the condition is high enough in NHANES to serve as a good indicator. Studies have demonstrated that risk factors associated with metabolic syndrome track throughout the lifespan. Therefore, it is a good indicator of both current and future health risk.

What does it mean to achieve or not achieve a criterion reference standard?

- The Fitnessgram standards have historically been characterized as the "*Healthy Fitness Zone*" (HFZ). Students that achieved the HFZ received feedback that their level of fitness was sufficient for good health. Students that did not achieve the HFZ were classified into the Needs Improvement (NI) Zone. A limitation of this approach is that it categorizes youth into only two distinct zones. Children just below the standard are not that different than students just above the standard.

- The new standards were established to allow three different zones. The use of three zones make it possible to provide more effective prescriptive messages to youth since the zones were based on clear differences in potential health risks. The same basic terminology was used for the new standards but the present standards include two different NI zones (*NI-high risk and NI-some risk*). Children in the *NI-high risk* zone would receive messages warning them of potential risk if they continue tracking at that level. Children in the *NI-some risk zone* would receive a message that they could reduce their risk by striving to move into the HFZ. The use of three zones allows clear indicators of risk (NI-High Risk) and clear indicators of good fitness and low risk (HFZ). Students between these two zones are considered as at "potential" risk because the values are in-between the two clearly distinct zones.

Specific information about the Fitnessgram Body Composition Healthy Fitness Zone Standards

What is body composition and how is it linked to health?

- Technically, body composition is the division of total body weight (mass) into different components, most commonly fat mass and fat free mass. Percent body fat indicates the proportion of total body weight that is fat. Body mass index does not indicate the composition of the body weight. It is an index that provides an estimate of the appropriateness of the weight for the height.

- High levels of body fatness are associated with increased risk of coronary heart disease, stroke, diabetes, high blood pressure, high cholesterol, some cancers, and joint problems. Obesity and heart disease risk factors are known to track through the life span.

What are the changes to the body composition standards?

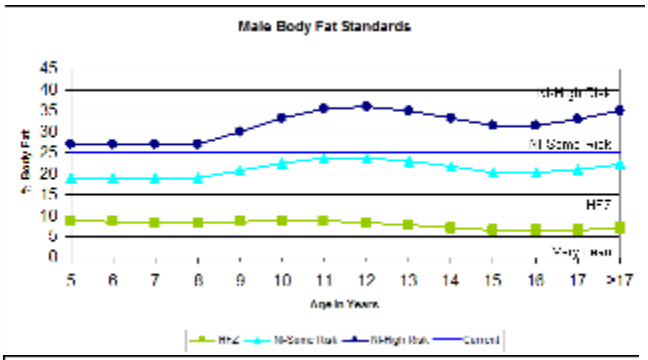
- The body composition standards were changed by determining what % body fat values distinguishes youth who did and did not have metabolic s2yndrome. The new standards reflect the %BF values that define a potential risk for metabolic syndrome and take into account the normal changes in growth and maturation.

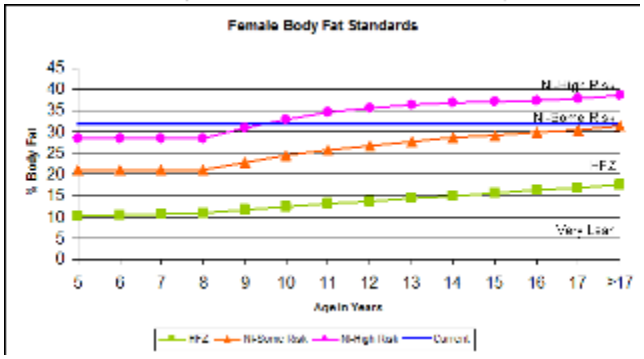
- The %BF standards were then equated with corresponding BMI values to ensure good agreement.

How different are the new body composition Healthy Fitness Zone (HFZ) standards from the previous standards?

- For percent body fat. The previous HFZ for Percent Body Fat (%BF) were set at a consistent cut-off of 25% for boys and a consistent cut-off of 32% for girls. The new standards now vary by both gender and age. These standards reflect the natural developmental trends for boys to gain muscle and girls to gain fat through adolescence as well as health risk. See the charts below.

	Boys	**Girls**
Previous %BF standards	25%	32%
New % BF standards	Varies by age 18.9% - 22.3%	Varies by age 20.9% - 31.4%





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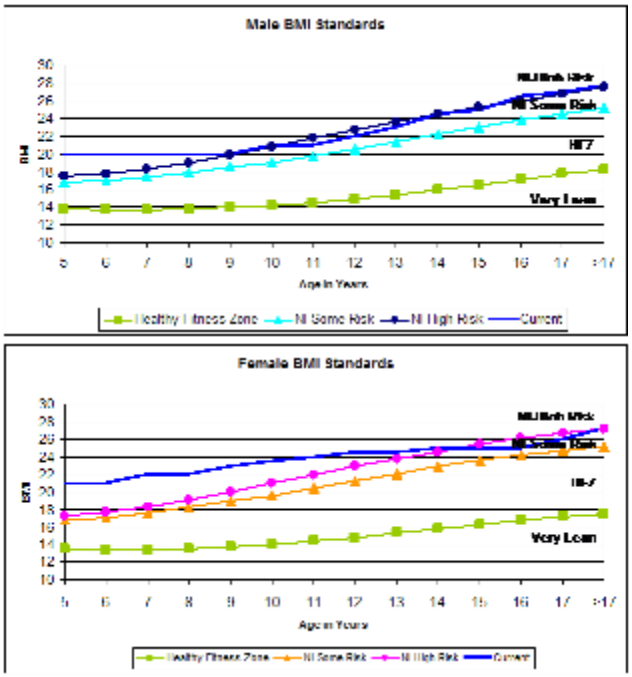
- For body mass index. The Healthy Fitness Zone standards for body mass index (BMI) have always varied by both age and gender. The new cut-point between the HFZ and Needs Improvement - Some Risk varies by age and gender being more similar at young ages and more different at older ages. These cut-offs take into account normal changes during growth and maturation as well as health risk.

- The following table indicates the cut-points between Healthy Fitness Zone and Needs Improvement-Some Risk for Body Mass Index. See the charts below.

	Boys	Girls
Previous BMI standards	20 to 20.7*	21 to 27.3
New BMI standards	16.8 to 25.2	16.8 to 25.2

*Unit of measure for BMI is kg-m^2



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- The new standards maximize the probability that students will be classified in the same zone (HFZ or NI) by either the %BF or BMI assessment.

Specific Information about aerobic capacity standards

What is aerobic capacity and how is it linked to health?

- Aerobic capacity (VO_2max) indicates the maximum rate that the respiratory, cardiovascular, and muscular systems can take in, transport, and use oxygen during exercise. This reflects the body?s ability to provide energy in the muscles using oxygen. It is generally expressed relative to body weight (mL.kg.min^{-1}) to account for differences in body size among individuals and to reflect each individual?s ability to carry out weight-bearing tasks.

- Good aerobic capacity (cardiorespiratory fitness) has been shown to reduce the risk of high blood pressure, coronary heart disease, obesity, diabetes, the metabolic syndrome, and some forms of cancer. Obesity and heart disease risk factors are known to track through the life span.

How were the Aerobic Capacity Standards Changed?

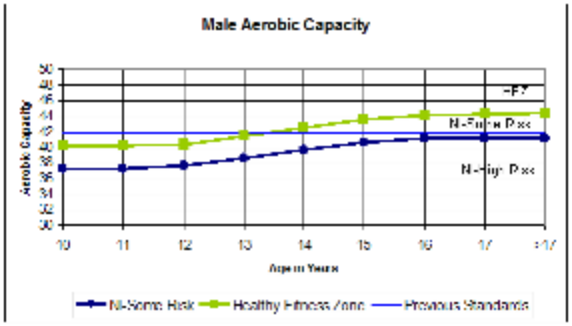
- The aerobic capacity standards were changed by determining what VO_2max values best distinguishes youth who did and did not have metabolic syndrome. Metabolic syndrome is considered as a group of risk factors that collectively promote the development of cardiovascular disease and increases the risk of diabetes. These risk factors include:
    - high fasting glucose,
    - high waist circumference,
    - high triglycerides,
    - low high density lipoprotein cholesterol and
    - high blood pressure.
- The new standards reflect the VO_2max values that define a potential risk for metabolic syndrome and take into account the normal changes in growth and maturation.

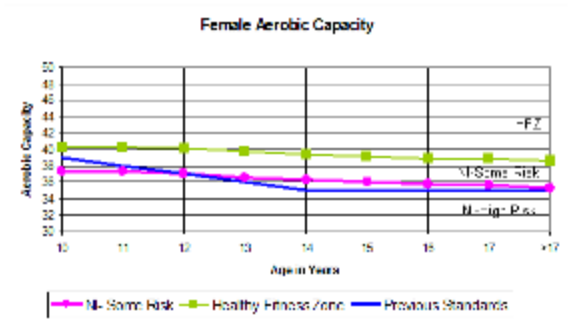
How different are the new aerobic capacity Healthy Fitness Zone standards from the previous standards?

- The previous aerobic capacity VO_2max standards defining the HFZ were consistent for boys from ages 10 to >17 yr, but declined for girls from 10 to >17 yr. Now the cut-off for achieving the HFZ for boys and girls is similar for younger children. As age increases the cut-off gradually increases for boys and decreases for girls. The differences do not imply higher expectations for boys than girls. These changes take into account the natural development of boys (who gain muscle) and girls (who gain fat) and reflect the same relative level of fitness for both boys and girls as they age and mature.
- The following table indicates the cut-points between Healthy Fitness Zone and Needs Improvement - Some Risk for aerobic capacity VO_2max.

	Boys	**Girls**
Previous AC VO_2max standards	42*	40 - 35
New AC $V0_2$max standards	40.2 to 44.3	40.2 to 38.6

*Unit of measure for Aerobic Capacity is $mL.kg.min^{-1}$





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- An important distinction with the new standards is that they are now based on the exclusive use of VO_2max mL.kg.min-^{1} as the reporting variable on the Fitnessgram student and parent reports. Students can be assessed with any test (e.g., PACER, mile run or mile walk), but the outcome will be based on the same estimate of aerobic capacity. That is, if a student achieves the HFZ on one test he or she will also achieve the HFZ with an equivalent VO_2max score on either of the other two tests. Remember, that height and weight must be entered for each student along with their test item score to receive an aerobic capacity VO_2max score on the reports.

Implications of changes in the Fitnessgram standards

How will these changes impact the test items?

- The actual test items for body composition and aerobic capacity remain the same:
  - Body composition. Skinfold measurements or Bioelectrical Impedance Analysis (for %Body Fat) and/or Height and Weight (for the calculation of BMI)
  - Aerobic capacity. PACER, one-mile run, walk test

How will these changes impact test administration?

- The body composition test items (skinfolds/bioelectrical impedance analysis or height and weight) are conducted exactly as before.

- The aerobic capacity items may/may not be conducted exactly the same way.
  - IF you always instruct your students to take the PACER test and run as long as possible or tell them to complete either the one-mile run or walk as quickly as possible, there will be no change. Please continue to encourage your students in this manner.
  - IF you always tell your students the number of laps they need to run (by age) to attain the HFZ for the PACER or the time they need to complete the one-mile run test, this is no longer possible.
    - Remember that height and weight need to be entered along with the test item score to receive as aerobic capacity VO_2max score.
  - The one-mile walk test is administered exactly the same as before.

Why can students no longer pre-determine how many laps they will need to complete for the PACER or times for the one mile run or one mile walk tests?

- All aerobic capacity evaluation and report output will be based on VO_2max (maximal oxygen uptake). This is a calculated value that requires both the performance element (number of laps or time) and the BMI (entry of height and weight into the software).

- First, to calculate aerobic capacity, the Fitnessgram software (either FG 8 or FG 9) will automatically convert the PACER lap value to a one-mile run time (using a test equating method). Second, another equation (Cureton, et al.) is then used to calculate the VO_2max .

- Thus, neither laps nor time can just be looked up on the HFZ chart ahead of test administration as the performance element can be different for students of the same age and gender based on their BMI.

- Using the previous PACER lap standards or trying to estimate PACER laps from the former one-mile run standards will most likely result in incorrect instructions to students and be a source of disappointment for both students and teachers.

- **NEW.** To assist administrators and teachers in the testing process a series of lookup tables have been created for body mass index and aerobic capacity. Be aware that it is not possible to include every height, weight, BMI and score possibility included on these tables. Thus, the lookup tables have estimated values for BMI and VO2max. However, administrators, teachers, and students can get an idea of the performance level necessary to achieve the HFZ for aerobic capacity. The lookup tables are posted here: http://www.cooperinstitute.org/ourkidshealth/fitnessgram/hfz-tables.cfm

How will these changes impact reports from the FG 8 or FG 9 software?

- The new standards has not only been updated in the software (FG 8 and FG 9), but also for all related Fitnessgram materials (e.g., wall chart, clipboard, and manual. The four levels of reports (student, parent, institutional and student tracking) all continue to be available in the software.

- The HFZ have been modified to reflect the new standards not only in the software (FG 8 and FG 9), but for all related Fitnessgram materials (e.g., wall chart, clipboard, and manual.

- Two major zones remain: *Healthy Fitness Zone* and *Needs Improvement.* The *Needs Improvement* zone, however, has been subdivided into *NI-Some Risk* and *NI-High Risk.*

- If height and weight are not entered into the software along with the score for the aerobic capacity test item, no VO_2max can be calculated and thus, no evaluation can be made relative to the HFZ or NI zones nor can it be displayed on the student or parent reports. Neither will an aerobic capacity message be printed on these reports. Instead, both the student and parent reports will display only the number of laps completed, the time for the one mile run, or the time for the one mile walk test. A VO_2max score will not be calculated and nothing will be graphed in the aerobic capacity section of the reports.

What is the difference between "some risk" and "high risk" in the Need Improvement area of the student and parent reports?

- "Some" risk indicates that if the student continues to track at this level there is the potential for future health risks. However, this potential is possible, not probable. Increased activity as well as eating a healthy controlled diet could delay or reverse this potential.

- "High" risk indicates that if the student continues to track at this level there is the potential for future health problems and that this risk is probable. The need for increased activity and eating a healthy controlled diet is more urgent for students in this category than those at "some" risk.

Is it possible that some students who would be in the HFZ on the basis of performance alone (PACER laps, one mile run, or one mile walk times) might not be when VO_2max is reported and vice versa? Why/why not?

- Yes, primarily because of the influence of body composition on performance and the expression of VO_2max in the unit $mL.kg.min^{-1}$ (milliliters per kilogram of body weight per min).

- Body mass is a critical factor in an individual's ability to perform aerobically and the addition of BMI to the performance result in the calculation of VO_2max will result in more accurate classifications.

Why have the upper limits been removed from the HFZ for the performance test items?

- The upper limits to the HFZ were established at the time when the Surgeon General?s public health message called for moderate levels of activity and fitness. The new United States Physical Activity Guidelines, however, clearly emphasize and encourage higher levels of fitness for greater health benefit. Therefore, in order not to discourage higher performances the upper limits have been removed for all Fitnessgram test items with the exception of the trunk lift and back-saver sit and reach tests.

- Care must be taken that this does not encourage an atmosphere of competition when the tests are administered.

How can new test results be compared to old tests results if the standards have changed?

- For the body composition test items, the actual raw scores can still be used for comparison between and among past and present test date results. Placement in or out of the HFZ may be different than it was previously because of the new standards.

- For the aerobic capacity test items, all performances should be available in the VO_2max unit and will be directly comparable. As with body composition placement, in or out of the HFZ may be different than it was previously. It is likely that fewer young girls will achieve the new HFZ standard. More young boys and fewer older boys will achieve the new HFZ standard.