

PURPOSE: The aim of this study was to examine the amount of self reported physical activity with relation to age, body composition, planned physical activity, and leisure time activities.

METHODS: Fifty-two male and 52 female volunteers ranging from 18-62 years (29.16±1.41) enrolled in this study. A self-administered physical activity questionnaire was given to all participants. The questionnaire was used to estimate participation in cardiovascular exercise, strength training, flexibility, stretching, and leisure time activity. Physical activity intensity levels were classified as mild, moderate or vigorous and each activity was assigned metabolic equivalents (MET). Energy expenditure (kcal/week) was then determined. Activity dimension (ACT) was calculated based on self-report leisure time activities. Anthropometric data was collected for the following variables: height, weight, and percentage body fat as assessed by 7-site skin fold (SKF). This study was approved by the Institutional Review Board at Linfield College.

RESULTS: Greater involvement in cardiovascular activity was associated with lower percent body fats ($r = -0.403, p < 0.05$). Age was negatively correlated with exercise intensity ($r = -0.447, p < 0.05$) and positively correlated with percentage body fat ($r = 0.405, p < 0.05$). Individuals with higher ACT scores reported higher energy expenditures in planned physical activity than those with lower ACT scores (3634.78 ± 581.92 vs. 2193.00 ± 341.38 kcal/week, $p < 0.05$). Of the participants, 29.8% ($n=31$) did not meet the Surgeon General's recommendations for cardiovascular exercise. Of these, 41.9% perceived themselves as more active than their peers and 35.5% thought they were as active.

CONCLUSION: These data suggest that increased involvement in planned physical activity may influence increased caloric expenditure during leisure time activity. More research is suggested to examine individual perceptions of involvement in physical activity in a sedentary population.

2883 Board #158 10:00 AM - 11:00 AM

Validation of a Modified Version of the Godin-Shephard Leisure-Time Exercise Questionnaire

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BACKGROUND: The Godin-Shephard Leisure-Time Exercise Questionnaire (LTEQ) is widely used to measure physical activity in adults. The LTEQ assesses the number of 15 minute bouts of strenuous, moderate, and mild physical activity over a week. A modified version of the LTEQ was developed to measure the number of minutes of strenuous, moderate, and mild physical activity for a week.

PURPOSE: The purpose of this study was to validate a modified version of the Godin-Shephard Leisure-Time Exercise Questionnaire as a measure of daily minutes of moderate-to-vigorous activity.

METHODS: One hundred and twenty men ($n=27$) and women ($n=93$) between the ages of 40-60 years wore an Actigraph accelerometer for seven days and completed a modified version of the LTEQ each day during the same time period. Cut-points developed by Freedson et al. (1998) were used to determine minutes of moderate-to-vigorous activity for the Actigraph. The modified LTEQ asked the participants to recall the amount of time spent in strenuous, moderate, and mild physical activity for each day over seven days. Time spent in moderate and strenuous physical activity was summed to calculate minutes of moderate-to-vigorous activity from the modified LTEQ. Validity of the modified LTEQ was assessed by comparing the self-reported moderate-to-vigorous activity minutes to minutes spent in moderate-to-vigorous activity from the Actigraph.

RESULTS: Reliability (95% CI) for seven days of assessment for moderate-to-vigorous physical activity from the modified LTEQ was 0.76 (0.69 to 0.83). Minutes spent in moderate-to-vigorous activity between the LTEQ and the Actigraph were not related ($r = -0.03$). Average minutes of moderate-to-vigorous physical activity were 42.4 for the LTEQ and 31.9 for the Actigraph. There was a similar frequency of under- and over-reporting of physical activity levels (under-report, > -11 minutes = 41.4%, over-report, > 11 minutes = 36.6%, and within +/- 10 minutes = 22.0%) on the modified LTEQ.

CONCLUSIONS: The modification of the LTEQ as a novel method for measuring daily moderate-to-vigorous activity was not related to an objective measure of physical activity. The amount of error present was random and resulted in both under- and over-reporting of moderate-to-vigorous activity levels. Modification of the LTEQ to measure daily time in moderate-to-vigorous activity appears to result in invalid estimates of moderate-to-vigorous activity in a middle-aged population.

2884 Board #159 8:00 AM - 9:00 AM

Prediction of Energy Expenditure by Combined Movement and Heart Rate Sensing During Varying Activities in Children

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Physical activity is difficult to assess accurately, especially in children. Various equations have been derived to estimate physical activity energy expenditure (PAEE) from body movement measured by accelerometry or heart rate (HR) data. However, few studies have utilised combined HR and movement sensing (HR+M).

PURPOSE: The primary purpose of this study was to compare the accuracy of uniaxial accelerometry and HR+M to predict PAEE during six common activities in children. As a secondary aim we assess the validity of three sets of treadmill-derived equations (Corder et al, MSSE 2005) to predict PAEE in this sample.

METHODS: PAEE was measured by indirect calorimetry during six activities (lying, sitting, slow walking, walking, jogging and hopscotch) in 181 children (12.4 ± 0.2y). Associations between measured and predicted PAEE (accelerometry output and HR+M) were assessed by linear regression analysis. The validity of these equations was cross-validated in a sub sample of participants. The validity of previously derived PAEE equations from treadmill walking and running was assessed.

RESULTS: Data from the Actigraph and the HR+M were significantly associated with measured PAEE values ($R^2 = 0.91$ and $0.90, P < 0.01$). In cross-validation analyses, significant correlations were observed between the estimation errors of both predictions (Actigraph $r = 0.46, P < 0.01$; Actiheart $r = 0.27, P < 0.01$), both manifesting as under estimations at high-energy expenditures, increasing with PAEE. Systematic errors (i.e. significant correlations between estimation errors) were observed for all treadmill-derived equations. Uniaxial accelerometry over estimated PAEE significantly ($r = -0.74, P < 0.01$). The branched equation model over estimated PAEE at low intensities ($r = 0.23, P < 0.01$), whereas the HR+M prediction equation showed less systematic error ($r = -0.09, P < 0.01$).

CONCLUSIONS: Both accelerometry and HR+M are valid to predict PAEE during selected physical activities in children. However, both models seem to underestimate PAEE at high intensity physical activity. Accelerometry derived PAEE during a progressive treadmill test was not suitable for predicting PAEE during the six activities. Both the HR+M model and the branched equation model derived from combined HR and movement sensing during treadmill locomotion showed less systematic error and were valid for PAEE prediction. Our results suggest that it may be possible to derive accurate PAEE prediction models using HR+M data that would not be possible using movement data alone due to the mechanical limitations of accelerometers.

2885 Board #160 9:00 AM - 10:00 AM

How Many Days to Monitor Levels of Physical Activity in Children? A Generalizability Approach

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There has been some debate about the number of days to monitor physical activity (PA). This discussion is relevant to have reliable estimates (means and variances) of PA of children and adolescents. Still, the approach taken so far, has not dealt with different levels of daily physical activity in children.

PURPOSE: the aim of this study is to evaluate the minimum number of days to have reliable data on different levels of PA of children aged 6 to 10 years of both gender.

METHODS: PA of 237 subjects aged 6 to 10 years of both gender were continuously monitored during 7 days using the CSA accelerometer. Based on information from counts per day, Freedson formula was used to divide PA in 3 levels: moderate (M), vigorous (V), and very vigorous (VV). SPSS was used for all statistical analysis to estimate reliability (intraclass correlation coefficient, R), and to decide on the number of days (generalizability coefficients (G) were based on variance components).

RESULTS: Main results from R according to gender indicated that for moderate and vigorous PA 6 to 7 provide good results (females: $0.786 \leq R \leq 0.810$; males: $0.776 \leq R \leq 0.794$). For very vigorous PA 7 days may not be sufficient to have an excellent reliability estimate (females: $0.572 \leq R \leq 0.717$; males: $0.683 \leq R \leq 0.759$). When using generalizability estimates (G coefficients), 5 to 6 days may seem adequate for moderate and vigorous PA (results for both gender: $G5M = 0.789$; $G6M = 0.780$; $G7M = 0.800$; $G5V = 0.797$; $G6V = 0.808$; $G7V = 0.767$). For very vigorous PA, 7 days may be required ($G5VV = 0.696$; $G6VV = 0.730$; $G7VV = 0.821$). **CONCLUSIONS:** PA reliability estimates and generalizability coefficients provide a suitable framework to solve a part of the problem on the minimum number of days of monitoring. It seems that for moderate and vigorous PA 5 to 6 days may be sufficient. When dealing with very vigorous PA 7 days may be just enough. Still, it is not clear the impact of different days of monitoring on sample means and variances, and the amount of violation of the

compound symmetry in estimating intraclass correlation coefficients. Increasing the days of monitoring beyond 7 days may pose a lot of problems (costs, attrition of the sample, equipment available, and control of the whole study).

2886 Board #161 10:00 AM - 11:00 AM

Pedometer and Accelerometer Accuracy in Physical Activity Assessment of Preschool Children

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Pedometer accuracy in measuring physical activity in preschool children has not been adequately assessed.

PURPOSE: To determine the reliability and validity of pedometers for measuring physical activity in preschool children, and compare results using measures of association and Bland-Altman regression analyses.

METHODS: Children ($n = 13$) aged 3.0 - 4.7 years were observed on two occasions: 1) during straight line ambulation at three paces (slow walking, walking, running) while wearing pedometers at the left hip, right hip, and back (lumbar spine, waist level); and 2) during a free-play session while wearing a pedometer and accelerometer. Data analysis was conducted using measures of association (Wilcoxon's signed-ranks test and Spearman's correlation coefficient) and also Bland-Altman regression analyses and 95% limits of agreement. Percentage differences were also calculated between observed steps and pedometer steps during straight line slow walking, walking, and running.

RESULTS: Step counts from pedometers worn at the back were significantly higher than observed steps during straight line walking ($Z = -1.962$, $p=0.05$). No other significant differences were found between observed steps and pedometer steps, or between pedometer placement sites. Significant moderate correlations were observed between direct observation and both pedometry ($r = 0.59$, $p=0.04$) and accelerometry ($r = 0.71$, $p<0.01$), and also between pedometry and accelerometry ($r = 0.93$, $p<0.01$). Using the Bland-Altman method, data from all straight line ambulation conditions were combined, and the resulting 95% limits width size for the pedometer placed on the back were around 7% wider than the left and right hip measurement sites. Using direct observation as a criterion, the prediction interval for pedometry was approximately 30% wider than for accelerometry. The range of percentage differences between observed and pedometer steps in slow walking, walking, and running were wide (-31% to 25%, -13% to 17%, and -10% to 40%, respectively).

CONCLUSIONS: Pedometer placement at the back of preschoolers was less accurate than hip placement. Pedometry showed more variability than accelerometry in quantifying physical activity in this population. Data analysis using simple measures of association are common in physical activity measurement research but may not be appropriate for the assessment of physical activity measurement tools because the magnitude of agreement and potential systematic bias are unaccounted for.

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2887 Board #162 8:00 AM - 9:00 AM

Evaluating Compliance of Grade School-Aged Children To Wear Accelerometers

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MTI Actigraph Accelerometers are a valid, objective measure of children's physical activity levels. However, little is known about how compliant children are when asked to wear an accelerometer over an extended period of time.

PURPOSE: The purpose of this study is to examine variability in compliance and factors influencing compliance.

METHODS: 210 children (age 8.7 ± 1.4 yrs, BMI 24.2 ± 5.5 kg/m²) wore an MTI accelerometer for 4 consecutive days on 2 separate occasions. Children were instructed to wear the monitor at all times except while sleeping or during activities involving water (i.e. shower, bath or swimming). A full day of wearing was defined as the period from 7:30am to 8:00pm. Compliance in wearing the monitor was checked by looking for continuous blocks of zeroes in the data. Participants with more than 3 blocks of 20 consecutive minutes of zeroes were considered to be non-compliant with the protocol since it is unlikely that this could occur without having removed the monitor.

RESULTS: The results indicated that 49% of the participants were compliant on all 4 days, 76% of participants were compliant 3 of 4 days and 91% of participants were compliant 2 of 4 days. Approximately 4% of participants were non-compliant on all 4 days. There was no difference in age, gender or BMI between compliant and non-compliant participants. The average number of 20 minute blocks of zeroes on non-compliant days was 15.7 ± 9.4 while the average number of 20 minute blocks of zeroes was 0.7 ± 0.8 on compliant days.

CONCLUSION: These results indicate that compliant days can be determined by this simple screening criteria. It appears that children either wear the monitor or they do

not as the monitor was off an average of 40% of the day on non-compliant days. Screening accelerometer data to remove non-compliant participants results in fewer days of usable data but the quality of the data would reduce measurement error to offset this loss. The use of 2 days provides a reasonable compromise as 91% had acceptable data using these criteria.

2888 Board #163 9:00 AM - 10:00 AM

Accelerometer Cut-Points and Youth Physical Activity Prevalence

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Daily physical activity (PA) plays a key role in strategies targeting youth health and behavioural changes. General guidelines are widely used to describe the amount of physical activity related to health benefits. Since policies and programs strategies are based on prevalence estimates for meeting these guidelines, it is essential that prevalence estimates are accurate. However, different conclusions had been reached depending upon the criterion selected to distinguish activity from inactivity.

PURPOSE: The purpose of this study was twofold. First was to examine the effects of specific cut-off scoring points (on the estimated prevalence of meeting health-related guidelines for physical activity in youth and second was to document the differences in gender physical activity patterns according to two different cut-off points.

METHODS: The sample comprised 62 children (boys $n=23$; girls $n=39$) aged 8-16 years-old. PA was assessed by MTI actigraph. Children wore accelerometers for three consecutive weekdays. Based on activities intensity (MET) the daily time spent in moderate-to-vigorous physical activity (MVPA) was calculated using an equation regression developed for youth according to Freedson et al. (1998) and Puyau et al. (2002).

RESULTS: The data analysis from Freedson's cut points showed that both sexes engaged in significantly ($p<0.01$) more MVPA when compared with Puyau's cut points. Boys engaged in significantly ($p<0.01$) more MVPA activities than girls regardless the cut-off point used. Our data also showed that except for boys, ages 14-16 years old, and the percentage of students that reach the physical activity-health related criteria (at least 60 min of MVPA/day) was significantly higher in both boys (77.3% vs 6.9%; $p<0.001$) and girls (60% vs. 2.3%; $p<0.001$) when the Freedson's cut-off point was used.

CONCLUSIONS: Our data showed that for preventive strategies a youth specific cut-off points still needs to be refined, and as a result health-related criteria for young people need to be based on further research evidence.

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Effect of Accelerometer Cut-Points on Apparent Levels of Physical Activity and Inactivity in Young Children

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Previous published studies have developed different accelerometer cut-points to categorise varying intensities of activity in adults and children based on free-living and laboratory-based activities. There is a need to investigate whether these different cut-points affect estimations of the physical activity and inactivity levels in young children.

PURPOSE: To assess the effect of using different popular accelerometer cut-points to quantify sedentary behavior and moderate-vigorous physical activity (MVPA) in young children.

METHODS: Habitual free-living physical activity data were collected, in 15-second epochs, over 7 days using the MTI Actigraph in $n = 85$ (42 male and 43 female), mean (SD) age 5.8 years (0.5) children from Glasgow, Scotland. These data, expressed as counts per minute, were analysed for mean daily physical activity using three different commonly used published cut-points for the assessment of sedentary behavior (Puyau et al (2002), Reilly et al (2003) and Treuth et al (2004) and three cut-points for the assessment of MVPA (Puyau et al (2002); Janz et al (2002) and Treuth et al, (2004)). Percentage (%) time spent at these activity levels for each was calculated using these cut-points. ANOVA and Tukey's pairwise comparison were used to determine if, and where, any differences lay between estimations of % time spent inactive and in MVPA, according to these cut-points.

RESULTS: The median % time spent in sedentary behaviour according to Puyau, Treuth and Reilly cut-points were all significantly different from each other ($p < 0.01$). The Janz cut-point for MVPA resulted in a much higher % time in MVPA compared with the other two cut-points ($p < 0.01$)[†] (Table 1).

CONCLUSIONS: Calculated levels of sedentary behavior and MVPA are sensitive to the cut-point chosen. Applying different cut-points to the same data from a single child can significantly alter the assessment of how active or inactive the child appears. This is a potentially important methodological problem and requires urgent attention.