PhD thesis by Mette Toftager, 2013:

Design, methods and effects of a school-based multicomponent intervention study among adolescents: SPACE for physical activity

Summary

Introduction

The transition from childhood to teenage years is a period of physical activity (PA) decline. As young people spend a large proportion of their waking hours at school, schools have long been recognised as potentially effective settings for public health initiatives including PA interventions. The overall purpose of the multicomponent intervention study *SPACE for physical activity* was to design, develop, document and assess a comprehensive intervention in schools to promote everyday PA level among adolescents.

Measurement of PA is a challenging task. Within the last decade, the use of objective measures, such as accelerometers to quantify PA in population-based studies of children and adolescents, has increased and accelerometry is regarded a valid and reliable method to measure PA in intervention studies. Nonetheless, the use of accelerometers comes with a number of challenges and data processing criteria remain inconsistent.

Aim

The focus of this thesis was to describe and critically explore the design, methods and effects of the SPACE study. The first aim was to describe the study design of the school-based intervention. The primary outcome measure in the SPACE study was PA measured with accelerometers, and hence the second aim was to investigate accelerometer data reduction criteria in adolescents and effects on sample retention and bias. The third aim was to report the intervention effect on the adolescents' total daily PA level as well as PA in school time and PA during recess. Finally the fourth aim was to explore the intervention effect on adolescents' aerobic fitness, musculoskeletal strength and adiposity.

Methods

Data was collected as part of the SPACE study; a cluster randomised controlled trial with a 2-year follow-up. The study involved 14 schools (7 intervention schools and 7 control schools) and 1,348 adolescents in grade 5 and 6 were enrolled at baseline (mean age 12.5 years). The intervention consisted of 11 components targeting the physical and organisational environment at the schools, e.g. upgrading school outdoor areas, implementing a school PA policy, mandatory outdoor recess, PA facilitating by teachers during recess (Kick-starters), cyclist education and improving safety for active transport and an after-school fitness program. PA behaviour was measured with accelerometer (Actigraph GT3X). Aerobic fitness was measured with a shuttle-run test, musculoskeletal strength with handgrip dynamometer, adiposity with waist circumference, height and weight were measured to calculate BMI. Sociodemographic and other background data were obtained from Statistics Denmark, from school records and from questionnaires.

Results

The SPACE study was developed based on social ecological models and practical experiences from Danish school settings. The intervention and control group showed similar characteristics at baseline, and there was a high participation rate for all types of measures (>90%). Results from the accelerometer method study showed that even small differences in accelerometer data reduction criteria can have substantial impact on sample retention and PA outcomes. We found a risk of introducing bias with regards to BMI and age with more overweight and older adolescents excluded from analysis when using short non-wear time definitions.

No significant effect of the intervention was found for overall PA at follow-up (adjusted difference of minus 19 accelerometer counts per minute (cpm), 95% CI: -92, 53) or for school time activity (adjusted difference 6 cpm, 95% CI: -73, 84). A sensitivity analysis of the effect analyses revealed a significant intervention effect of PA in recess with an adjusted difference of 95 cpm (p=0.046). No adjusted intervention effect was found for aerobic fitness (the shuttle run test showed an adjusted difference of 6 meter (95% CI: -20, 31)), for musculoskeletal strength the effect size was minus 1.1 kg (95% CI: -2.2, 0.0), and for adiposity measured as waist circumference the difference between intervention and control group was 0.2 cm (95% CI: -2.4, 2.8). Furthermore, large between schools differences were found across outcomes measures.

Discussion and conclusion

A large school-based multicomponent intervention did not provide evidence for an overall intervention effect on PA, physical fitness and adiposity in adolescents. For PA during recess, the intervention revealed effect in a sensitivity analysis. The reason for not finding an overall effect could be due to both the design of the intervention programme and the implementation of the intervention components. The intervention relied primarily on non-curricular activities and voluntary participation components and for that reason, the intervention was very dependent on the motivation and engagement from students, teachers and school leaders. We experienced large variations between schools in adopting the intervention. An intervention with more focus on educational and compulsory elements and activities of higher intensity might be more effective in increasing PA. Especially, implementation of the components outside the school setting (improving safety for active school transport and the after-school fitness programmes) turned out to be difficult to implement. Finally, accurate measurements of PA are essential in intervention studies. Given the impact accelerometer data reduction procedures have on attrition rate, PA outcomes and the risk of introducing bias, it is important to clearly describe choices made when processing the data.