

Effects of extra school-based physical education on the development of physical fitness, injuries and the combined effect of extra physical education and injuries on physical fitness development

The Childhood Health, Activity, and Motor Performance School Study-DK.
The CHAMPS Study-DK

Centre of Research in Childhood Health
Research Unit of Exercise Epidemiology
Department of Sport Science and Clinical Biomechanics
Faculty of Health Science

PhD thesis
Christina Trifonov Rexen
Odense, 2015

Summary of the thesis

Introduction

The health related benefits of regular physical activity (PA) engagement in children and adolescents are widely known and both fitness and activity levels may track into early adulthood. Children with low levels of fitness are particularly interesting from a health-related perspective. The World Health Organization has provided global recommendations on PA levels with the purpose of health enhancement and prevention of non-communicable diseases. Public schools have been recognized as potentially effective settings for public health interventions to increase PA levels and introduce a healthy lifestyle. However, increased PA levels may also increase the risk of injury through accumulation of exposure. Injuries are important, as they may cause both short term, and possible long term, negative consequences for physical activity participation, opposing health related benefits. Moreover, the potential impact of injuries on general physical fitness development in schoolchildren is unknown.

Aim and objectives

The focus of this thesis was to examine the longitudinal effects of extra physical education on injuries and physical fitness development in elementary schoolchildren. The first objective was to examine the effect of extra physical education on the number of physical activity related musculoskeletal injuries (study I). The second objective was to examine the effect of extra physical education on physical fitness development (study II). Finally, the third objective was to examine the combined effect of extra physical education and injuries on physical fitness development (study III).

Methods

Data were collected as part of the CHAMPS I study; a longitudinal controlled school-based study among ten Danish public schools. Children were enrolled in preschool to fourth grade level and followed for three school years (denoted cohorts 0 to 4). Six schools had four additional physical education (PE) lessons per week and four schools continued the normal curriculum with two weekly PE lessons. At baseline, 1507 children were invited (normal PE schools: 522, extra PE schools: 773). Study participation rates at baseline testing were 71% and 91% for normal and extra PE schools respectively. Physical fitness tests consisted of five motor performance tests and one aerobic performance test: Short shuttle run test and handgrip strength test (Eurofit test battery), vertical jump test (Abalakov's vertical jump test), balancing backwards ("Körperkoordinationstest für Kinder"), precision throw ("Der Allgemeiner Sportmotorischer Test für Kinder von 6-11 Jahren"), and The Andersen test, developed as proxy for maximal oxygen uptake.

Physical fitness measurements were collected five times during the study period. Information of injury was derived from weekly-automated mobile phone text messages surveying the presence of musculoskeletal pain. Children reporting pain were examined and diagnosed according to the International classification of Diseases version 10 from World Health Organization. Only PA-related musculoskeletal injuries were used in the study. Injury count were analysed using a two-part model; zero-inflated negative binomial regression. Development in fitness was analysed using a composite z-score based on performance in six different physical fitness tests. Multilevel mixed-effects linear regression was used to examine the association between school type and development in fitness and the combined effect of extra PE and injuries.

Results:

Study I: Extra PE had no influence on odds of sustaining an injury or not, but increased the probability of sustaining a higher injury count among children with one or more injuries: total injury count and overuse injury count by a factor 1.29 (95% CI 1.07; 1.56 & 1.06; 1.55), and growth-related overuse (GRO) injury count with a factor 1.38 (1.02; 1.80).

Study II: Extra PE increased the total development of physical fitness in children enrolled in cohort 4 and borderline in cohort 3 with 1.06 and 0.52 composite z-score units respectively (95% CI: 0.48-1.65 and -0.06-1.09). Children within the lower 50 percentile of physical fitness at baseline increased their development with 0.47 composite z-score units (95% CI: 0.08-0.85).

Study III: Injury and extra PE both influenced the development of physical fitness. Injury decreased the development of physical fitness with -1.01 composite z-score units (95% CI: -1.57; -0.45) over the 2.5-year study period. Extra PE increased physical fitness development with 0.80 composite z-score units. The influence of injury was not dependent on school type (extra PE vs. normal PE).

Conclusions and perspectives

Extra PE in elementary schools did not increase the risk of PA-related musculoskeletal injury compared to no injury. However, children with injuries at schools with extra PE had an increased probability of a higher injury count compared to children with injuries at schools with normal PE.

Extra PE in schools improved development in physical fitness for cohort 4 and borderline for cohort 3 among all children. However, extra PE improved physical fitness development across all cohorts among children within the lowest 50th fitness percentile at baseline.

Extra PE in schools increased the development in composite physical fitness with 16% whereas injuries decreased composite physical fitness development with 17-18% over the 2.5 years study period. The negative effect of injuries was not dependent on school type. In perspectives, extra physical education is safe to recommend. However, identification of children at risk of multiple injuries is important considering the negative short term and potential long term consequences. Future school-based intervention studies may focus on both injury awareness and prevention along with increased activity levels.