



30 Years of SLOfit: Its Legacy and Perspective

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ABSTRACT

Slovenia is a pioneer of surveillance of physical fitness of schoolchildren. For more than 30 years, national system SLOfit monitors and evaluates the annual changes in the physical fitness of children and adolescents aged 6 to 19. The purpose of this article is to present the legacy of the SLOfit and some further perspectives of its development.

The SLOfit is national physical fitness monitoring system in which almost the entire Slovenian school population is measured by 8 motor tests and 3 anthropometric measurements every April. Annual measurements allow researchers to constantly monitor the population developmental trends, while teachers use the analysed data to identify children with special developmental needs, to follow the development of every individual child and adjust the teaching process to the needs and capabilities of children. Centralised management and evaluation of data with unique feedback system enables children and parents to compare their development with the development of their peers and identify the needs for improvement. On the national level, the SLOfit data serves as scientific backbone for most of the physical activity policies, and the policies, related to school physical education. Slovenian educational policy, informed by the SLOfit data, managed to develop one of the most efficient system of physical education and extracurricular sports programs in the world, which results in very favourable level of physical fitness and physical activity of children in Slovenia in comparison to the rest of the world. In the future, we want to explore SLOfit even more for physical activity interventions. We have prepared a web application My SLOfit, which allows student, their parents, teachers and physician web access to students' SLOfit results, with feedback about health risk. With support of My SLOfit we would like to introduce new paradigm of collaboration between school and health sectors in local settings.





Keywords: Physical fitness, Children, Youth, Anthropometry, Test Battery, Physical Education

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INTRODUCTION

Physical fitness is one of the most important determinants of health. Systematic review of predictive validity of health-related fitness in youth (1) has shown following evidence:

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- Strong evidence
 - Higher levels of cardiorespiratory fitness in childhood and adolescence are associated with a healthier cardiovascular profile later in life.
 - Muscular strength improvements from childhood to adolescence are negatively associated with changes in overall adiposity.
 - A healthier body composition in childhood and adolescence is associated with a healthier cardiovascular profile later in life and with lower risk of death.
- Moderate evidence
 - Higher levels of cardiorespiratory fitness is associated with a lower cardiovascular diseases risk.
 - Higher levels of cardiorespiratory fitness is associated with the lower risk of developing the metabolic syndrome and arterial stiffness.
 - A healthier body composition is associated with lower prevalence of low back pain.
- Inconclusive evidence (due to a limited number of studies)
 - Higher levels of muscular strength or motor fitness is associated with a lower cardiovascular diseases risk.
 - Better flexibility is associated with lower prevalence of low back pain.

Due to the negative effects of growingly sedentary lifestyles among young people (2-5) the importance of sustaining sufficient level of physical fitness is increasing. Therefore, many countries strive to establish national physical fitness monitoring systems. Some test batteries are widely used, but rarely on a population level: Eurofit (6), AAHPER Youth Fitness Project (7), The President's Challenge (8), Fitnessgram (7,9), Japanese MEXT Fitness Test (10) The International Physical Fitness Test (11), ALPHA Fitness Test Battery (12).

Slovenia is a pioneer in this type of accompaniment since national physical fitness surveillance system SLOfit was developed from 1969 to 1989 (13). SLOfit monitors and evaluates the annual changes in the physical fitness of schoolchildren and adolescents aged 6 to 19. This year is the 30th anniversary of the introduction of the system in all Slovenian schools. The purpose of this paper is to present the legacy of this system and some further perspectives of its development.

What is SLOfit?

SLOfit is a national surveillance system for physical and motor development of children and youth in Slovenia, which was formerly known as Sports Educational Chart. The system was implemented in 1982 on a sample of Slovenian schools and after 5 years of testing, it was introduced to all Slovenian primary and secondary schools. Therefore, SLOfit enables annual monitoring of physical and motor status of children in all Slovenian schools from 1987 onwards. Every April, almost the entire Slovenian population, aged 6 to 19 (220,000 students) is measured by 8 motor tests and 3 anthropometric measurements (see www.slofit.org):

- height (longitudinal dimension of the body)
- weight (voluminosity of the body)
- triceps skinfold (subcutaneous fat)
- 20-second arm plate tapping (neural regulation of movement)
- standing broad jump (explosive power)
- polygon backwards (coordination of whole body movements)
- 60-second sit-ups (isometric strength)
- stand and reach (flexibility of legs and lower back)
- bent arm hang (isotonic strength)
- 60-meter dash (speed)
- 600-meter run (general aerobic endurance)

Physical Fitness Index is calculated as a measure of overall physical efficiency of every child from all motor variables and from BMI and triceps skinfold.

Enrolment in the SLOfit system requires positive parental informed consent, while in high schools it is the student alone who signs informed consent regardless of their age. The consent enables their data to be processed centrally and included in the SLOfit database. After the school-based measurements are performed, the data are sent from schools to the Faculty of Sport at the University of Ljubljana where they are checked, cleaned, analysed and the feedback reports, which include comparison with the national average, are sent back to schools for every individual child, class and every school.

Annual measurements allow researchers to constantly monitor the population developmental trends, while teachers use the analysed data to identify children with special developmental needs, to follow the development of every individual child and adjust the teaching process to the needs and capabilities of children. Centralised management and evaluation of data with unique feedback system enables children

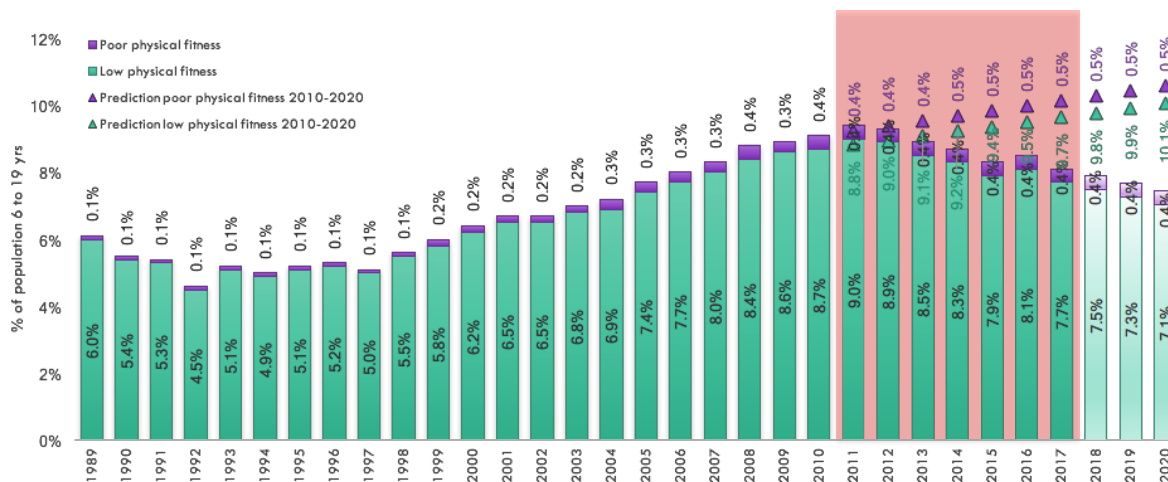
and parents to compare their development with the development of their peers and identify the needs for improvement.

On the national level, the SLOfit data serves as scientific backbone for most of the policies, related to improvement of physical activity of children and youth and the policies, related to school physical education.

To date the SLOfit database includes over 7 million sets of measurements of over 1 million children and is one of the largest cross-sectional and cohort database of physical and motor development in the world. Slovenian educational policy, informed by the SLOfit data, managed to develop one of the most efficient systems of physical education and extracurricular sports programs in the world, which results in very favourable level of physical fitness and physical activity of children in Slovenia in comparison to the rest of the world (14).

Healthy Lifestyle intervention in 2010 caused the decline of prevalence of obesity and the growth of physical fitness of children on the national level

Figure 1. Effect of intervention on physical fitness of children



Not so much obvious as in other parts of the world (15, 16), increased body mass and fatness were also markedly present in Slovenian children and youth. This was also one of the best examples of the evaluative strength of the SLOfit system. Through SLOfit system the Laboratory detected an accelerated increase of childhood overweight from the mid-1990s onwards (17) that was predicted to exceed 30% of the population in 2020 and we proposed to the Ministry to intervene with the introduction of additional 2 hours of PE per week, administered by newly employed PE teachers. Based on our warnings, a national project Healthy Lifestyle was introduced in school year 2010/2011. The progress of the included 30,000 children was monitored through the SLOfit system for the next five years and each year an emphasis was put on the poorest component of physical fitness from the preceding school year. Such targeted intervention caused the decline of prevalence of obesity and the growth of physical fitness in all Slovenian schools (see Figure 1) and the trends from 2010 to 2015 today suggest only 22% prevalence of overweight in 2020, which is at the level of the year 2004.

My SLOfit

Despite its strengths, the SLOfit system has a huge potential for improvement. In order to improve the identification of higher-health risk children there is a growing demand of school physicians to get access to the SLOfit database to get a better insight into overall development of a child. There is also a growing demand of PE teachers to receive some medical information on the health status of their children in order to minimize any possible health risks, deriving from chronic diseases and conditions of children.

At the same time, the parents and children are not informed enough about the consequences of poor physical fitness of a child or about the adequacy of child's habitual physical activity. In addition, current policies regarding the exchange of data do not allow the linking of personal data between different stakeholders, which means that integration of data from

different sources needs to be resolved on the political level.

Current policies for increasing physical activity in schools is effective and produces results but these results could be further enhanced if the health sector could contribute, which is currently impossible because they don't have access to relevant information.

We have a vision how to implement all mentioned challenges. In 2016, we launched a new SLOfit web site. Its purpose is the dissemination of information to different users of system: children and their parents, university students, PE teachers and physicians. We enable separate access to each of the target group along with the general information, available to wider audience.

In 2016-18, we have developed and tested a web tool that will promote SLOfit and give more meaning to its results. Web application My SLOfit (<https://moj.slofit.org/Prijava>) allows student and their parents web access to students' SLOfit results. PE teacher can also see a child's SLOfit results via this application as well as a child's physician provided by parents' invitation to application. On My SLOfit annual SLOfit data are available with following augmented feedback:

- progress of student physical fitness in recent year
- comparison of his/her physical and motor development with peers
- fitness and health-risk category of individual SLOfit results
- link on advice how to improve poor components of physical fitness.

Such report is a good basis for the informed decisions, taken by parents, teacher and physician about school-based and out-of-school physical activities and diet habits of child. The parents have an additional advantage to get the insight into information about physical fitness of all their children on one place.

PERSPECTIVES

The rich legacy of SLOfit challenges us for well-designed further development of system. Within our cooperation in H2020 project CrowdHEALTH, we are developing predictive models, which could visualize health risks and raise the awareness of children, parents, teachers and physicians regarding the health risks due to physical inactivity. We have also plans for lifelong monitoring of physical fitness.

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