

## HEALTH PROMOTION

# Assessment of Knowledge and Practices Related to Children's Physical Fitness and Health Among French PE Teachers

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## Keywords

Physical fitness • School • Physical education • Teachers • Health

## Summary

**Objectives.** To assess PE teachers' knowledge of physical fitness and its link to children's health and identify barriers and facilitators for its management in schools.

**Methods.** A total of 2,378 PE teachers (56% men) completed an online questionnaire on their knowledge, perceived barriers, and facilitators regarding physical fitness.

**Results.** Most of teachers reported being aware of the associations between cardiorespiratory fitness (CRF) (96%) and muscular strength (MS) (88%) with current health in youth. A smaller proportion of teachers acknowledged knowing the potential associations of these fitness components with future health in adulthood, specifically 40% for CRF and 22% for MS. The majority of teachers (80%) reported being sufficiently trained during their training courses to assess and develop the CRF. Only 50% of

teachers reported feeling sufficiently trained to assess MS, while 58% reported being adequately trained to develop this component. Among the teachers, 82% reported that insufficient practice time, large class sizes, and high heterogeneity are key obstacles. Less than 50% identified other prioritized objectives as barriers, while 30% reported a lack of material resources as a significant limitation. Then, 84% of teachers reported being interested in participating in continued professional development focused on the promotion of physical fitness in youth through PE.

**Conclusions.** Barriers such as limited training, structural constraints, and low awareness of MS recommendations hinder effective fitness management. Addressing these through improved curricula, teacher training, and resources is crucial to enhancing youth fitness and health in France.

## Introduction

For many years, robust and consistent evidence has highlighted the importance of physical fitness in youth as a key determinant of both current and future health [1]. Physical fitness encompasses several components, including cardiorespiratory fitness, musculoskeletal fitness (muscular strength, power, endurance, and flexibility), motor fitness (agility, speed of movement, balance and coordination), and body composition. Among these components, cardiorespiratory fitness and muscular strength have been widely studied and have shown the strongest and most consistent associations with health in children and adolescents [1].

Cardiorespiratory fitness (CRF) has been found to be strongly and consistently associated with significant health outcomes, including reduced adiposity, lower risk of obesity, cardiovascular risk factors, and cancer, as well as improved mental health during childhood and adolescence [1]. The benefits of high physical fitness during this period extend into adulthood. A systematic review and meta-analysis demonstrated that a higher levels of CRF are associated with a reduced risk of

developing obesity and cardiometabolic disease later in life [2]. Moreover, a large Swedish prospective study revealed that low CRF in late adolescence is associated with an increased risk of chronic cardiovascular disease-related disability and predicts severe, irreversible health conditions adulthood, as reflected by higher rates of disability pensions [3, 4]. Muscular strength has also been consistently and strongly linked to important health outcomes during childhood and adolescence, and is similarly associated with health status in adulthood [1, 5-7]. Several large cohort studies have demonstrated that lower muscular strength in youth is associated with a higher risk of physical disability and increased all-cause and cause-specific (cardiovascular and cancer) mortality in later life [8, 9]. A recent study further explored the combined impact of these two components of physical fitness [7]. The authors found that adolescents with both high CRF and high muscular strength had a significantly lower risk of coronary atherosclerosis, particularly severe coronary stenosis, nearly 40 years later [7].

This evidence highlighting physical fitness as a powerful marker of health in youth emphasizes the need to improve

or maintain high physical fitness levels in children and adolescents. However, temporal trends in physical fitness among French youth are concerning. Recently, Vanhelst et al. (2024) reported a significant decline in CRF levels, as assessed by the 20-m shuttle run test, in 15,420 French children and adolescents between 1999 and 2022 [10]. Another study examining trends in muscular strength showed a negligible decline in mean lower limb strength (assessed using the standing broad jump) and a slight improvement in mean upper limb strength (assessed using handgrip strength) among French youth from 1999 to 2023 [11]. Furthermore, both studies indicated that these trends were not consistent across the population, with data suggesting an increasing gap between low and high performers over time [11]. To address these findings, national public health initiatives are urgently needed to monitor physical fitness levels and implement programs aimed at improving physical fitness in French youth. Children and adolescents spend a significant amount of time at school, making it an ideal environment to provide opportunities for all students, regardless of socioeconomic background, to enhance their physical fitness. Two systematic reviews and meta-analyses have shown that school-based interventions can effectively improve CRF and muscular fitness in children and adolescents [12, 13]. Within the school setting, physical education (PE) curricula appear to be the most effective avenue for assessing and promoting physical fitness. Despite this context, there is a lack of research into the knowledge levels of PE teachers and their subsequent suitability to teach health-related PE [14]. However, PE teachers in North America and Australia have reported barriers to implementing fitness assessments and interventions in their lessons, including insufficient facilities, limited confidence, and time constraints [15]. In Europe, Cox et al. highlighted a poor understanding of muscular fitness activities among UK PE teachers [16]. Currently, there is no data available on the knowledge or capacity of French PE teachers to assess and develop physical fitness in children and adolescents, and these aspects are not prioritized in French school policies. Therefore, the primary aim of this study was to assess the physical education teachers' knowledge of physical fitness and its association with health in children. The secondary objective was to identify barriers and facilitators to improving the management of physical fitness in the school setting. We also aimed to determine whether duration of teaching experience and sex might influence knowledge of physical fitness and the perceived barriers to implementing effective strategies for promoting physical fitness in schools.

## Methods

### STUDY DESIGN AND PARTICIPANTS

This study employed a cross-sectional design targeting a sample of French PE teachers. Data were collected through an online survey conducted between October 2023 and June 2024. To reach potential participants, all

regional academic institutions ( $n = 30$ ) across France were contacted. These institutions then reached out to middle and high school principals and headteachers. The institutions were informed about the objectives of the study and asked to share the survey link with their PE teachers. From a total of 29,725 PE teachers in France, 2,378 participated in the present study.

This study did not involve any intervention, and was conducted on a volunteer basis. In this context, written informed consent was not required according to French human research regulations. The answers provided by PE teachers were anonymous and confidential. The data collection process was approved by the French National Commission of the Informatics Personal Data (CNIL).

### QUESTIONNAIRE

The questionnaire was developed by a group of experienced professionals in the fields of sport science, physical education, and educational research. The team included PE teachers, researchers specializing in physical fitness, and experts in questionnaire design. Before data collection, a preliminary version of the questionnaire was tested with a small sample of 10 secondary school PE teachers to evaluate the clarity, relevance, and length of the questions. This pretest allowed the identification of any ambiguities and helped ensure the comprehensibility and acceptability of the instrument. Following this, a pilot study was conducted with 15 additional PE teachers to assess the response quality and completion rates for each question. Items with a completion rate below 80% were reviewed and either revised or removed as necessary. After each stage, adjustments were made to improve the instrument, resulting in the final version of the questionnaire.

The final questionnaire consisted of 28 questions divided into four parts: (i) Teacher profile: information regarding the participant's teaching background, experience, and current teaching context (*e.g.*, type of school, years of teaching experience); (ii) Cardiorespiratory fitness: questions focused on teachers' perspectives and practices regarding the assessment and development of cardiorespiratory fitness in children and adolescents; (iii) Muscular strength: questions focused on teachers' perspectives and practices regarding the assessment and development of muscular strength in children and adolescents; (iv) Global objectives: questions addressing overall teaching priorities, obstacles, and facilitators in promoting physical fitness among children and adolescents, as well as their interest in further training or additional resources.

In the section on teacher profiles, demographic and professional information was collected, such as gender, years of teaching experience, and type of school (*e.g.*, middle school or high school). The cardiorespiratory fitness and muscular strength sections investigated teachers' knowledge, confidence, and practices in assessing and developing these physical fitness components, as well as their perceptions of trends in youth fitness over the past 20 years.

Participants answered questions using Likert scales

(*e.g.*, “Strongly Disagree” to “Strongly Agree”), multiple-choice options, and binary formats (*e.g.*, “Yes/No”). Specific questions allowed for multiple responses when addressing perceived correlations (*e.g.*, between cardiorespiratory fitness or muscular strength and health outcomes) or barriers to implementing physical fitness programs.

The questionnaire was preceded by an informative letter explaining the objectives of the survey and assuring participants that all data would remain strictly anonymous/confidential.

### STATISTICAL ANALYSIS

Continuous variables are presented as means (standard deviation, SD), while categorical variables are expressed as frequencies (percentages). The normality of distributions was assessed using histograms and the Shapiro-Wilk test. The results of the questionnaires are expressed as the percentages of participating teachers who answered each item. The  $\chi^2$  test was used to compare differences between sexes and levels of experience among teachers. Data were analyzed using R statistical software (version 3.2.1). A *p*-value of < 0.05 was considered significant.

## Results

Demographic and professional characteristics of the PE teachers are presented in Table I. Among the participants, 56% were male, with 64% teaching at the middle school level and 36% at the high school level. The mean duration of teaching experience was  $19.8 \pm 10.1$  years.

PE teachers' knowledge regarding physical fitness and health in youth according to sex and teaching duration of experience is displayed in Table II. Most of PE teachers reported being aware of the associations between CRF (96%) and muscular strength (88%) with current health in youth. In contrast, a smaller proportion of PE teachers acknowledged knowing the potential associations of these fitness components with future health in adulthood, specifically 40% for CRF and 22% for muscular strength. The percentages were higher for knowledge of the relationships between physical fitness and mental health (Tab. II).

Significant differences were found for the sex and the teaching duration of experience (Tab. II). Men reported being more aware about the association between CRF and muscular strength with future health compared to women. The percentage of teachers with less duration of experience teaching (< 10 years) reported to be more aware about the association between physical fitness and health (current, future and mental) compared to their more duration of experienced counterparts (Tab. II).

Results from teachers' perceived training and practices for assessing and developing physical fitness in youth according to sex and teaching duration of experience are presented in Table III. Regarding CRF, the majority of PE teachers (80%) reported being sufficiently trained during their training courses to assess and develop this

component. Concerning muscular strength, only 50% of PE teachers reported feeling sufficiently trained to assess it, while 58% reported being adequately trained to develop this component. About assessments, 60% of PE teachers reported performing at least one measurement of CRF a year, while only 14% reported assessing muscular strength at least once a year.

In addition, men reported to feel more sufficiently trained to assess and develop CRF and muscular strength compared to women (Tab. III). Moreover, the percentage of PE teachers who reported performing at least one assessment of muscular strength was significantly higher among those with more than a 10 years duration of experience compared to their less experienced counterparts (Tab. III).

PE Teachers' perceived barriers to improving the management of physical fitness in the school setting are presented in Table IV. Among these PE teachers, 82% reported that insufficient practice time, large class sizes, and high heterogeneity among students are key obstacles. Additionally, less than 50% identified other prioritized objectives as barriers, while 30% reported a lack of material resources as a significant limitation.

A significant difference was found based on sex, with men more frequently reporting competing priorities within the PE curriculum as a barrier compared to their women counterparts (Tab. IV). Additionally, PE teachers with less duration of experience more often reported a lack of facilities/equipment and insufficient teacher training as barriers (Tab. IV).

Regarding PE teachers' perceived facilitators to improving the management of physical fitness in the school setting, the most important were improving teaching conditions, including increasing the number

Tab. I. Characteristics of participants.

	N or mean	% of total
<b>Sex</b>		
Men	1 332	56
Women	1 046	44
<b>Teaching level</b>		
Middle school	1 522	64
High school	856	36
<b>Geographical location</b>		
Auvergne-Rhône-Alpes	323	13.6
Bourgogne-Franche-Comté	128	5.4
Brittany	195	8.2
Centre-Val de Loire	82	3.4
Corsica	10	0.4
Grand Est	173	7.3
Hauts-de-France	134	5.6
Ile-de-France	234	9.8
Normandy	125	5.3
Nouvelle-Aquitaine	278	11.7
Occitanie	249	10.5
Pays de la Loire	139	5.8
Provence-Alpes-Côte d'Azur	220	9.3
Overseas	88	3.7

**Tab. II.** PE teachers' knowledge regarding physical fitness and health in youth according to sex and duration of teaching experience (n, %).

		Sex		Teaching experience		P value*	
	Total	Men	Women	< 10 years	≥ 10 years	Sex	Experience
CRF							
Association with current health	2 307 (97)	1 280 (96)	999 (98)	463 (98)	1 823 (97)	0.07	0.198
Association with future health	962 (40)	601 (45)	345 (34)	215 (45)	763 (39)	< 0.001	0.011
Association with mental health	1 587 (66)	880 (66)	684 (67)	329 (69)	1 242 (66)	0.75	0.131
Muscular strength							
Association with current health	2 096 (88)	1 170 (88)	901 (88)	440 (93)	1 636 (86)	0.97	< 0.001
Association with future health	521 (22)	322 (24)	178 (17)	128 (27)	377 (20)	< 0.001	< 0.001
Association with mental health	1 115 (47)	642 (48)	456 (44)	255 (54)	848 (45)	0.07	< 0.001
Knowledge of WHO recommendations	272 (12)	158 (12)	112 (11)	71 (15)	199 (11)	0.49	0.007

\*Chi-squared test

of PE hours per week, reducing the number of children or adolescents per class, and modifying the objectives assigned to PE lessons. Furthermore, 84% of PE teachers reported being interested in participating in continued professional development focused on the promotion of physical fitness in youth through PE. Additionally, 90% expressed a strong interest in a shared web platform that would facilitate the administration of physical fitness tests and generate personalized reports for youth.

## Discussion

This study is the first large-scale survey to assess the knowledge, perceptions, and practices of French PE teachers regarding physical fitness in children and adolescents. Our main results revealed significant gaps in PE teachers' understanding of the importance of physical fitness components, particularly muscular strength, and their association with health outcomes. Moreover, while teachers recognized the importance of CRF and declared to be confident in assessing it, barriers such as limited facilities and time constraints hindered the implementation of comprehensive fitness programs. These findings are of major interest because since the 2024 Olympic Games in Paris (France), there has been increased attention on the assessment and the

development of children's health-related physical fitness levels among national policymakers. Data from this study highlight the need to address the gaps and support PE teachers in promoting physical fitness. In addition to informing new school policies, easily applicable solutions should be implemented, such as integrating targeted modules on muscular strength and fitness into initial teacher education, encouraging participation in free online training (e.g., ONAPS and FitBack resources), and promoting practical workshops during continued professional development. These results could inform the development of new school policies aimed at enhancing training and resources for PE teachers to effectively promote physical fitness within the school setting.

The main finding regarding PE teachers' knowledge of physical fitness and health was that less experienced teachers were more aware of the association between muscular strength and current/future/mental health. This observation is linked to the evolution of the French training program content for PE teachers, which has been modified over the past 10 years. Recent changes have focused on health and well-being, particularly in areas such as healthy living, risk prevention related to sedentary behavior, development of psychosocial skills through physical activity including muscle development [17]. In contrast, regarding PE teachers'

**Tab. III.** PE Teachers' perceived training and practices for assessing and developing physical fitness in youth according to sex and teaching experience (n, %).

		Sex		Teaching experience		P value*	
	Total	Men	Women	< 10 years	≥ 10 years	Sex	Experience
CRF							
Sufficient training to assess	1 945 (82)	1 125 (85)	812 (80)	377 (78)	1 568 (83)	0.005	0.079
Sufficient training to develop	1 836 (77)	1 072 (81)	757 (74)	352 (75)	1 484 (79)	< 0.001	0.06
Perform at least a test assessment a year	1 426 (60)	808 (61)	613 (60)	300 (63)	1 126 (60)	0.865	0.126
Muscular strength							
Sufficient training to assess	1 141 (48)	690 (52)	451 (44)	218 (46)	926 (49)	< 0.001	0.200
Sufficient training to develop	1 366 (58)	833 (63)	533 (52)	265 (56)	1 104 (59)	< 0.001	0.311
Perform at least a test assessment a year	324 (14)	190 (14)	134 (13)	46 (10)	278 (15)	0.406	0.005

\* Chi-squared test



**Tab. IV.** PE Teachers' perceived barriers to improving the management of physical fitness in the school setting (n,%).

		Sex		Teaching experience		P value*	
	Total	Men	Women	< 10 years	≥ 10 years	Sex	Experience
Barriers							
Insufficient practice time	1 925 (82)	1 085 (81)	840 (82)	396 (84)	1 535 (81)	0.767	0.210
Competing priorities within PE curriculum	1 100 (47)	656 (49)	444 (43)	221 (47)	881 (47)	<b>0.004</b>	0.966
Lack of facilities/equipment	716 (30)	387 (29)	329 (32)	189 (40)	530 (28)	0.112	<b>&lt; 0.001</b>
Lack of teachers training	493 (21)	263 (19)	230 (22)	130 (27)	364 (19)	0.112	<b>&lt; 0.001</b>
Scared of student injuries	205 (9)	121 (9)	84 (8)	44 (9)	162 (9)	0.447	0.614

\* Chi-squared test

perceived training and practices to assess and develop physical fitness, the differentiating factor was not the duration of experience but the sex of the PE teachers. Men reported feeling more adequately trained to assess and develop CRF and muscular strength compared to women. This observation was already shown in the study of Cox et al. where women PE teachers were less likely to plan muscular strength [16]. This may be due to gender-based biases such as muscular strength is perceived as a more masculine activity and differing physical education learning experiences influenced by societal stereotypes, as observed in previous studies [18-22]. Less experienced PE teachers expressed a desire for more physical training facilities/equipment and additional PE teachers in settings (or decrease class sample sizes). This may be because younger, less experienced teachers would have been trained with a more modern view of training PE, have higher expectations and needs extra materials to enhance their PE programs in order to increase quality and attractiveness of PE lessons. Moreover, sports media program content exerts multiple influences on practices behaviors including the need of more and novel sport equipment to reinvent PE lessons [23]. Additionally, they are likely more motivated to perform innovative pedagogical model to offer quality lessons and, as a result, feel the need to improve teaching conditions, as previously observed by Wiyono et al. [24].

Another important finding was that the majority of PE teachers (90%) expressed a need for access to a free online platform to help the administration of physical fitness assessments and generate personalized reports for each youth evaluated. Two main actions could address this request. First, the National Observatory for Physical Activity and Sedentary Behaviors (ONAPS) has developed manuals for several physical fitness tests, including the 20m shuttle run test, handgrip strength, standing broad jump, and sit-and-reach test. These manuals provide valuable information for PE teachers, such as instructions to give to children and adolescents, required materials, methodologies suitable for the school environment, and scales for interpreting the results. These documents are available online and can be downloaded as PDFs (<https://onaps.fr/boite-a-outils/evaluer/#>). The second interesting tool for PE teachers is the initiative developed by the European FitBack network [25]. The FitBack project, endorsed by international fitness experts, aims to provide scientific and practitioner communities

with a free online platform outlining the steps required for implementing and harmonizing physical fitness assessments and interpreting results in school settings across Europe [25]. Authors also emphasize that the FitBack platform offers guidance to prevent undesirable practices, such as grading students based on their fitness levels or encouraging fitness competitions among youth. Instead, it promotes the use of physical fitness testing as an educational tool to foster learning and understanding about fitness, its importance for health and sports, and to help children and adolescents set individual objectives for improvement [25]. The web platform is available in French version (<https://www.fitbackeurope.eu/fr-fr/>).

Our last finding revealed that 84% of PE teachers showed an interest in participating in continued professional development focused on promoting physical fitness in youth through PE. Similarly, the EmPOWERment survey by Cox et al. (2023) reported the same results for PE teachers in the UK regarding the delivery of muscular activity [16]. Given these results, future research is needed in France to provide continued professional development opportunities for PE teachers about the development of physical fitness in children and adolescents. These programs should focus on practical, evidence-based strategies and provide teachers with simple, accessible tools and resources that can be directly applied in schools. A group of experts will be formed soon in order to develop and offer a free online continued professional development program on this topic. A similar work was conducted in UK where authors assessed the feasibility and acceptability of an online continued professional development program to enhance PE teachers' knowledge of muscular fitness activity [26]. The authors concluded that co-producing an online CPD program can enhance knowledge and positively impact teaching practices [26]. This study has several strengths that contribute to its relevance. First, the questionnaire was rigorously developed and corrected through pretesting and a pilot study to ensure the feasibility, clarity, relevance, and comprehensibility. This systematic approach to questionnaire design strengthens the validity and reliability of the data collected. Additionally, the study provides valuable insights for policies makers into PE teachers' knowledge, practices, and perceived barriers regarding the promotion of physical fitness in schools, addressing an important gap in the literature. However, the study is not without limitations. Although the present data were obtained from a large sample, the study

did not employ a stratified sampling design. Additionally, while this study represents a unique and the largest survey conducted among French PE teachers, encompassing a substantial sample of 2,378 participants, this accounts for only 8% of the national PE teacher population. Consequently, caution should be considered when extrapolating our results, as it cannot be assumed that the studied cohort is fully representative of French PE teachers. Another limitation concerns the absence of contextual data, such as the geographical location of schools (urban versus rural) or socioeconomic environment. These factors could significantly influence the management of physical fitness in schools. Furthermore, the absence of official national training programs on the evaluation and development of students' muscular and cardiorespiratory fitness limits the possibilities for analyzing the effectiveness of existing interventions. Future research should integrate these variables to provide a more comprehensive understanding of their potential impact on physical fitness promotion in educational settings.

## Conclusions

PE in schools offers a unique opportunity to enhance physical fitness and health in children and adolescents. However, findings from our study highlight several barriers within French schools, including insufficient training, structural constraints such as large class sizes and limited practice time, and low awareness of international recommendations regarding muscular strength. To maximize the impact of PE on public health, it is essential to: (i) prioritize the development of physical fitness in school curricula; (ii) strengthen initial teacher training and implement ongoing professional development programs focused on physical fitness assessment and effective interventions; (iii) improve teaching conditions (time, resources, class sample sizes); (iv) establish a national surveillance platform to monitor physical fitness among youth in the school environment. In addition, practical solutions should be promoted, such as integrating specific modules on muscular strength and fitness into teacher education, encouraging the use of free online platforms (*e.g.*, FitBack, ONAPS) for fitness assessment and reporting, and offering hands-on workshops as part of professional development. These actions are crucial to enhancing the role of PE teachers in promoting the physical fitness and health for our future generations of children and adolescents.

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There is no funding for this study.

## Ethics approval

This study did not involve any intervention, and was conducted on a volunteer basis. In this context, written informed consent was not required according to French human research regulations. The answers provided by PE teachers were anonymous and confidential. This data collection was approved by the French National Commission of the Informatics Personal Data.

## Consent to participate

Written, informed consent was obtained from the adolescents and the parents.

## Consent for publication

NA.

## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

DM, FC and JV designed research; DM, FC and JV conducted research; DM and LB analysed data and performed statistical analysis; DM, LB and JV wrote the paper; JV had primary responsibility for final content. All authors read and approved the final manuscript

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