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# Writing legibility of selected effectors: Evidence for a generalized motor program?

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## ABSTRACT

The purpose of the study was to determine if a generalized motor program (GMP) exists for writing, as has been previously reported. Beginning with a 1942 experiment by Lashley, and continuing with a 1976 (Raibert) example, writers of some motor learning texts have asserted that one can write with different effectors (nonpreferred hand, mouth, foot, etc.) and the results are quite similar, thus demonstrating that writing is a generalized motor program. The task has not been reported in recent literature. In order to determine if the results reported were generalizable, the researchers recruited 31 individuals who volunteered to write a short sentence under five conditions: 1) preferred hand, 2) preferred hand with wrist stabilized, 3) non-preferred hand, 4) mouth, and 5) foot. Participants ranged in age from 19 to 75 and were grouped as follows: < 25 yrs, n = 15; 25–44 yrs, n = 6; > 44, n = 10. Although all of the samples were legible in Conditions 1 and 2, legibility deteriorated significantly in Conditions 4 and 5. Contrary to expectations, there were no significant differences between the samples produced by based on age groupings. The authors concluded that most adults cannot write legibly with their mouths or feet, contrary to what has been previously reported.

## KEYWORDS

Marc Raibert; handwriting; preferred hand; non-preferred hand; motor program

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## INTRODUCTION

In the first few grades of elementary school, children begin learning academic content, but also establishing the groundwork for learning to express themselves through the written word. Handwriting is considered to be integrating motor programs, visual-spatial skills, and setting of parameters for letter formation (Graham, Struck, Santoro, & Berninger, 2006). For some children, handwriting is the first instance in which coordination of all three systems is tasked simultaneously. Handwriting, as with all physical skills, requires effectors (skeletal muscle fibers) which are under manual or

voluntary control. With practice, one develops a certain style, which is accompanied by motor programming, a term used to describe performance of certain motor skills in an automatic, spontaneous fashion (Shusterman, 2011). The brain/hand motor memory has been thought to be the most powerful of people's memories (King, 2015).

For the most part, handwriting is still taught in elementary schools in the U.S. About 90% of teachers stated that they provided about 15 minutes per day on instruction (70 minutes per week), and about 80% of the districts require teaching of handwriting (Graham, Harris, Mason, Fink-Shorzempa, Moran, & Saddler, 2008). Typically, handwriting continues to improve for the first few years (Accardo, Genna, & Borean, 2013; Overvelde & Hulstijn, 2011), and speed and legibility continues improving through fourth or fifth grade (Bara & Morin, 2013). When some elementary schools experimented with children composing by keyboard and by hand, almost all students composed superior essays by hand, both in terms of speed and content (Connelly, Gee, & Walsh, 2007).

Despite the proliferation of computers/voice-activated devices/phones with keyboards, Feder and Majnemer (2007) maintain that legible handwriting remains an important life skill that deserves continued emphasis from educators and health practitioners. Handwriting is a critical part of childhood development and can have negative consequences if not accomplished.

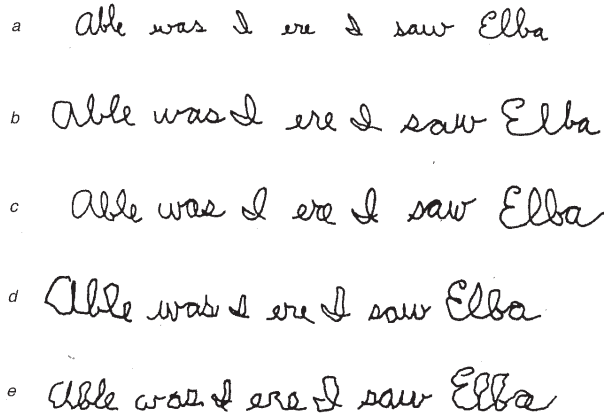
Even though computer keyboarding is progressively becoming the norm, vital cognitive benefits are lost with the disappearance of handwriting (Berninger, 2012; Zubrzycki, 2012) because handwriting engages more networks within the brain, which aids in recall (Berninger, 2012).

Failure to attain handwriting competency during the early school age years often has far-reaching negative effects on academic success and self-esteem (Feder & Majnemer, 2007). In a review of 13 studies, the authors (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997) concluded that handwriting fluency was moderately correlated with measures of writing achievement. Jones and Christensen (1999) estimated that after controlling for reading ability, the ability to form accurate letters accounts for about two-thirds of the variance in written expression.

Handwriting is integrally linked to composition. Impaired handwriting can impact the ability:

- 1) to be accessible to others (Graham, 1999),
- 2) for a composition to be perceived as being of good quality (Marshall & Powers, 1969),
- 3) to put thoughts onto paper if the writer is trying to remember how to form letters (Scardamalia, Bereiter, & Goleman, 1982),
- 4) to develop writing competencies (McCutchen, 1995), and
- 5) to make the writer believe he/she can become a writer (Berninger, Mizokawa, & Bragg, 1991). Thus, handwriting is a critical developmental process in early education.

In becoming adept at writing, the practice of writing letters, joining them together to form words, joining those to create sentences, etc., the mechanical part eventually becomes, for most people, a rather effortless process that is executed without thought, and is known as a motor program. Handwriting has been considered a generalized motor program (GMP) (Carter & Sharpiro, 1984), and if practiced, has the potential



**Figure 1** Writing sample in motor learning books used to illustrate GMP  
Used by permission of author (Raibert, 1977).

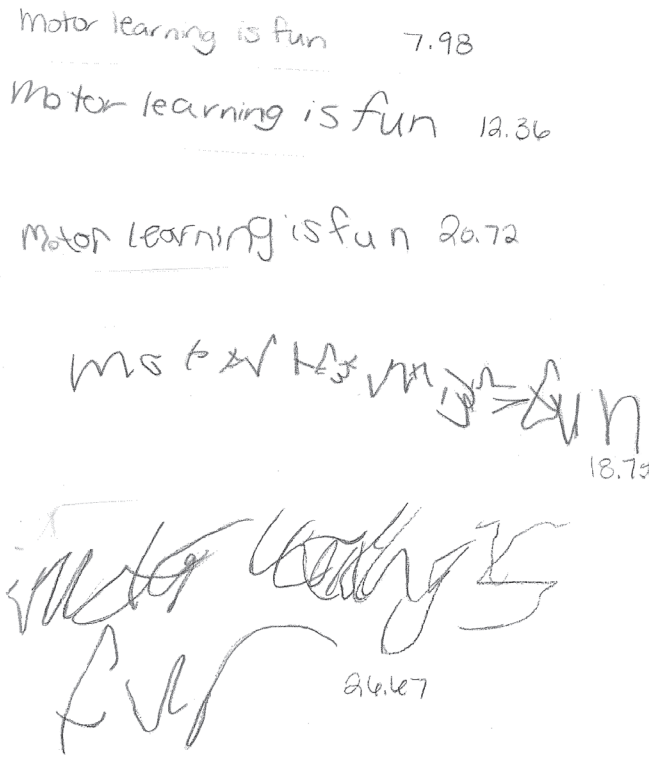
to develop into an instantaneous action (Schmidt, 1991; Schmidt & Lee, 2014) with invariant writing patterns (Castiello & Stelmach, 1993).

A GMP is one in which the timing/rhythm (an invariant feature) remains the same for different movements, but each movement itself can vary in terms of size, direction, force, speed, angle, or sets of muscles (effectors) used. In other words, in a tennis game with a skilled player, the same GMP for a forehand stroke occurs to contact the ball even though the ball may be coming at a different angle, speed, or direction from one shot to the next (Schmidt & Lee, 2014).

In the case of the effectors or size varying while accessing the same GMP, when one writes a word on a piece of paper, it should look almost identical if written on a blackboard. Thus, a person with a motor program for cursive handwriting should still be able to perform the same action on a grand scale, say a blackboard, and the samples should be easily recognizable as coming from the same person (Merton, 1972).

Beginning with the first edition of Richard Schmidt's *Motor Learning and Performance: From Principles to Practice* (1991), the author(s) included five writing samples written by one person with preferred hand, preferred hand stabilized, non-preferred hand, teeth, and foot. Each of the sentences is easily recognizable as coming from the same person, and all samples are approximately the same size, with similar spacing between letters, equivalent pressure, and the same slant. Results of the original study by Raibert (1976) have been included in each subsequent edition of Schmidt's book, up to and including the current fifth edition. Raibert (1976, 1977) drew two conclusions from the writing samples in his 1976 paper: 1) that motor programs are independent of effectors or kinematic considerations, and 2) a GMP can be translated into directions for "muscles, mechanics, and sensors of a particular limb" (p. 10, 1976).

A similar example was illustrated by Schmidt and Lee (2011), by two different participants who wrote with preferred and non-preferred hand, right mirror image, left mirror image, and teeth (Lashley, 1942). Again, samples were easily identifiable as being written by the same person, albeit one of the participant's trials was notably larger than the other samples. The authors suggested that the spatial pattern was invariant, even though different effectors were used.



**Figure 2** Average writing (score of 20/25)

Bernstein (1967) asserted that handwriting with different effectors shows a high degree of motor equivalence. Merton (1972) demonstrated the difference in writing on a wall versus a tabletop, and though the size was considerably larger, the actual letters themselves were very similar in character, suggesting that though the effectors were different for the two trials, the same motor program was accessed. Motor equivalence was also seen through the qualitative findings of spatial similarities across familiar writing patterns or similar letter forms (Castiello, & Stelmach, 1993).

More recently, Li et al. (2015) found that there were no significant differences in the size or number of motor units activated for movement between dominant and non-dominant hands. They reasoned that since muscle activation is quite similar, the actual action carried out might be similar, as well. Changing the orientation of the surface used to write on, such as a desk versus a chalkboard, changes how the effector approaches the movement, however. Factors such as gravity increase the acceleration of downward strokes, and more effort is needed for upward strokes (Phillips & Ogeil, 2010). In this case, the motor program appears to adjust for the added orientation.

Additional factors were also present when attempting to write with effectors that differ from the usual mode of writing, such as writing on the floor using the foot. Phillips and Ogeil (2010) drew the same conclusion as Raibert (1976), in that similar outcomes may be achieved when using multiple joints, such as comparing movements between the shoulder and wrist. In a recent publication, Osiurak, Lesourd, Delporte



& Rossetti (2018) reported that, regardless of the effector, and without any instruction, participants maintained approximately the same amount of force (left and right hand, right elbow and right foot) with different effectors.

However, others have found that the dominant hand and the non-dominant hand patterns exhibited different movement characteristics, indicating that learned writing patterns share only the very highest and most abstract representation suggesting that these similarities may not be sufficient in themselves to demonstrate that writing with different effectors is controlled by a single, effector-dependent representation (Castiello & Stelmach, 1993; Wright, 1990).

After one of the authors watched several hundred students over the course of the past twelve years attempting to write with the foot and mouth, she has observed that not a single student ever produced the high quality of the writing reported by Raibert (1976, 1977). When one of the authors queried Richard Schmidt (lead author of *Motor Learning and Performance*) about the discrepancy between the completely legible writing samples provided by Raibert and current university students' failure to meet up to the presented standards, Schmidt responded "if people can't write with their feet, the world should know about it. At least, the textbook writers should stop claiming that they can" (personal correspondence, 2008). Tim Lee, a co-author of Schmidt's 5th edition of the text further suggested, that since 1976, when Raibert authored the original paper, handwriting may have become an especial skill, not a GMP, but because of massive amounts of practice with the preferred hand, a very specific motor program that is usable only for the preferred hand. In other disciplines, this phenomenon is known as a splinter skill. Lee suggested that perhaps handwriting is still a GMP for adults who have spent decades handwriting, but not for the young generation who grew up with computers, and suggested a comparison of university students and their parents' capabilities (personal correspondence, 2008).

Although GMPs have been studied in regard to other effectors, the writing task included in Raibert's 1976 and 1977 papers has not been replicated. The purposes of the current study, therefore, were to determine whether 1) contemporary adults have a GMP for writing with different effectors and 2) to determine if age is a factor in writing quality across conditions.

## METHOD

### Participants

Following Institutional Review Board (IRB) approval, during the spring semester of 2018, a convenience sample of university students and adults in the community was approached to participate, and those wishing to do so read and signed an IRB approved consent form. In total, 31 participants (male  $n = 17$ , female  $n = 14$ ) provided complete data. Age was separated in the following manner: < 25 yrs,  $n = 15$ ; 25–44 yrs,  $n = 6$ ; > 44,  $n = 10$ . The ages ranged from 19 to 75.

Data were collected individually at a site and time of the participants' choosing. No attempt was made to diversify the sample by sex or ethnicity, however, researchers attempted to recruit approximately equal numbers of participants in each group.

Each participant received several pieces of standard size paper, a short "golf" pencil (9 cm), and packaged alcohol wipes. The first condition was to write with the pre-

ferred hand in their usual form (print or cursive). In the second condition, participants used the preferred hand with the wrist stabilized by the contralateral hand so the larger effectors of the arm completed the task. The third condition was writing with non-preferred hand and the fourth condition was to write while holding a short “golf” pencil in the mouth. The fifth condition was holding the pencil between the toes using the preferred foot. The researchers taped the paper to the floor and the pencil to the foot so enough pressure could be maintained to write, and to minimize movement of the pencil. Each condition consisted of three trials in which participants wrote as normally as possible, “*Motor learning is fun*”.

Previous studies (Graham, Weindtraub, & Berninger, 1998) have identified numerous elements contributing to handwriting legibility (spacing between letters and spacing between words, alignment, size and slant of letters, and letter formation accuracy). In the current study, the investigators chose to focus on letter formation alone as the main criterion for determining legibility. Researchers chose the most legible sample of the three trials in each condition and determined a readability score of 1 to 5. Out of the 18 letters in the trial, a score of 1 = 0–4 letters legible, 2 = 5–8 letters legible, 3 = 9–12 letters legible, 4 = 13–16 letters identifiable, and 5 = legibility of 17–18 letters. Across the five conditions, a possible cumulative score of 25 was attainable.

Interrater reliability was established in a two-step process. In the first step, two of the investigators independently determined the most legible sample in each condition for each participant and scored the sample based on the criteria outlined above. In the second step, all three researchers met together, compared scores, discussed scores that differed, and reached a consensus, resulting in 100% interrater reliability.

### Data Analysis

The researchers computed descriptive statistics for demographic variables. All data were subjected to correlation crosstabs and repeated measures ANOVA conducted with SPSS v. 24 (IBM, 2018).

## RESULTS

Three-fourths (74.2%) of the participants recalled being graded on their handwriting in elementary school. The vast majority of the participants (87%), regardless of age, stated they had completed homework during secondary school by hand, not using typewriter or computer. Approximately half ( $n = 15$ ) said that their handwriting quality was important to them, 11 (35.5%) said that quality was sometimes important to them, and 5 (16.1%) said that quality was unimportant. Of the sample, 6 (19.4%) had completed high school, 14 (45.2%) earned some college credit, 7 (22.6%) had earned a bachelor’s degree, and 4 (12.9%) reported having a graduate or professional degree.

The participants reported how much they currently wrote by hand: less than 25% (25.8%), 25–50% (25.8%), 50–75% (32.3%), and more than 75% (16.1%) of writing was still done by hand. As expected, the scores for dominant hand and dominant hand stabilized were the highest with the scores progressively decreasing with each subsequent condition (Table 1). Across all five conditions, means ranged from 5.00 (dominant hand) to 2.73 (foot) with a total mean of 4.22. The most legible condition, not surprisingly, was dominant hand, with all participants receiving a “5” for readability.

Although scores for conditions 1 and 2 were nearly identical, writing legibility degraded rapidly across the remaining conditions.

**Table 1** Means and standard deviations for each condition

Variables	Means SD±
Dominant hand	5.00 (0.00)
Rigid wrist	4.96 (0.18)
Non-dominant hand	4.77 (0.49)
Mouth	3.61 (0.92)
Foot	2.74 (1.18)

A repeated measures ANOVA for the five conditions resulted in statistically significant differences ( $F(4, 120) = 72.127, p < 0.001$ ) among the conditions. A Newman-Keuls post hoc test indicated that, with the exception of rigid wrist and dominant handwriting, all subsequent combinations were significantly different, with the combination of dominant hand and non-dominant hand and the combination of rigid wrist and non-dominant hand reaching significance at  $p < 0.05$  (Table 2). No significant difference ( $p = 0.22$ ) was found between handwriting quality and age group.

**Table 2** Results of repeated measures ANOVA for each combination of dependent variables

Variables	Means SD±	df	P value
Dominant hand	5.00 (0.00)	54	0.321
Rigid wrist	4.96 (0.18)		
Dominant hand Non-dominant hand	5.00 (0.00) 4.77 (0.49)	54	0.014*
Dominant hand Mouth	5.00 (0.00) 3.61 (0.92)	54	< 0.001**
Dominant hand Foot	5.00 (0.00) 2.74 (1.18)	54	< 0.001**
Non-dominant hand Rigid wrist	4.77 (0.49) 4.96 (0.18)	54	0.045*
Non-dominant hand Mouth	4.77 (0.48) 3.61 (0.92)	54	< 0.001**
Non-dominant hand Foot	4.77 (0.48) 2.39	54	< 0.001**
Rigid wrist Mouth	4.96 (0.18) 3.61 (0.92)	54	< 0.001**
Rigid wrist Foot	4.96 (0.18) 2.39 (2.74)	54	< 0.001**
Foot Mouth	2.39 (2.74) 3.61 (0.92)	54	< 0.001**

\* $p < 0.05$ , \*\* $p < 0.01$

The researchers computed correlations to determine whether any variables were related to writing quality. When comparing handwriting quality of those who wrote in cursive ( $n = 8$ ) or print ( $n = 23$ ), the researchers found there was no statistically significant relationship between the two ( $p = 0.126$ ) (Table 3).

**Table 3** Spearman rank order correlations by dependent variable

Variable	Rigid Wrist	Non Dominant	Mouth	Foot
Rigid Wrist	1.000	0.356*	-0.078	0.273
Non Dominant	0.356*	1.000	0.094	0.237
Mouth	-0.078	0.094	1.000	0.426*
Foot	0.273	0.273	0.426*	1.000

\* $p < 0.05$

## DISCUSSION

The purpose of this study was to determine whether 1) adults have a GMP for writing with different effectors, and 2) if mature adults' and young adults' writing patterns differ in quality, independent of effector. We determined from the repeated measures ANOVA that the quality of mouth writing and foot writing was significantly poorer than the other conditions. Additionally, statistical analysis revealed that mature adults' and young adults' writing patterns did not differ in quality independent of effector. In spite of taking into account numerous variables that could potentially influence the quality of writing, the authors were unable to find any variables that accounted for differences in writing quality across the five conditions. All foot and mouth samples were inferior in quality and legibility to the preferred hand samples, both visually and statistically.

The original source of the sample in the motor learning textbook (Raibert, 1977), was a paper generated in 1976 while Raibert was a doctoral student in the Artificial Intelligence Laboratory at MIT, and presented the results of one person (Raibert, 1976). The paper related to computer programming for a robotic arm, and how that could be accomplished. The sample was again included in his dissertation the following year (Raibert, 1977). Richard Schmidt (1991) included the sample in each of the six editions of *Motor Learning and Performance*. The task does not seem to have been replicated until now.

Samples from conditions 1, 2, and 3 demonstrated the same GMP with respect to size. However, following condition 1, samples in each of the conditions typically became larger, to the point where condition 5 often took more than one page for each of the three trials.

Examination of our writing samples provides support for and against GMPs for writing. It may be argued that the individuals with the best writing showed a GMP, because all of the conditions appeared to be from the same person – the style and shape of the letters were clearly similar, although the size of the letters and variability increased with each condition. However, the vast majority of the participants' attempts on conditions 3, 4, and 5 were vastly inferior to conditions 1 and 2. When observing

the majority of our samples, not only were the letters illegible, but there was no consistent spacing, style, or construction of letters. Without knowing ahead of time what was written, it would be improbable for a reader to be able to decipher the sentence in the last two conditions. If the samples are illegible, they probably cannot be part of a GMP, concluding that writing may not be a GMP for most people. Although many of the samples received acceptable scores, writing for the fourth and fifth conditions were clearly and conclusively inferior to Raibert's sample. Most of the samples of the last two conditions were more than double or triple the size, and had altered spacing and forms from the first three conditions.

Sülzenbrück, Hegele, Rinkenauer and Heuer (2011) hypothesized that people who spend more time using a computer, therefore practicing their handwriting less, have less precision in their handwriting. Evaluation of participants in the current study who completed 50% or more of their writing using a computer did not confirm this conclusion. When evaluating the differences between those who did the majority of writing by hand and those who did not, no significant difference in overall quality appeared.

During the scoring process, researchers were aware of the identity of the letters. This allowed for an increase in likelihood that the letters would be recognizable (ex. looking for an "M" at the beginning of "Motor learning is fun."). More conservative scores would have resulted if the samples had been graded by someone who did not know which letters to look for. In this instance, the researchers were trying to generate the best scores possible in order to show any real differences between the groups and Raibert's sample. Statistical analysis of handwriting samples strengthened the current study. Aside from, Sülzenbrück, Hegele, Rinkenauer and Heuer (2011), most researchers have not employed statistical analysis for handwriting.

Because the results of this study were so dissimilar those of Raibert (1976, 1977), these authors suggest that practice is required to attain competence in foot writing. Some have accomplished foot dexterity in the absence of arms, a prime example being Christy Brown, Irish author and painter with cerebral palsy who wrote and painted with his left foot (later made into a movie called "My Left Foot"), or mouth dexterity in the absence of arm or foot functionality (Nonaka, 2013). However, we disagree with the notion that effector independence is automatic, as Raibert appeared to believe, and as Schmidt and co-authors have continued to suggest in all editions of *Motor Learning and Performance* (1991, 2000, 2004, 2008, 2014).

As to the second hypothesis, the authors cannot confirm that mature individuals have a GMP for writing, as Lee suggested (T. Lee, personal communication, September 25, 2008), because mature adults' attempts were as uncontrolled and illegible as younger adults' for mouthwriting and footwriting. It appears that handwriting may be or may have become an especial skill (Keetch, Schmidt, Lee, & Young, 2005) for all adults, suggested by Tim Lee (T. Lee, personal communications, September 25, 2008), as opposed to a GMP, as suggested by authors of motor learning textbooks.

Suddath (2009) suggested that using keyboards may cause a general loss of handwriting skills. Sülzenbrück et al. (2011) further reinforced the idea that mature adults performed better at a fine motor task with a pen than younger individuals, although on most skills, mature adults do not perform as well as young ones. Researchers have found that learning to write with novel effectors can be accomplished in a relatively short period of time (Schmidt, 1991; Schmidt & Lee, 2014). In another case, after

25 years, a person who did calligraphy by mouth was able to achieve master level (Nonaka, 2013).

In any case, samples from a total of three participants in 1942 and 1976 being held up as a GMP deserve to be examined, as good science would demand. Based on results from 31 participants, these investigators suggest a GMP for writing with different effectors does not exist.

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# Development of the Young Men's and Women's Christian Associations (YMCA and YWCA) in Czechoslovakia

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## ABSTRACT

The Young Men's Christian Association (YMCA) and its later sister organization, focusing on care of girls (YWCA), have a long tradition dating back to 1844. They were targeted at young people aged between 12 and 18 years, trying to provide conditions for their overall development. In the Czech lands, the first organization was founded in 1886 as part of the Evangelical Church. In 1919, its American offshoot came to Bohemia along with returning legionnaires, and soon, a local association was formed, which was generously subsidized mainly from American sources. Many of these organizations then operated here mainly with their social and sports activities. Above all, American affiliates brought new methods of training and sports. YMCA and YWCA were abolished twice in 1943 and 1951.

## KEYWORDS

Christian movement; youth organizations; sport history; physical education; student organizations

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## INTRODUCTION

When you say YMCA, most people in the Czech Lands imagine the American YMCA, richly subsidised by its mother state and later by our own state, operating not only in the social field but also that of culture, and above all sports, bringing with it modern sport, a modern lifestyle and a modern world view. However, this is a great simplification that misses out the much older history both of the international YMCAs and of their more diverse activities. In addition to the organizations gathered in this YMCA, there were also other organizations that also considered themselves as “YMCA”, espoused its ideological basis and cooperated with each other. In addition, there were a number of other organizations that either originated in, or were inspired by, the YMCA movement. Many of them were based on the missionary

aspect of the work of Young Men's Christian Associations and worked mainly with students.

Internationally, these were mainly the British Colleges Christian Unions (BCCU), the Campus Crusade for Christ (CCC), the International Fellowship of Evangelical Students (IFES), the National Association of Evangelicals (NAE) and in particular the World Students' Christian Federation (WSCF), represented here by the Academic YMCA (AY). The World Council of Churches<sup>1</sup> and the International Federation of Democratic Women<sup>2</sup> emerged from this environment; the Czechoslovak YMCA and YWCA were also members of these. All these organizations were interconnected ideologically, and often in personnel terms, and worked closely together. International relations established with these associations were used by Czechoslovakia after 1950 to operate on the international scene even after the abolition of the YMCA and YWCA.

In the Czech environment, these were mainly organizations connected to the Evangelical Church of the Czech Brethren, such as the Czech Brethren Evangelical Youth Union (SČME), the Slovak Evangelical Youth Association (SEM) or the Chelčický Youth Union. Among the student organizations are mainly the Czechoslovak Students Revival Movement, the predecessor of the Academic YMCA, which also acknowledged allegiance to the World Student Christian Federation (WSCF), and associations linked to it.

In inter-war Czechoslovakia YMCA and YWCA played an important role mainly in the field of sports and youth education. They contributed to building of new sport facilities, improvement of new training methods and general youth education through sports. In many sport disciplines their clubs here managed to keep an outstanding position and even got to Czechoslovak top. They have introduced new kinds of sports such as basketball and volleyball and organized summer camps of youth with physical education in nature.

### **Archive documents and literature about YMCA and YWCA**

The present study relies mainly on materials stored in the National Archives and the Prague City Archives. Its aim is to provide basic information on the available material, pointing out its possibilities and the basic characteristics of organizations that identified as part of the YMCA movement and whose materials could be traced. Both archives whose materials were used, i.e. the National Archive of the Czech Republic and the Prague City Archive, are important in this regard because they store the materials of the central bodies of organizations that operate nationwide. In the case of the National Archive this is because it is within its competence as defined in law, in the case of the Prague City Archive it is because most of the central bodies operating nationwide in the Czech Lands were based in Prague. Only a few Czech-German organizations in the inter-war period had their headquarters elsewhere, mostly in Liberec. However, there were exceptions.<sup>3</sup>

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<sup>1</sup> World Council of Churches (WCC).

<sup>2</sup> Fédération démocratique internationale des femmes, FDIF – a federation linking together women's organizations in the struggle for peace and equality. Est. 1945 in Paris; headquartered since 1948 in Berlin.

<sup>3</sup> For example, the headquarters of the German National Social Youth was based in Ústí nad Labem.

Both archives contain two basic types of materials related to association activities. Above all, these are the associations' own materials as preserved. However, due to persecution during the Second World War and the changes following 1948, this material tends to be incomplete, indeed only rudimentary. The same applies to the collections of the national Czechoslovak YMCA headquarters<sup>4</sup> and the YWCA Revival Movement of Czechoslovak Young Women, the female equivalent of the male Christian movement. Only the rump of two branches has been preserved in the Prague City Archive. On the other hand, the Prague City Archive stores materials kept by the authorities in respect of the associations.

The Association Act of 15 November 1867, "On the Right of Association", renewed by Decree of the President of the Republic of 25 September 1945 No. 81, "On Certain Measures in the Federal Area", imposed on newly established associations the duty of declaring to the provincial police authorities their name, purpose, articles of association, method of financing and members of the Board of Directors. The supervising authority was the district governor's office. In statutory cities, this function was performed by the municipal town hall.

The Prague City Archive stores the files of all the main YMCA associations.<sup>5</sup> They contain basic data mainly on their origin and termination. A file usually begins with the notification of the constituent meeting and the articles of association as sent. Given that under the law the competent authority did not actually approve the establishment and articles of association, but only had the power to prohibit them, there is usually a formula that the competent authority, such as the Regional Political Administration, does not ban or prohibit the association. The file also contains notifications of all important events and the holding of general meetings. After each general meeting, an association announced a list of committee members with their functions, profession and place of residence. In some cases, police reports on the holding of certain events and the required political assessment of individual officials are also kept in the files. A file closes with the termination of the activities of an association, the decision on the settlement of assets and deletion from the Associations Cadastre.

Remnants of YMCA and YWCA registries are then stored in the National Archive.<sup>6</sup> This is unprocessed material from 1919 to 1951 and 2003 respectively. Only provisional inventories from the 1950s and early 1960s have been compiled for these collections. The material is rudimentary, with most of it preserved from the period after 1945. The preserved collections include, in addition to brochures, almanacs and promotional materials, mainly annual reports, meeting minutes, budgets and financial reports, branch materials, inventories, circulars, guidelines and personnel files. Of particular interest are documents relating to foreign contacts, reports of war damage and domestic and foreign subsidies.

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<sup>4</sup> Czech official translation "Young Men's Christian Association".

<sup>5</sup> City of Prague Archive (AMP), NAD 5/1 Prague City Hall II., Associations Cadastre (SK), file class marks II/35 Christlicher Verein deutscher junger Männer in Prague, II/97 Christian Youth Association in Bohemia, II/154 Christian Youth Association of the Unity of Brethren, II/330 Czech Brother, Christian Youth Association in Prague, II/511 YMCA, II/534 YWCA, II/840 Prague YMCA, X /352 Academic YMCA and XXVII/78 "Blahoslav" Young Men's Christian Association in Bohemia.

<sup>6</sup> National Archive (NA), NAD 491 YMCA and NAD 626 YWCA collections.

There is little professional literature dealing with these materials. Until recently, there have been only a few references in works dealing with wider topics.<sup>7</sup> Recently, however, there have been works attempting to map the history of Czechoslovak YMCA organizations.<sup>8</sup> Memoir literature on this topic is not very numerous, but there are still significant works to be found. These include in particular the memoirs of Václav Havel, father of the later post-November president, who met with representatives of the YMCA as early as 1920 when chairman of the Union of Czechoslovak Students and then worked in the leading bodies of YMCA from its beginnings to its end in 1951.<sup>9</sup>

A second important book of memoirs is that by Josef First entitled *Shorter and Longer Paths*.<sup>10</sup> Joe First was an important figure in the Czechoslovak YMCA. He worked there since its military beginnings, was sent to a sports school in Springfield, USA, and attended American camps there. There he also met the chairman of US summer camp directors, H. G. Gibson. He took advantage of his experience as the manager of the summer camp in Soběšín, one of the most important YMCA camps. He was also the CFO of YMCA until the end.<sup>11</sup> He and the secretary and later director of Prague YMCA F. M. Marek, also a graduate of the Springfield School, were prominent figures in inter-war Czechoslovak sport.

The rest of the YMCA literature is almanacs and promotional brochures from the time of the YMCA's activities. In particular, the titles "What the YMCA is and what it wants in Czechoslovakia", "YMCA in its first decade 1921–1931"<sup>12</sup> or "Where to go during the holidays".<sup>13</sup>

### **Establishment of youth organizations in the middle of the 19th century**

The emergence of extracurricular youth organizations in the first decades of the twentieth century was the culmination of a long-term process that began in the middle of

<sup>7</sup> E.g. Kössl, J., Štumbauer, J., Waic, M. *Selected Chapters from the History of Physical Culture*. Textbook from Prague: Karolinum, 2004, 137 p.

<sup>8</sup> Helga Černá, *YMCA as a centre for the education of youth in Czechoslovakia 1919–1951*. Master's thesis. Faculty of Arts, Institute of History. České Budějovice: University of South Bohemia in České Budějovice, 2009, 112 p.; Tomáš Tlustý, *The Building of national YMCA organizations in Czechoslovakia and Poland. Development of physical culture from 1918 to 1939*. Prague: Karolinum, 2017; Aleš Rosický, *Christian student movements in the 20th century*. Bachelor's thesis. Department of Church History, Protestant Theological Faculty. Prague: Charles University Prague, 2015, 85 p.

<sup>9</sup> V. M. Havel, *My Memories*. Publ. Lidové noviny, Prague, 1993. 462 p. In addition, he was a founding member of the Revival Movement of Czechoslovak Students, which was considered part of the World Christian Student Federation (WSCF), and which was later incorporated in the Academic YMCA, which took its place on the international scene. It also reveals the interconnection of these organizations, the impact they had on each other, their joint projects and ties.

<sup>10</sup> Josef A. First, *Shorter and Longer Paths*. Eknih. Beroun: nakl. Machart, 2012.

<sup>11</sup> As for sport, he was, among other things, an excellent archer and was one of the first in our country to write a handbook about this sport. Cf. J. A. First, *Archery*. YMCA, Prague, 1929.

<sup>12</sup> *What the YMCA is and what it wants in Czechoslovakia*. YMCA, Prague; *YMCA in its first decade 1921–1931*. YMCA, Prague.

<sup>13</sup> *Where to go during the holidays*. YMCA, Prague, 1936.

the previous century.<sup>14</sup> At its beginnings there was the deteriorating social position of young apprentices and workers in the period of the so-called industrial revolution, when large factory zones were created in which people lost any direct contact with nature. The unhealthy environment of the emerging large industrial agglomerations had a tragic impact on children in particular. Apart from living conditions, the breakdown of family ties also had a negative effect. In this situation, the first attempts were made to organize the free time of young people, albeit initially as a philanthropic activity. The establishment of the YMCA was thus directly related to the social and welfare situation of the time. It is no coincidence that in the Catholic environment a similar organization was established in northern Italy, which was a centre of the emerging industrial society similar to Britain.

In 1841 Don Bosko founded an oratory in Turin.<sup>15</sup> He gathered around him poor working boys for whom he created a programme for Sunday, their only day off. After mass and Sunday school of course, he led them out on walks. They walked over hills, along rivers, visiting churches of the Virgin Mary. After a few years, several hundred boys regularly attended the oratory. He obtained a permanent residence for it with a free plot of land for games. Here he built a church, boarding dormitory and workshops. He founded other oratories with the same success. In 1859 the Society of St Francis de Sales was founded, which was to continue his work. Many later Salesians were also involved in scouting.<sup>16</sup>

Similarly, in 1844 George Williams founded the Young Men's Christian Association (YMCA) in England. Their goal was to live according to the gospel. The founder wanted to lead young men to faith as opposed to a destructive lifestyle, thus avoiding the pitfalls of developing capitalism (crime, alcoholism, etc.) in the rapidly industrializing and dehumanizing cities. The aim of the new organization was to improve the spiritual state of young people involved in corporate business through the creation of Bible courses, family and social prayer meetings.<sup>17</sup> From the beginning, the emphasis was on education, improving social conditions, meaningful use of leisure time, and the development of someone's entire personality. The YMCA created an environment which

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<sup>14</sup> Until 1908, there was a strict ban on assembly of school youth in the Austrian monarchy. Only school-related activities under the guidance of the relevant teachers were allowed. All other associations with youth care in their remit were primarily charitable. There may have been individual experiments with the activities of the so-called boys' clubs dealing with pre-military education, but these were not on a larger scale. Under the influence of the spread of English scouting of the Baden-Powell type, in 1909 the government established a commission to assess the organization of education in boys' after-school clubs and their relationship to general and municipal schools. Based on this commission's report, the aforementioned ban was rescinded, thus enabling the development of the youth movement. As a result, a number of organizations such as Wandervogel, Pfadfinder and the Czech scouting organizations such as Junák, Psohlavci, Children of Živěna and others arise in Bohemia. After the First World War, these organizations boomed. See Tomáš Jelínek, *The Beginnings of "Nature Education" in Bohemia*. In: *Yearbook of the ABS Scout Institute 2007–2008*, pp. 29–61.

<sup>15</sup> Jan Bosco,\* 16 August 1815 in Becchi near Turin, 31 January 1888 Turin. Catholic priest, founder of the Order of Salesians. Beatified in 1934.

<sup>16</sup> Teresio Bosco, Don Bosko. Rome, 1989, 427 p.

<sup>17</sup> YMCA Internacional – World Alliance of YMCAs. History [online]. 2013; Aleš Rosický, op. cit., p. 16.

succeeded in combining aspects that were both purely Christian and also universally shared by different cultures around the world. This environment arose because the YMCA's representatives wanted to promote tolerance, fraternity and openness instead of clear dogma. The movement sought to foster the harmonious development of all aspects of the personality, i.e. reason, body and spirit. This pattern was apparently derived from the teaching on the Trinity, and a triangle is also part of the YMCA logo. Because the YMCA avoided being incorporated into theology or the ideological tradition of Christian churches or movements, a universalism began to emerge in it that was increasingly well received. It tried to create an alternative environment and encourage participation in discussion. Its work was supposed to be not only in the social, but also in the civic-political and cultural fields. There is a rule within the YMCA that each national YMCA has responsibility for another national YMCA. The American YMCA had the Czechoslovak YMCA under its patronage.<sup>18</sup>

In 1851, the YMCA was established in Canada and the USA, and then spread to Scotland, Ireland, India, Australia, Ceylon, New Zealand and South Africa. The first association on the continent of Europe was established in 1852 in France.<sup>19</sup> Creating a global movement with an international headquarters was the idea of Henry Dunant, Secretary of the YMCA in Geneva.<sup>20</sup> The first YMCA World Conference was held in August 1855. It was attended by 99 delegates from 9 countries. The conference passed a resolution adopting the Paris Basis for the Mission of the YMCA. An international commission was formed, which in 1878 received its own headquarters located in Geneva. At that time, the organization began to be called the World Alliance of YMCA's. The so-called Paris Basis gives YMCA organisations a clearly defined mission, to which all organizations associated within this world movement are committed:

“The Young Men's Christian Associations seek to unite those young men who, regarding Jesus Christ as their God and Saviour, according to the Holy Scriptures, desire to be his disciples in their faith and in their life, and to associate their efforts for the extension of his Kingdom amongst young men. Any differences of opinion on other subjects, however important in themselves, shall not interfere with the harmonious relations of the constituent members and associates of the World Alliance.”<sup>21</sup>

## Czech YMCA

The oldest “Czech YMCA” was founded in 1886 under the name Christian Youth Association in Bohemia.<sup>22</sup> At that time, YMCA was already known in Bohemia, since many Czechs, both students and apprentices, were involved in its activities in Vienna, where it had been operating since 1873. The immediate impulse for its creation was probably the visit of its founder George William to Prague in 1884 on the occasion of his travels

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<sup>18</sup> Ibid., p. 18.

<sup>19</sup> <http://hk.ymca.cz/historie.php>

<sup>20</sup> Henry Dunant, b. 8 May 1828 Geneva – d. 30 October 1910 Heiden. Swiss businessman and humanist, initiator and co-founder of International Red Cross, initiator Geneva Conventions and the first bearer of the Nobel Peace Prize from 1901.

<sup>21</sup> <http://www.ymca.cz/info-o-ymca/poslani/prizska-baze/>

<sup>22</sup> The association was recognised by the decree of the Czech governor dated 6 March 1886 No. 19.464 (2743 p.p.).

across Europe.<sup>23</sup> Those mainly involved in the foundation were Albert W. Clark, an American preacher, active at that time in Prague, and Czech preacher Alois Adlof.<sup>24</sup>

The articles of association gave Prague as its registered seat<sup>25</sup> with the purpose of the association being to:

“To bring young people up in good character and to encourage them to a true Christian life and civic integrity and to help them prepare for a useful life.”<sup>26</sup>

This means was to be achieved by organizing educational lectures, singing performances and teaching according to the needs and wishes of the members. Furthermore, association shelters, canteens, heated shelters and orphanages were to be set up. These institutions were to be accessible to all those in need, regardless of status, nationality or religion. Appropriate sections, including a women's section, were to be established for the work of the association, an association library was to be established, and the ideas of the association were also to be disseminated by publishing tracts, also including the establishment of a printing shop and bookshop. Similar philanthropic businesses were to be supported. The association was also supposed to cooperate with other associations with the same focus and also to establish its branches throughout Bohemia. In 1913 a point was added about the cultivation of physical education and camping in the wild.

The association also had in its name “Czech YMCA”, and this part of the ceased to be used when changing the articles in 1926, apparently in connection with the establishment of the so-called American YMCA in our country. This year, the Provincial Political Administration also verified the legal existence of the association.<sup>27</sup> Another change in the articles occurred just before the dissolution of the association in 1948.

From its beginning<sup>28</sup> the chairman was American preacher of the Free Reformed Church<sup>29</sup> Dr Albert W. Clark, Alois Adlof was elected secretary in 1888.<sup>30</sup> In 1917, the former vice-chair, dentist MUDr. Josef Straka became long-term chairman.<sup>31</sup> The further social composition of the committee was varied – a bookbinder, a factory worker, a dental technician, a clerk, a student, a tailor, a businessman, and of course another preacher.<sup>32</sup> In 1938, Jindřich Špaček, representative of the Bible Society was

<sup>23</sup> <http://tensingnachod.wz.cz/ymca.htm.html>

<sup>24</sup> Alois Adlof, b. 16 July 1861 in Hořice in Podkrkonoší, d. 25 March 1927 in Prague. A major preacher of the Free Reformed Church and of the Unity of Czech Brethren. Active in Prague from 1879. Involved in the founding of Czech YMCA.

<sup>25</sup> The association was based at Praha II, Soukenická 15.

<sup>26</sup> Prague City Archive (AMP), Prague II, City Hall, Association Cadastre (SK), class mark II/97.

<sup>27</sup> Provincial Political Administration, Decree dated 18 September 1926 No. 361.821 ai 26-2a-2151/1 ai 26 (15217 p II/26).

<sup>28</sup> I.e. since the introduction of the new register of the Association Cadastre. Previous data not available.

<sup>29</sup> Later the Church of the Czech Brethren.

<sup>30</sup> Alois Adlof, b. 16 July 1861 in Hořice in Podkrkonoší, d. 25 March 1927 in Prague. A preacher of the Free Reformed Church and of the Unity of Czech Brethren. Active in Prague from 1879.

<sup>31</sup> MUDr. Josef Straka, Prague VII, Strossmayerovo nam. 2.

<sup>32</sup> Secretary of the association Alois Adlof, resident at Prague II, Soukenická 15. The central treasurer of the committee also lived at the office of the association.

elected chairman,<sup>33</sup> with Dr Straka also continuing to serve as a vice-chairman on the committee. Quite new people appear on the board in 1946 – chairman Karel Toušek student of philosophy, executive Karel Sita student of theology, treasurer Vlastimil Štěrba student at the business school, and others. The only member of the board who was not a student was upholsterer Josef Jirásek, who was the librarian.<sup>34</sup>

The association decided on its dissolution at a General Meeting held on 29 December 1948. In his final speech Dr Samuel Verner briefly described the history of the association from its inception to its end. He emphasized that the association was actually from the beginning part and a section of the Church of the Czech Brethren in Prague II and was therefore a church organization. He stated that the dissolution of the association was in keeping with the contemporary organization of society, which had to be respected following the events of February (1948). Furthermore, the attendees resolved that all the association property would go to the Church of the Unity of the Czech Brethren. The present acting vice-chairman of the Council of the Czech Brethren Unity then assured the General Meeting that the transferred property would serve exclusively Christian purposes, and especially the bookstore. The publishing house should continue to publish exclusively ecclesiastical works.

In the 1890s, a number of branches were established following the Prague model, for example in Plzeň, Brno and Čáslav. However, a larger expansion was prevented, inter alia, by the strict rules of the association life, which forbade dancing, amateur theatre, visits to rural festivals, fairs, trips and, of course, visits to inns. After 1898, however, there was a turnaround, and the whole concept of youth work started to accommodate the situation and needs of the times and of the Church.<sup>35</sup>

We know practically nothing about the association's own activities, because its materials have not been preserved in the main archives. Only under the name YMCA Praha-Liběchov<sup>36</sup> has a manuscript entitled "Working with Working Youth (Arbeit unter Arbeiterjugend)" been retained in the Prague City Archive. It is a typewritten German text arising from the work of a committee at the YMCA International Meeting in Geneva in 1926. The document was based on a meeting of delegates from 50 countries around the world working on this topic. The typescript material was intended for possible publication. The foreword was written by Basil Mathews, a prominent official of YMCA and WSCF. In particular, the work characterizes the position of young working people on the various continents, emphasizing their diversity, and therefore the need for an individual approach in individual cases. It describes the organization and possible methods for work with young people. Examples include setting up libraries, organizing bible lessons and study courses, teaching foreign languages, organiz-

<sup>33</sup> Jindřich Špaček, resident at Prague XVI – Dejvice, Soborská 18.

<sup>34</sup> Composition of the committee elected on 29 March 1946:

Chairman: Karel Toušek, student of philosophy, Prague II, Soukenická 15.

Executive: Karel Sita, student of theology, Prague-Hloubětín, Za horou 9.

Treasurer: Vlastimil Štěrba, student of commerce, Prague II, Soukenicka 15.

Minute taker: Miroslav Valach, technical student, Prague II, Soukenická 15.

Room manager: Jan Laznický, student of medicine, Prague XIX, Na Piavě 13.

Librarian: Josef Jirásek, upholsterer, Prague XI, Grégrova 23.

<sup>35</sup> <http://tensingnachod.wz.cz/ymca.htm.html>

<sup>36</sup> Prague City Archive (AMP), NAD collection No. 2256.



ing literary societies and craft courses, conducting music activities, setting up chess, photo, scouting and other clubs. Among sports activities mentioned the main ones are football, cycling, boxing, swimming, athletics and hiking. In summer weekend trips, summer camps and long-distance trips were to be organized. The conclusion of the work focuses on the German *länder*.

Material has survived from only two of the branches of the Christian Youth Association. Unfortunately, this is again material from the Associations Cadastre, which mainly concerns official announcements of the associations.<sup>37</sup> The "Blahoslav" Christian Young Men's Association in Bohemia was founded in 1893 and was not forbidden by Governor's Decree No. 33,139 of 1893. According to its articles, the association was based in Královské Vinohrady and its purpose was to cultivate the evangelical-Christian life and the provision of charitable works. The association intended to achieve this by organizing lectures, social events and trips. Furthermore, a library was to be established, educational writings were to be published, and the association was supposed to provide members with an opportunity to be educated in the knowledge of the Holy Scriptures, in singing, in foreign languages, and so on. Ludvík Bohumil Kašpar, a Protestant reform pastor, as chairman and Josef Šimša, a Protestant reform vicar, as church leaders, were on the association board. Other members of the committee were František Polák, a railways clerk, and Antonín Auervek, a bookstore assistant. All were residents of Královské Vinohrady. By letter dated 7 December 1922, the Association informed the authorities that it had broken up during the war and that a church youth association had been formed following its demise, which had not worked according in line with the law on associations.

Christian Youth Association of the Czech Unity of Brethren Prague XVI – Smíchov served as a branch of the Christian Youth Association in Bohemia. The association was not forbidden by Governor's Decree No. 24,876 of 28 February 1896 (3464 p.p.) under the name of the Branch of the Christian Youth Association in Bohemia. In 1925 it was renamed the "Christian Youth Association" of the Unity of the Czech Brethren. Its purpose was initially to cultivate and disseminate humanity and education, to support the poor and further to educate young people in character and to encourage them to live a Christian and civic life of integrity and to help prepare them for a useful life. Otherwise, the purpose of the association and its articles were based on those of the parent association.<sup>38</sup> The association was again chaired by Dr A. W. Clark, preacher. After him, preacher Pavel Zelinka was elected chairman; he held this position until 1935. Other members of the association came more from the lower social strata – a shoemaker, pharmacist, plumber, worker and business assistant. From 1915 and 1917 the association was monitored by the police and the files contain police reports on the course of general meetings. It was stressed that no foreigners were present at the meetings.

From 1922, the association also had a women's section, chaired by the preacher's spouse Anna Zelinková. In 1936, the preacher P. Zelinka was replaced by Josef Cvrček, also a preacher, who led the association through the war years until 1944, when Timoteus Zelinka was elected. However, in October of the following year,

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<sup>37</sup> AMP, Prague II, City Hall, SK II/154 Christian Youth Association of the Unity of Czech Brethren Prague XVI – Smíchov; SK XXII/78 "Blahoslav" Christian youth community in Bohemia.

<sup>38</sup> I.e. Prague City Archive, Prague II, Town Hall, SK II/97.

Josef Cvrček once more returned to the chair. In 1948 the association formed its own action committee,<sup>39</sup> however soon, on 12 January 1949, at an extraordinary general meeting, at the recommendation of the senior body of the Union of Christian Youth Associations (the Unity of Czech Brethren), the association terminated its activities and dispersed. One of the reasons for the break-up was that three-quarters of the members were over the age of 25, so joining the Czech Youth Union<sup>40</sup> was out of the question. Thanks to its fifty-year tradition, there were a number of fifty-, sixty- and seventy-year olds in the association. One lady member was as much as 91 years old.

The last association of this type was the “Czech Brother”, a Christian youth association in Bohemia.<sup>41</sup> The association was founded in 1913 at Vyšehrad.<sup>42</sup> Most of its members lived either in Vratislavova or Halkova Street. Only the chairman, a postman by profession, lived in Prague IV in Pohořelec. The purpose of the association was to cultivate and spread a life in the spirit of Christianity and to show charity. The association was to organize meetings, public lectures, social events and entertainments and excursions in keeping with the Christian spirit. Furthermore, an association library was to be set up, educational writings were to be published, Bible study hours and singing and language courses were organized. Charitable activities were also to be cultivated. By letter dated 15 April 1924, the police directorate was informed that the association was dissolved in 1920 through the founding of the “Czech Brother” association, a youth centre of the Unity of Brethren in Bohemia.

The Christian Young Germans’ Association in Prague,<sup>43</sup> founded in 1902, can be considered a typical German representative of this kind of association.<sup>44</sup> In 1914 and 1915 it was investigated and kept under surveillance by the police. One result was the expulsion of its preacher L.R. Kiepe<sup>45</sup> from Austria.<sup>46</sup> Anna Hauschild, who was a missionary, was expelled with him. One of the probable reasons was the discovery of brochures critical of the Catholic Church and the Papacy.

The chairman of the association was parish priest Dr Robert Zilchert.<sup>47</sup> Other members of the committee were more middle class.<sup>48</sup> From 1927, Richard Klier was in the

<sup>39</sup> Its members were:

Jan Cvrček – clerk,  
František Bednář – joiner,  
Josef Hala – bank manager.

<sup>40</sup> The Union of Czech Youth (SČM) was active from 1945 to 1949 and was supposed to bring together young people aged 14 to 29 years. On 23 April 1949 it was replaced by the Czechoslovak Youth Union (ČSM) at a merger conference.

<sup>41</sup> Prague City Archive, Prague II, Town Hall, SK II/330.

<sup>42</sup> The association was not prohibited by the governor’s decree of 4 May 1913 No. 8A 1314/116.147 ai 1913.

<sup>43</sup> AMP, Prague II, Town Hall, SK I/35 Christlicher Verein, deutscher junger Männer in Prag.

<sup>44</sup> The association was not prohibited by the governor’s decree of 15 December 1902 No. 255,003 (20015 pp).

<sup>45</sup> Ludwig Rudolf Kiepe, b. 11. 11. 1886. 7th Day Adventist preacher, living in Liberec, Lange Str. 16, married, native of Höringhausen, Frankenberg region, Hesse-Nasau.

<sup>46</sup> Decision of the Governor dated 27 June 1915 ref. no. Z1 2309.

<sup>47</sup> Dr. Robert Zilchert, Praha II, Gerbergasse 13.

<sup>48</sup> The committee elected in 1924 consisted of: Dr. Johannes Pfeifer – vicar, Max Weigelt – clerk, Karl Reiman – clerk, Heinz Tasler – bookseller, Anton Wirth – chief postal controller,

chair. A few years later, the association broke up at an extraordinary meeting held on 1 June 1933. The meeting was held in the building of the German Evangelical Community in Prague II, V Jirchářích 13. As the reason for the dissolution given in the notice to the police directorate it states that the association was breaking up due to lack of interest and the moving away of the majority of its members.<sup>49</sup>

The most famous in the Czech Lands is the so-called American YMCA, which came here together with the legionnaire units after the First World War. Even this was actually a set of organizations, the most important of which was the central headquarters of YMCA, then the Prague YMCA, student Academic YMCA, which was preceded by the Association of the Revival Movement of Czechoslovak Students, and of course its female counterpart YWCA. Materials for these organizations are found mainly in the National Archive,<sup>50</sup> where the preserved remains of the YMCA and YWCA registries are kept. Other important documents can be found in the Prague City Archive in the Associations Cadastre.<sup>51</sup>

### The YMCA in Czechoslovakia

After a phase of being active within the army, the YMCA civil organization was founded in 1921, when its establishment was acknowledged by Decree of the Ministry of the Interior dated 22 March 1921 No. 21,387/6-21 and Decree of the Provincial Political Administration of 26 April 1921 No. 2-A-3008-135-045 (11,302 p. II)<sup>52</sup> under the name Czechoslovak YMCA, in Czech Křesťanské sdružení mladých mužů. In addition, American YMCA was supplied on letterhead. In 1923 this name was<sup>53</sup> changed to YMCA in Czechoslovakia and later in 1939 to Christian Youth Association (KSML),<sup>54</sup> which it then used until its demise in 1951.

The purpose of the association was to create a number of centres throughout the country to implement a four-fold programme for practical life, in terms of the physical, mental, moral and social, aimed at improving men and preparing them for the higher ideal of a selfless citizen with developed social feeling and a world outlook. This care was to include all men, young men and boys, regardless of status, employment, nationality, political beliefs, religion or confession. The association claimed itself to be international, non-political and non-denominational. The Czechoslovak YMCA was to apply the social principles of Christ contained in the New Testament in every city and village, referring to the legacy of J. Hus and J. A. Comenius as the source of the moral

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Eduard Pilz – bank clerk, Rudolf Effenberger – clerk, Julius Kötritzsch – clerk, Heinrich Frank – teacher.

<sup>49</sup> The notice of dissolution was published in the Official Gazette on 4 June 1933.

<sup>50</sup> National Archive, collection NAD No. 491 YMCA, collection NAD No. 410 YWCA.

<sup>51</sup> Prague City Archive, Prague II, Town Hall, SK II/15 YMCA, SK X/226 Revival Movement of Czechoslovak Students, SK II/534 YWCA, SK II/840 Prague YMCA, SK X/352 Academic YMCA.

<sup>52</sup> The legal existence of the association was verified by the Ministry of the Interior on 12 October 1921 No. 75,289/6/21 (19,737 p. II).

<sup>53</sup> Amendment to the Articles of Association acknowledged by Decree of the Ministry of the Interior dated 14 February 1923 No. 8082/6-1923.

<sup>54</sup> The amendment to the Articles of Association was not prohibited by the Decree of the Ministry of the Interior dated 8 November 1939 No. 57,892/1939-6.

and spiritual power needed to realize these principles in the lives of individuals and nations. The association took up its work with a lively faith in God and in the brotherhood of all people proclaimed by God on earth. The intention to remain in close and beneficial contact with the World YMCA and to form part of that federation was also stated in the introduction to the articles.

As part of its activities, the Czechoslovak YMCA was to build community centres, preferably in its own buildings or in rented buildings and rooms. Furthermore, clubs, games rooms, singing rooms, writing studios, libraries, reading rooms and study rooms were to be established. Theatre was to be cultivated and educational lectures, academies, concerts, and film performances organized. Evening schools were to operate as part of the association, where principally languages and professional subjects such as accounting, etc., were to be taught. The religious nature of the association was shown mainly in the organization of Bible study hours and in its selection of magazine, book and brochure subscriptions.

Concerning entertainment, singing, music and especially sport were to be cultivated along with camping and outdoor activities. For these reasons, pools, gymnasiums and bathrooms were also to be housed in association buildings. Playgrounds were to be set up for younger children.

The association was also to help mediate work and to build dormitories and canteens. Association cafés and restaurants were supposed to be cheap and alcohol-free. The revenue should only be such that expenditure was covered at least in part. Young volunteers were to assist in the implementation of the programme.

The list of committee members elected in 1921 was truly impressive:

Chairperson: PhDr. František Drtina – university professor.

Vice-chairman: PhDr. Emanuel Rádl – university professor.

Members: Jan Hála – member of Prague City Council; Appolo Růžička – Chief Executive Officer of Živnostenská banka; Anton Štefánek – Ministerial Council; MUDr. Vavro Šrobár – MP and minister; JUDr. František Veselý – senator and attorney; Silvestr Voda – Chairman of the Red Cross.

Another important function was held by the National Director, who was in charge of the entire central agenda of the Czechoslovak YMCA, handled ordinary correspondence, prepared and implemented the Central Committee resolutions, organized and managed the implementation of the YMCA's ideological programme and practical activities by local YMCA associations, and was supposed to support their work by counsel and in deed. This position could also be remunerated. The salary and the service conditions were set by the Central Committee. Due to the massive subsidies for building of the facilities<sup>55</sup> and because of their own work, Americans were appointed as the first national directors. In the 1920s WW Gethmann and Howard B. Durke

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<sup>55</sup> In the first two years alone, the American YMCA invested US \$ 100,000 in this country. The last big action of the Americans in this country was the building of the Na Poříčí headquarters, to which they donated \$ 800,000.

Helga Černá, op. cit., p. 39.

Václav Havel, op. cit., p. 203.

alternated in this position.<sup>56</sup> Ing. Václav Havel was the first Czech in this post from 1927 to 1931, and was in turn replaced by the American Joseph John Sommerville.<sup>57</sup> Czechs as national directors only appeared at the end of the thirties, when, due to political and wartime events, personnel changes also occurred in many other organizations.<sup>58</sup> In 1945, the YMCA secretary Václav Velkoborský was elected director; he was replaced by Jiří Horyna in 1947.<sup>59</sup> The last director was Ladislav Hejránek.

YMCA also had its German section, represented by four members on the Central Committee.<sup>60</sup>

During its existence in the Czech Lands, YMCA was investigated twice for its state, political and national reliability. The first time was in 1930, mainly in connection with the activities of the Liberec branch. The investigation mainly concerned the leaders of the association. On chairman E. Radl the report states that he is a member of the "Human Rights" and "Aufruf" associations, vice-chairman of the "Böhmisch-mährisch-schlesischer Verband für Förderung des nationalen Friedens", vice-chairman of the Chelčický Peace Society and member of other cultural and humane corporations. YMCA vice-chairman Bedřich Jerie<sup>61</sup> is characterized as a nationally aware person who does not participate in politics. Of central director Ing. Václav Havel it writes that he is a functionary of the Ethical Movement of Czechoslovak Students and a supporter of various physical education and cultural associations. Politically, he apparently does not appear in public and, according to confidential information, is an adherent to the direction of progressive parties. There is also a note that he is entered in the register of political problems. Most of the complaints concerned the Liberec branch, which was criticized for suppressing the Czech language. On the whole, however, nothing was found to raise doubts about political or national reliability.<sup>62</sup>

The second investigation took place in 1950. Here it is stated that the association always announces its association activity as the YMCA in Czechoslovakia and uses an association stamp with this text. It is therefore concluded that it does not operate according to the most recently approved articles,<sup>63</sup> but according to the previous articles, under which it is a member of the international YMCA headquartered in the United States and thus under the influence of a foreign organization, which could be misused

<sup>56</sup> WW Gethmann, resident at 1993-II, 1921-1924, 1925-1926; Howard B. Durke, resident at Prague IV, Badenihó 191, 1924-1925, 1926-1927.

<sup>57</sup> Joseph John Somerville, resident at Dejvice, Pelléova 29, 1931-1933; Followed by Lewis Brackett in 1933, resident at Prague VII, Čechova 15.

<sup>58</sup> The following worked in this position: Ing. Václav Havel in 1937, Ing. František Písař in 1937-1938; Dr. Miroslav Kozák in 1938-1939; Václav Velkoborský in 1939; Dr. Miroslav Kohák in 1939-1943.

<sup>59</sup> Jiří Horyna, resident at Prague II, Na Poříčí 12.

<sup>60</sup> In 1926 these were JUDr. F. L. Štěpánek, Huszt; PhC. R. Arnold, Prague, Opatovická 32; MUDr. R. Krumbholz, Znojmo and A. Lux, editor-in-chief, Liberec.

<sup>61</sup> Bedřich Jerie, b. 5. 1. 1885 Nové Veselí, d. 27. 10. 1965 Ústí n. Labem. Evangelical pastor and writer. During his time in Prague he influenced the later philosopher Ladislav Hejránek.

<sup>62</sup> Prague City Archive, Prague II, Town Hall, SK II/115.

<sup>63</sup> The 1939 articles according to which the association should use the name "Christian Youth Association" (KSML).

for anti-state activities. However, this is excluded because the organization has been under national administration since 1 April 1948. According to a query from the Ministry of the Interior, the association's action committee recommended its liquidation before the end of 1950.

The association was mainly active in the social and cultural field, with its headquarters and many of its branches having their own modern and luxuriously equipped buildings. Its work among young people and in the field of physical education and sport was particularly notable.<sup>64</sup> The YMCA was abolished for the first time in 1943; since 1940 its assets had been used by the Nazi youth organization Hitlerjugend. The Association Registry was first handed over to the Czechoslovak Youth Union, which in 1960 handed it over in turn to the State Central Archive. Despite the rump nature of the information, it is possible to form a picture of the activities of the organization in our country, its management and international relations.

The Prague YMCA<sup>65</sup> was established in 1930 as a special organization of the Prague headquarters.<sup>66</sup> Its articles were derived from those of the parent organization. The headquarters was in the headquarters building in Nove Mesto, Na Poříčí 12. Ing. Václav Havel and Ing. Václav Jelen alternated as chairman until 1941.<sup>67</sup> Then they were replaced by JUDr. Viktor Zedníček. After 1945 the lawyer Jaroslav Cebe was in this post, followed after 1946 by Bohumil Pour. After February 1948 a twelve-member action committee, led by Dr. J. Řepa, was appointed. Despite an overall positive assessment by the Central National Committee of the City of Prague, the association was liquidated in 1952.

### Academic YMCA

The Revival Movement of Czechoslovak Students<sup>68</sup> was based on the international missionary work of the YMCA and its related organizations among students. According to one of the founding members, the immediate impetus for the establishment of the organization was the speech of the President of the Republic T. G. Masaryk at the Castle on his birthday on 7 March 1920.<sup>69</sup> However, the articles of the association were initially because of some uncertainties, such as representation of the association externally, the method for electing certain bodies, etc.<sup>70</sup> Later, however, the amended articles were accepted and the existence of the association was acknowledged on

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<sup>64</sup> See aforementioned student work.

<sup>65</sup> Prague City Archive, Prague II, Town Hall, SK II/840.

<sup>66</sup> The association was not forbidden by the Decree of the Land Office dated 26. 3. 1930 No. 119,509 and 30: 9A.1100ai 30 (9553 S II/30).

<sup>67</sup> Ing. Václav Havel, resident of Prague II, Vodičkova street Lucerna in 1930–1935 and 1938–1939, 1941; Ing. Václav Jelen, Prague XIX, Nicola Tesly 17, from 1935 to 1938 and from 1939 to 1941 (he also acted as an important scout official).

<sup>68</sup> Prague City Archive, Prague II, Town Hall, SK X/266.

<sup>69</sup> The president then apparently said: "I wish we had a lot of men in all disciplines who could observe and think, and only such a 'public mafia' cooperation, I would say, will ensure successful development."

Václav Havel, op. cit., p. 128.

<sup>70</sup> Ibid., Letter of the Ministry of the Interior dated 6 June 1921 No. 42,331/1921.

27 August 1921 by the Ministry of the Interior.<sup>71</sup> At the time of its establishment, the movement had 29 registered members.

The purpose of the association was:

“To bring together Czechoslovak students, especially students and graduates of Czechoslovak universities, to work and strive for a revival of life on a religious basis.”

The movement then participated in the construction of the Na Slupi and Letná student dormitories and organized a series of lectures on political and educational topics.<sup>72</sup> The lecturers were recruited from the whole political spectrum from the left (communists, social democrats) to the right (the People's Party, the national democrats). In 1926, the association split and the more religiously oriented part joined an organization set up for this purpose, the Academic YMCA. The remainder founded the aforementioned Ethical Movement of Czechoslovak Students.<sup>73</sup>

The Academic YMCA in Czechoslovakia – the Christian Student Association (by its official name) was founded in the spring of 1927.<sup>74</sup> According to its articles of association, it was to act as a Christian academic association, which was to strive to spread Christian ideals, moral esteem and honesty in life. It was supposed to educate its members for a life in society in which there is also a place for social and global sensitivity and to care for nobility in sport and physical education. The spiritual basis was to be the same as the ideas of other Czechoslovak YMCA associations and the world YMCA. It was to take care of academics, and male and female students regardless of nationality, political beliefs and religious confession. The association was supposed to be non-political and non-denominational.

University professor J. L. Hromádka was elected chairman. He worked in this position with short breaks until 1947. The last chairman, as at the headquarters of YMCA, was Ladislav Hejdiánek.<sup>75</sup> In 1950, the association and its branches operated and cooperated with the Czechoslovak Youth Union and the bodies of the people's administration.<sup>76</sup> Its end is unclear and is not noted in the association records.

### The YWCA in Czechoslovakia

The female counterpart of the Young Men's Christian Association was the YWCA,<sup>77</sup> which had, however, a greater emphasis on social activities; the pursuit of recreational,

<sup>71</sup> Decree of the Ministry of the Interior dated 27 August 1921. The existence of the association was confirmed by Decree of the Regional Political Administration dated 22 September 1921 No. 2A 3682/3-294.536 (18.172 p. II).

<sup>72</sup> The movement was supported initially both financially and organizationally by YMCA and WSCF.

<sup>73</sup> The Association broke up by resolution of a General Meeting held on 10 July 1927. Its assets were transferred to the Academic YMCA.

<sup>74</sup> In this association also the first version of the articles was rejected for lack of clarity, this time of a political nature. The formation of the association was noted by Decree of the Ministry of the Interior dated 4 April 1927 No. 16.334/127/6, and then by Decree of the Provincial Political Administration of 19 May 1927 No. 202.513-2A-1122/1 ai 1927 (11365 p. II/27).

<sup>75</sup> Ladislav Hejdiánek, resident at Prague XII, Chodská 5.

<sup>76</sup> Prague City Archive, Prague II, Town Hall, SK X/352 Report of the District national Committee for Prague 3 Central National Committee for Prague dated 20 October 1950.

<sup>77</sup> Young Women's Christian Association.

sporting and sports activities did not play such a role in it. Its official title “Revival Movement of Czechoslovak Young Women, YWCA section”<sup>78</sup> already suggested more space for moral and humanities work and a lesser interest in natural physicality than in their male counterpart. The organization was founded almost at the same time as its male equivalent in the autumn of 1921.<sup>79</sup>

The purpose of the association under the statutes was to:

- “1. Work to consolidate the health, develop the education and refine the nature of young women, regardless of status, nationality, religious confession and political beliefs, so that they can best serve each other, their homeland and the world.
2. To raise them to an awareness of true womanhood and to teach them to work with other women to build a better social order.”

The emblem of the guild was a blue triangle with the corner turned down and a YWCA inscription ribbon. Marie Záhořová-Němcová was elected the first chairwoman.<sup>80</sup>

The association was mainly involved in building shelters for girls. For this purpose, it obtained permission for a number of collections. The German section of the organization was particularly active in this respect, receiving large subsidies from major German financial institutions such as the Böhmisches Union-Bank, the Böhmisches Es-kompte-Bank und Credit-Anstalt, the Bank für Handel und Industrie (formerly the Länderbank), the Allgemeiner Böhmischer Bank-Verein and others, such as Petschek and Co. The section acted as a club of German women and girls under the name of the “Deutscher Klub der Prager YWCA”. Its main task was to address only German sponsors. Otherwise it was controlled by the Prague YWCA, because according to the articles there could be only one YWCA in the Czechoslovak Republic.

Like the YMCA, the YWCA was abolished by decision of the Reich Protector in 1943.<sup>81</sup> In July 1945, the association resumed its activities under its 1939 name of “Christian Association of Czech Women, Headquarters in Prague”, but soon returned to its original name.

The main activity at that time was the operation of hostels for girls and social work. In this regard, the YWCA cooperated with the international CARE organiza-

<sup>78</sup> National Archive, NAD collection No. 410; Prague City Archive, Prague II, Town Hall, SK II/534.

<sup>79</sup> The first version of the articles was rejected by letter of the Ministry of the Interior dated 6 October 1921 No. 72304/21. This time it was uncertainties over the title, where it was not clear whether the organization was independent or simply a branch of a foreign organization. In fact the international YWCA organization had no legal remit to operate in Czechoslovakia. Furthermore, the designation of the executive body as a ‘national committee’ was criticized; this was inadmissible because, in contemporary terminology, the term was reserved for pan-national organizations of political significance. The articles then had to be corrected in line with these comments.

The association was acknowledged by Decree of the Ministry of the Interior dated 28 November 1921 No. 89.574/6-1921 and Decree of the Provincial Political Administration of 2 December 1921 No. 2A-4254/4-390.591 (22678 p. II).

<sup>80</sup> Marie Záhořová-Němcová resident at Prague VII, reg. No. 1116.

<sup>81</sup> Decision of the Reich Protector of 18 June 1943 No. II/762 70 A-4, No. II/764 70 A-4 and No. II / 763 70 A-4.



tion (Cooperative for American Remittances to Europe, Inc.). This was the distribution of gifts from American citizens, which could either be addressed to specific people or legal entities, or could be unaddressed and distributed to people according to need.<sup>82</sup>

After 1948 the association began to have problems. In February of the following year, the association premises in Prague II, Žitná 12, were searched, where anti-state printed materials and a quantity of illegal goods were seized. In addition, there was testimony from the cleaning staff that the girls in the boarding house “negatively criticized political developments after February 1948 and did not conceal their warm affection for the West”. Although the organization continued to operate, it was temporarily in a legally uncertain and unclear position. However, in the absence of any further measure, the association continued and its legal existence was not called into question.

On 6 April 1949, the Ministry of Social Care placed the association under national administration. Bohumila Suchánková was appointed administrator, but was replaced by Vlasta Krejčová-Hrubá in June of the same year.

The decision to dissolve the association was taken at a meeting held on 1 February 1951. At the opening, the chairwoman Mrs. Kalousková recommended a resolution for the liquidation of the association.<sup>83</sup> According to a subsequent explanation, the chairwoman of the YWCA Action Committee, Mrs. Friedländer made this decision in agreement with the YMCA at a joint meeting.<sup>84</sup> The reason was given that most of the functions of the association had been taken over by the state and national organizations, mainly in the social field. In the area of morals, the churches were to continue to operate, mainly the evangelical church, which had always been very close to the spiritual basis of both associations (YMCA, YWCA). The association's assets were transferred to the Czechoslovak Youth Union.

## CONCLUSION

Although this work provides only a basic mapping of the material, which would require much more space and time to elaborate more thoroughly, it can be stated that the issue cannot be narrowed merely to the organizational network of associations connected to the US headquarters in Prague. The ideological, religious, political and social aspects reach much further and are part of international movements. While at first it was primarily an evangelical apostolic mission, due to its massive financial endowment, a tendency towards a non-ecclesiastical organization was established; this, however, promoted a certain way of thinking, lifestyle and world view. The difference between the original evangelical organizations and the later American ones is clearly

<sup>82</sup> National Archive, NAD collection No. 410, box 5, file 410-5-1.

<sup>83</sup> The preliminary liquidation decision was made on 30 November 1950 at an unofficial meeting of YWCA branch representatives; National Archive NAD collection No. 410, box No. 4, file 410-4-1.

<sup>84</sup> The following were present at the meeting; chairs of action committees: prof. Hromádka (YMCA), Mrs. Friedländer (YWCA); association chairs: senior Klouček, Mrs. Kalousková; central directors: Velkoborský, Fraňková; for the Academic YMCA Mr. Drapák, for Prague YMCA Apl. Hušek; Finance Director First.

evident not only in the financial background, but also in the immense differences in the social status of the representatives of both currents. The American YMCA was primarily to promote the American spirit in Europe – “The Gospel of Americanism” – and this it certainly did. Europe was and is under the influence of Americanization, and even in the Czech Lands, the great popularity of American culture, thought and the hierarchy of values was already manifest in the inter-war period. In practice, this was reflected not only in the YMCA’s reputation which persists to this day, but also in spontaneous manifestations such as the hiking movement.

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# Current physical activity and sports history of children 11 to 19 years old at high schools in Prague

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## ABSTRACT

*Objectives.* Objective of this study/thesis/work was to analyse the level of free time physical activity and its specifics on a sample of the adolescent population. To goal was to analyze the historical factor in each proband and its effect on the activity development. The analysis included information spanning from the initial experience with organized physical activity. The results of the survey are further compared with the conclusions of previous studies on the issue.

*Methods.* A total of 563 respondents (235 boys and 328 girls) from grammar schools in Prague participated in the research. Data were obtained using a questionnaire survey (computer assisted web interviewing – CAWI) based on preliminary research and evaluated using MS Excel, GraphPad Prism and mathematical software R.

*Results.* The preference of just one sport (63.8%) was found in the examined population. Predominant frequency of trainings was 2 to 4 per week (61.2%). The vast majority (93.6%) stated that they participated in fundamental movement training at a younger school age. More than half (61%) experienced pain or injury during physical activity, especially in the lower limbs (61.9%). The main factor in the termination of physical activity were psychosocial reasons (76.9%). Increasing age has not been shown as a factor leading to reduction of physical activity in children. On the contrary, the frequency of activity increased as the children aged ( $p = 0.02$ ). There was no significant dependence of the current activity on the completion of fundamental movement training ( $p = 0.08$ ), nor was the confirmation of a general trend of higher activity of boys compared to girls ( $p = 0.64$ ).

## KEYWORDS

physical activity; adolescence; fundamental movement training; injury; pain

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## INTRODUCTION

With the rapid development of information technology, there is an ongoing discussion of its effects on decreasing physical activity in children. The relevance of the issue is confirmed mainly by the global trend of declining physical activity and quality of movement, which is influenced by several factors. The main initiating reasons for conducting the study of children's activity are the impact on health and quality of life. The main areas of interest are importance of physical activity, beginning of physical activity, its frequency and subsequent development, including influencing factors during adolescence.

## THEORETICAL BACKGROUND

Research clearly shows that adequate fitness and physical activity results in significant health benefits for individuals as well as significant socio-economic benefits for society as a whole. Examples of health benefits may be reduced risk or at least delayed onset of civilization diseases, such as childhood obesity or a proven positive effect of activity (and physical activity automatically leads to psychological) on delaying and possibly alleviating the onset of dementia at senior age (Care, 2019; Findholt, 2007; Guthold, Cowan, Autenrieth, Kann, & Riley, 2010; Khan et al., 2009; Rolland, van Kan, & Velas, 2008; Verghese et al., 2003).

According to the study (Telama et al., 2005), it was concluded that a high level of physical activity at the age of 9 to 18 years, especially in the case of its continuity, significantly correlates with a high level of activity in adulthood. Simultaneously, another study (Dumith, Gigante, Domingues, & Kohl III, 2011), summarizing facts from a adequate 26 studies, evaluated physical activity using a questionnaire and found a decrease during adolescence by an average of 7.0% per year.

The worldwide trend of insufficient activity of adolescents (11 to 17 years) implies the need to address this situation. A study (Guthold, Stevens, Riley, & Bull, 2020) conducted by WHO researchers showed that more than 80% of adolescents worldwide did not follow the recommendation of at least one hour of physical activity per day (Gába, 2018; Martins, Marques, Sarmiento, & Carreiro da Costa, 2015). Several studies from different years (Downward & Rasciute, 2015; Draper, Basset, De Villiers, & Lambert, 2014; Sherar, Esliger, Baxter-Jones, & Tremblay, 2007; Trost et al., 2002) (Care, 2019) point to the fact that boys are more physically active than girls in all ages at all ages. Guthold et al report prevalence of insufficient physical activity in boys 78% and in girls 85%. In connection with gender, on the basis of this study, numbering 1.6 million probands, students from all 146 countries, girls can be identified as less active compared to boys (Guthold et al., 2020).

Ending a sports career is a highly discussed topic, especially in relation to the elite sphere. The literature (Alfermann, Stambulova, & Zemaityte, 2004; Jansa, 2017) in relation to the end of a (professional) sports career introduces a basic division into involuntary (forced by circumstances) and voluntary termination (free choice).

Most authors are particularly concerned with elite athletes (Arvinen-Barrow, De-Grave, Pack, & Hemmings, 2019; Fernandez, Stephan, & Fouquereau, 2006; Knights, Sherry, Ruddock-Hudson, & O'Halloran, 2019; Moesch, Mayer, & Elbe, 2012). However, some research has also searched for motives in amateur-level athletes

(Ristolainen, Kettunen, Kujala, & Heinonen, 2012). In most cases, the available literature agrees on the multifactoriality of the reasons, ie the interplay of circumstances.

Among the psychological factors, there are specifically reasons such as: lack of or, conversely, excessive motivation, dissatisfaction or frustration due to failure to achieve set goals, anxiety caused by excessive pressure. Examples of social factors include: loss of a sports partner, unsatisfactory environment or team, disagreements and bad relationships within the club or with teammates, other hobby activities, work or study workload, lack of time for the family, loss of family support (Crespo & Miley, 2003; Moesch et al., 2012).

## **OBJECTIVES OF THE WORK**

The aim of the work was to obtain and analyze data on the subject of the current state of physical activity of children from multi-year grammar schools in Prague, including the sports history of each proband. The work is focused on the history of the beginning of the child's involvement in the sport and its further development up to the present. The partial goal is to investigate the reasons for the termination of physical activities, as well as the reason for avoiding physical activities in a given sample of the population.

## **METHODS**

The work is an empirical quantitative study. A one-off anonymous questionnaire survey was used to obtain data via an electronic form at selected multi-year grammar schools without specialized focus of study in Prague. The researched phenomenon is physical and particularly sports activity at the time of research, including the history of its development in specific individuals.

The research group consisted of children regardless of gender between the ages of 11 and 19 attending selected multi-year grammar schools in Prague, which, through management, agreed to the children's participation in the study. The reason for selecting this subpopulation is the homogeneity of the sample in terms of age and social classification and at the same time the personality spectrum of children. The number of individuals in the sample was limited by the number of these facilities in Prague and the willingness of school management to participate in the research. Subsequently, a responsible, non-participating person was contacted, who ensured the distribution of the form among students of specific classes.

### **Data collection method**

The questionnaire was created in the form of CAWI (Computer-Assisted Web Interviewing), ie online research including distribution and data collection. The environment for the form or the questionnaire was provided by the Google Docs service. The final form of the questionnaire contained a combination of question forms. The most frequent was the form of closed questions of alternative (selective) and enumerated type. Within several open questions, one can also be considered as control for previous answers.

Data collection took place in the period before and after the summer holidays of 2019. Most schools, or school management, used information technology lessons to complete the questionnaire. Other schools sent a link to the questionnaire directly

to the students using school e-mail addresses, and educators orally introduced them to the essence of the research. After the collection, the data were converted to a table in csv format for further analysis.

**Factors of termination of physical activity (PA)**

For the purposes of this work, the division of reasons into main groups (factors) was created on the basis of answers. Psychosocial factors (Cumps, Verhagen, & Meeusen) included responses such as a psychological block based on an event within the collective or the collective as such, moving, but also loss of interest and motivation. Health factors (H) included all the answers on the topic of long-term illness, injury or injury limiting the comfortable continuation of PA. Training factors (T) included the options of the coach leaving, high demands on the respondent, the breakdown of the club, category or association, as well as capacity issues.

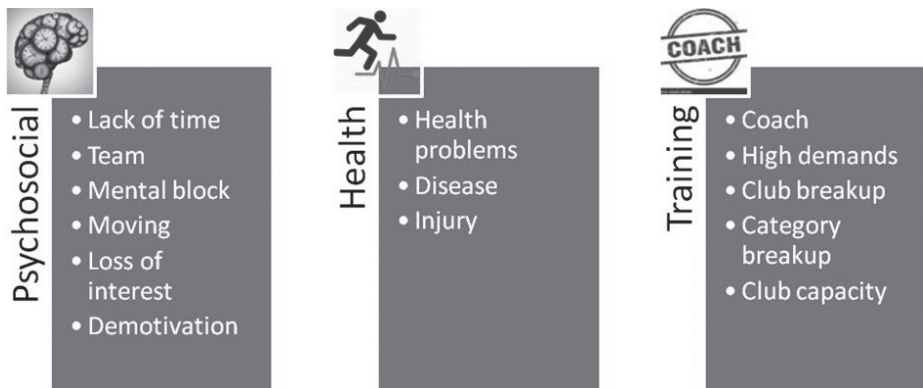
**Data processing**

The total number of completed questionnaires (n = 566) was checked and any incorrectly completed questionnaires were removed and excluded from further analysis. The control of the data thus consisted in the assessment of the factual content, the authenticity of the answers and the elimination of meaninglessly filled in forms (especially open-ended questions).

**Data analysis**

As part of quantitative research, the analysis of descriptive statistics was carried out in two phases. The classification of the first stage took place mainly using the MS Excel environment, including output tables and graphs, or the calculation of mean values. The GraphPad Prism 8 system and the R mathematical system were used for the statistical analysis of the second stage, including graphical representation.

For all second-stage analyses, descriptive statistics and normality tests (Shapiro-Wilk, Kolmogorov-Smirnov, and QQ plots) were first calculated for the data to test whether the values were from the normal probability distribution. Based on the result, a choice was subsequently made between tests for parametric or non-parametric data distribution for hypothesis testing.



**Table 1** Categorization of termination factors of PA adolescents according to survey answers

## Correlation analysis

For all examined dependencies, Spearman's test was used for correlation analysis due to non-parametric distribution of data (normality tests had a negative result). The significance level was maintained at its standard value of  $\alpha = 0.05$  (5%) and had a two-sided p-value variant for all analyses.

## Comparison of two selections

To test one of the established hypotheses, a comparison of two sets was used, namely boys and girls and their volume of physical activity per week. Due to the repeated negative result of the normality tests, the Wilcoxon two-sample test (Mann-Whitney) was used. For this analysis, the level was also set at  $\alpha = 0.05$  (5%) with a variant of the two-sided p-value.

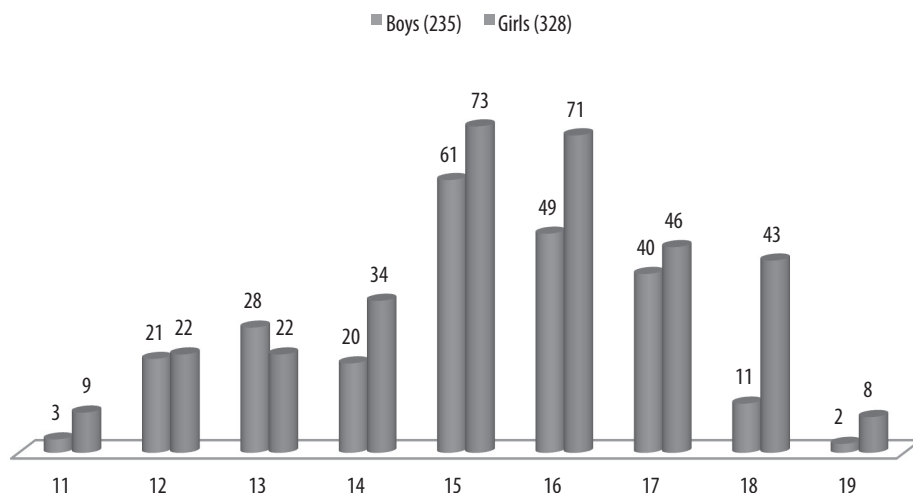
## RESULTS

### File characteristics

After excluding incomplete questionnaires, the girls represented a majority ( $n = 328$ ; 58%) compared to boys ( $n = 235$ ; 42%). From the graphic visualization, this ratio is visible in all age groups except at 13 years, where there is a higher proportion of boys. The age distribution of respondents shows a higher proportion of high school children at age 15 years ( $n = 134$ ; 23.8%) and 16 years ( $n = 120$ ; 21.3%). On the contrary, the extreme groups reached a markedly low proportion, 11 years ( $n = 12$ ; 2.1%) and 19 years ( $n = 10$ ; 1.7%).

### Types of sports

The total sum of answers significantly exceeds the number of respondents due to the possibility to choose more physical activities. The possible choice of sports was dominated by swimming ( $n = 261$ ; 50.2%) and martial arts ( $n = 131$ ; 25.2%). Among



**Graph 1** Overview of the number of girls and boys by age in the examined sample ( $n = 563$ )



girls, dance was also frequent ( $n = 71$ ; 23.9%). Less common sports include tennis (59; 11.3%), athletics (58; 11.2%), girls' volleyball ( $n = 43$ ; 14.5%) and boys' floorball ( $n = 43$ ; 16.6%). A slight surprise is the result of football ( $n = 38$ ; 7.3%), which is numerically only slightly above the mean value ( $Me = 29$ ).

Despite the effort to include all of the most probable types of sports activities, it was obviously not possible and the group "Other" was the most frequently selected ( $n = 332$ ; 63.8%).

**Table 2** Detailed frequency of sports

Sport (type)	Boys (223)	%	Girls (297)	%	Overall (520)	%
American football	1	0.4	0	0.0	1	0.2
Athletics	23	10.3	35	11.8	58	11.2
Badminton	11	4.9	10	3.4	21	4.0
Baseball	10	4.5	2	0.7	12	2.3
Basketball	22	9.9	9	3.0	31	6.0
Martial arts	<b>80</b>	<b>35.9</b>	51	17.2	<b>131</b>	<b>25.2</b>
Cycling	22	9.9	13	4.4	35	6.7
Floorball	37	16.6	12	4.0	49	9.4
Football (soccer)	34	15.2	4	1.3	38	7.3
Golf	3	1.3	1	0.3	4	0.8
Gymnastics	8	3.6	20	6.7	28	5.4
Ice hockey	3	1.3	0	0.0	3	0.6
Lacross	4	1.8	2	0.7	6	1.2
Climbing, Boulder	15	6.7	15	5.1	30	5.8
Skiing	22	9.9	14	4.7	36	6.9
<b>Swimming</b>	<b>104</b>	<b>46.6</b>	<b>157</b>	<b>52.9</b>	<b>261</b>	<b>50.2</b>
Parkour	8	3.6	2	0.7	10	1.9
Showjumping, Horse racing	1	0.4	15	5.1	16	3.1
Rugby	2	0.9	0	0.0	2	0.4
Softball	4	1.8	5	1.7	9	1.7
Table tennis	15	6.7	4	1.3	19	3.7
<b>Dancing (ballet)</b>	9	4.0	<b>71</b>	<b>23.9</b>	80	15.4
Tennis	27	12.1	32	10.8	59	11.3
Rowing	6	2.7	4	1.3	10	1.9
Volleyball	9	4.0	43	14.5	52	10.0
<b>Other</b>	<b>123</b>	<b>55.2</b>	<b>209</b>	<b>70.4</b>	<b>332</b>	<b>63.8</b>

### Frequency and volume of physical activities

The visible conditional formatting of the table data, including additional fattening, shows that more than half of the interviewed children play sports with a frequency of two to four trainings sessions per week ( $n = 318$ ; 61.2%). About a third of children complete more than 5 trainings ( $n = 137$ ; 26.3%).

**Table 3** Frequency of physical activities in the weekly regime

Frequency per week	Boys (223)	Girls (297)	Overall (520)
Once	26	39	65
Twice	35	60	<b>95</b>
<b>Three times</b>	<b>63</b>	<b>68</b>	<b>131</b>
Four times	33	59	<b>92</b>
Five times	26	30	56
Six times	26	23	49
Seven times	14	18	32
<b>Median (Me)</b>	<b>26</b>	<b>39</b>	<b>65</b>

In case of the total amount of time devoted to sports, including competitions, 3 to 6 hours per week represent almost a half of the average values ( $n = 229$ ; 44%). However, a significant number of children answered that they spend 7 to 8 hours a week playing sports ( $n = 76$ ; 14.6%) and the same amount even up to 12 hours ( $n = 76$ ; 14.6%).

**Table 4** Hourly volume of physical activities in the weekly mode

Volume per week (hours)	Boys (223)	Girls (297)	Overall (520)
1 to 2	34	50	84
<b>3 to 4</b>	<b>50</b>	<b>65</b>	<b>115</b>
<b>5 to 6</b>	<b>50</b>	<b>64</b>	<b>114</b>
7 to 8	28	48	76
9 to 10	27	28	55
11 to 12	34	42	76
<b>Median (Me)</b>	<b>34</b>	<b>49</b>	<b>80</b>

### Muculoskeletal disorder as a limitation of sport

All respondents were asked about the musculoskeletal disorders associated with sports, possibly in recreational form. The answers were evenly distributed, only the answer “No”, ie no experience with difficulties in sports was slightly more frequent ( $n = 219$ ; 38.9%). Girls ( $n = 104$ ; 31.7%) reported slightly more frequent difficulties (pain) than boys ( $n = 62$ ; 26.4%).

**Table 5** Number and percentage representation of the frequency of difficulties of the examined sample of individual body sites ONLY TABLE

Body part	Boys (140)	%	Girls (204)	%	Overall (344)	%
Head	7	5.0	9	4.4	16	4.7
Neck	2	1.4	6	2.9	8	2.3
<b>Upper extremity</b>	<b>31</b>	<b>22.1</b>	<b>41</b>	<b>20.1</b>	<b>72</b>	<b>20.9</b>
Torso	13	9.3	22	10.8	35	10.2
<b>Knee</b>	<b>43</b>	<b>30.7</b>	<b>65</b>	<b>31.9</b>	<b>108</b>	<b>31.4</b>
<b>Ankle</b>	<b>44</b>	<b>31.4</b>	<b>61</b>	<b>29.9</b>	<b>105</b>	<b>30.5</b>

In the majority of cases it was a sport restriction of a temporary nature ( $n = 210$ ; 61.0%). Other options were relatively rare. Only in 15.7% ( $n = 54$ ) of cases there were no restrictions in sport. Restricted mobility occurred in boys in 20.0% ( $n = 28$ ). In contrast, in the case of girls, there was a relatively high percentage ( $n = 78$ ; 38.2%) of recurrent pain.

**Table 6** Impact of physical disorders encountered

Restrictions due disorders	Boys (140)	%	Girls (204)	%	Overall (344)	%
None	25	17.9	29	14.2	54	15.7
<b>Temporarily</b>	<b>95</b>	<b>67.9</b>	<b>115</b>	<b>56.4</b>	<b>210</b>	<b>61.0</b>
Permanent	6	4.3	15	7.4	21	6.1
Lasting significantly longer than necessary for healing	10	7.1	17	8.3	27	7.8
Performance decrease	19	13.6	21	10.3	40	11.6
Mobility restriction	28	20.0	25	12.3	53	15.4
<b>Recurrent pain</b>	<b>22</b>	<b>15.7</b>	<b>78</b>	<b>38.2</b>	<b>100</b>	<b>29.1</b>

### Factors of reduced physical activity

For the purposes of the investigation, the question on the subject was of an open type. Based on the answers and theoretical background, a categorization of factors (reasons) for the termination of PA was created. The summary of the survey results is presented in Table 16. Graph 8 shows the predominance of factors that were defined as psychosocial ( $n = 70$ ; 76.9%).

**Table 7** List of reasons for termination of physical activity (own resource)

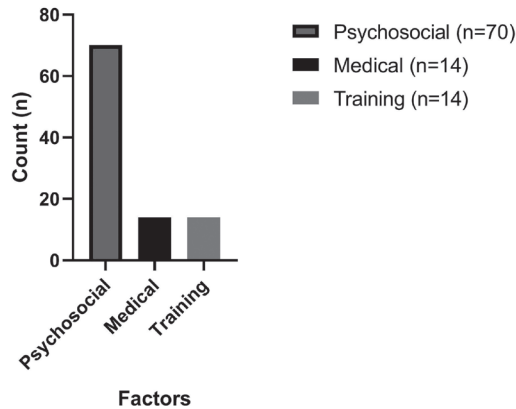
PA termination reasons	Factor	Overall (98)
Lack of time (time-consuming)	PS	31
Team	PS	6
Loss of interest ("I didn't like it")	PS	29
Coach (high demands)	T	10
Health (illness, injury)	H	14
Moving	PS	3
Club/category breakup	T	3
Mental block due the partner's injury	PS	1
Club capacity	T	1
Number of respondents		91

Note: PS – psychosocial, H – health, T – training

## STATISTICAL ANALYSIS

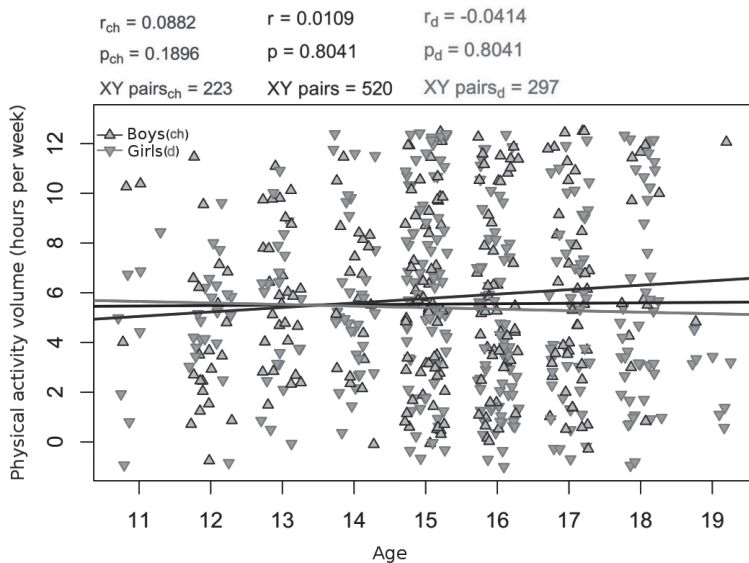
### Relationship between age and volume of physical activity

In an effort to determine the connection between different ages and total weekly activity, a correlation analysis was performed. For a set of 520 participants aged 11 to 19 years, the median value was calculated to  $Me = 5.5$ . In the retroactive conversion



**Graph 2** Representation of categorized reasons for termination of PA in adolescents (medical reason = health category)

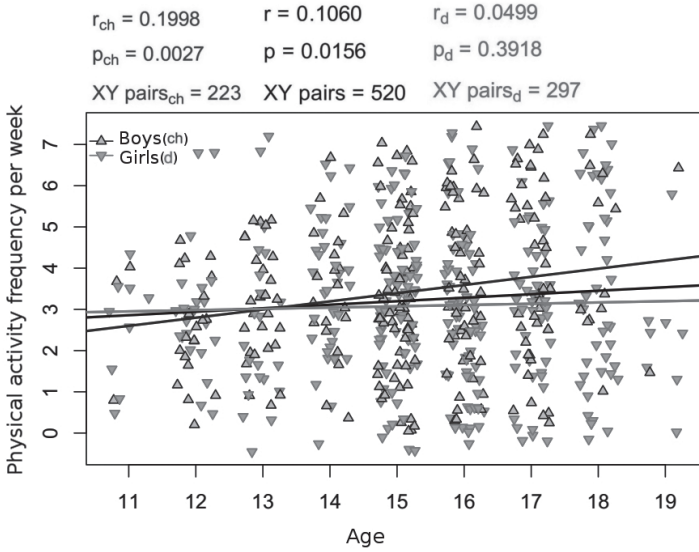
from nominal value, the median corresponds to the option “5 to 6 hours”. The graph below shows the linear regression curve. Although it has an increasing tendency ( $r = 0.01$ ), the p value ( $p = 0.80$ ) is insignificant with respect to the determined level of  $\alpha$  (0.05). And the assumption that the volume of physical activity will decrease in older age has not been confirmed, it even has the opposite tendency.



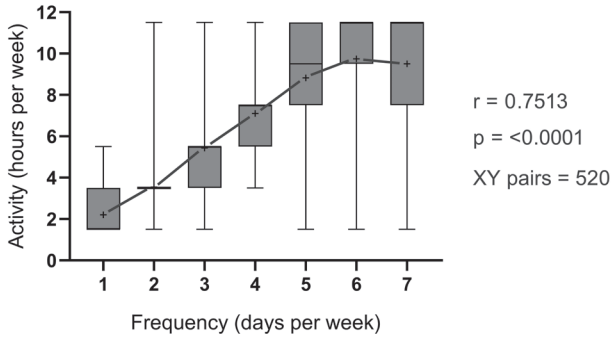
**Graph 3** Dependence of the volume of physical activity on the age of respondents, including the difference by gender; linear regression

**Relationship between age and frequency of physical activity**

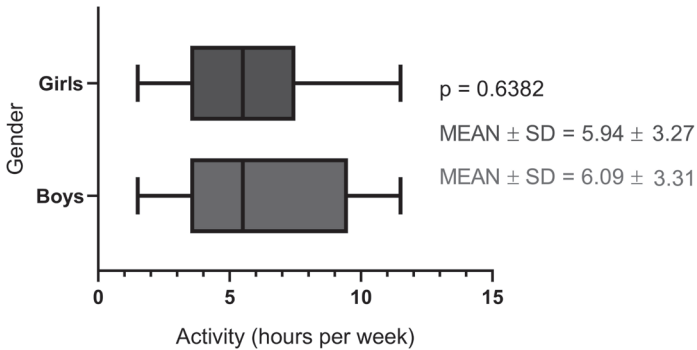
Similarly, to study the correlation between age and frequency of PA, the analysis was performed first in the original age range. The investigated dependence of the frequency of physical activities on age has already been found to be statistically significant at the level  $\alpha = 0.05$  ( $p = 0.02$ ), confirming the higher frequency of PA with increasing age.



**Graph 4** Dependence of the frequency of physical activity on the age of respondents, including the difference by gender; linear regression



**Graph 5** Dependence of the frequency of physical activity on the volume of activity



**Graph 6** Average volume of physical activity in girls and boys

### Gender and volume of sports activity

Comparison of the two groups by non-parametric test shows the expected tendency of higher physical activity of boys compared to girls, but with insufficient value of significance ( $p = 0.64$ ) at the determined level of  $\alpha$  (0.05). On the box graph (reference to the graph) it is possible to see identical median values, but a different 75% percentile, which is equal to 7.5 (“7 to 8 hours”) in girls, 9.5 (“9 to 10 hours”) in boys.

## DISCUSSION

In the group of students from multi-year grammar schools in Prague, the value of the correlation coefficient was positive, so with increasing age there is a tendency for the time spent on physical activity to increase. However, in relation to the question on the total number of hours of physical activity per week, insufficient value was reached for statistical significance.

With the same tendency but with sufficient p-value (significance) in this research, it turned out that a specific population of children plays sports more often as they age. However, it cannot be said with certainty that they spend more time during the week on physical activities.

Globally, several longitudinal, cross-sectional, and other studies recognize that there is a significant decrease in activity during adolescence (Collings et al., 2015; Dumith et al., 2011; Martins et al., 2015; Murray, Calderwood, O'Connor, & Mutrie, 2016; Reilly, 2016). This fact was recorded as early as 1998, when Gavarry et al. confirmed this tendency in moderately intensive activity (Gavarry et al., 1997). The 2003 study reached the same result in the Moderate to Vigorous Physical Activities MVPA relationship (Mota, Santos, Guerra, Ribeiro, & Duarte, 2003). The linear course of decrease in PA (from 9 to 17 years of age) and the specific breakpoint (14 years) were described by Wall et al. with the subsequent largest decline in PA in both genders (Wall, Carlson, Stein, Lee, & Fulton, 2011).

However, in recent history, there have also been studies that have not found an evident decrease in the physical activity of adolescents (Harding, Page, Falconer, & Cooper, 2015; Mitchell et al., 2012). In their conclusions Harding et al. only confirmed the increased value of time spent in a sedentary manner. Another study confirmed a decrease in activity, but only of a mild nature, especially in the case of boys (Corder et al., 2015).

Research in the Czech Republic, Rubín points to the equally surprising result of the increase in physical activity with increasing age (Rubín et al., 2018). However, this is a research on the population of adolescents with the MVPA measurement. However, the author points out the generally declining trend of the common physical activity (for example, taken steps) in the population of Czech adolescents since 1998.

Despite the fact that Rubín studied MVPA on a common sample of the adolescent population, the study took place in the context of an artificially built environment (Rubín et al., 2018). These were larger cities, with the exception of Prague, but the trend in the results still coincides with our results.

The original assumption was that with the increasing complexity of teaching, the amount of time devoted to physical activities will decrease. It can be assumed that with older age the frequency of PA increases, for example due to more frequent match-

es or racing activities (Way, 2019). The results of this work could also be explained by a general increase in the complexity of training plans in most sports based on the physiological development of the child's body. According to the LTPD recommendations, in the case of training a hockey player from the age of 12 to the age of 18, increases the time on ice during training and the number of matches increases by up to half (Wall et al., 2011). In the case of swimming, by the age of 12 years, the recommended time spent in the pool doubles (American Swimming, 2017; Radford, 2008). In the next period, up to about 18 years of age, however, the volume is maintained and there is more focus on specialization and periodization.

The disadvantage of the questionnaire survey with regard to the conclusion of not only this hypothesis could be the insufficient understanding of the term "performance sport" by students. It is not possible to trace back which of the respondents is a performance athlete and which is only a recreational one. Thus, there is no differentiation of the level of PA in individual respondents. The question is to what extent this difference affects the results. Just in the sense that we expect regular, intensive training for performance athletes. For recreational athletes, it may be a lower intensity and even an irregular PA.

Another result was the confirmation that the most common reason for the reduction or termination of dominant sports and physical activity is psychosocial factors. Respondents in the questionnaire survey listed the reasons for which they ended the sport. It was an open question.

The most common factor was psychosocial reasons in terms of lack of time and, in general, the time required for physical activity and its effect on school workload. The very next reason was the loss of interest, especially the lack of fun and the lack of a sense of fulfillment from the activity. Only half of the responses stated the reason for no longer participating in PA as an injury or illness. Ultimately, we can interpret these answers as the fulfillment of both parts of the term "psychosocial".

The categorization of factors itself is not entirely unambiguous, because according to the cited literature, the reasons for the termination of sports activities are very often multifactorial.

Several studies (Azzarito & Hill, 2013; Knowles, Niven, & Fawcner, 2011; Slater & Tiggemann, 2010) state that adolescents do not value competitive-type physical activities (exposing them to competition) and, paradoxically, for them, the performance-motivating climate is a barrier to further sports activities. Adverse factors included adolescent pressure for victory, failure in front of peers, and negative peer reactions; feeling discomfort or lack of fun. One factor was also the lack of study opportunities (Martins et al., 2015; Quaresma, Palmeira, Martins, Minderico, & Sardinha, 2015). Even in our investigation, there were reasons such as high demands of coaches or the team. A very common reason given by girls in particular (60%) in the research of Kimm et al. is the lack of time for PA (Kimm et al., 2006). Another reason was fatigue and lack of interest in activity.

Although some studies Quaresma et al. mention the considerable importance of the influence of the family, especially parents, none of the respondents answered in this sense (Quaresma et al., 2015). For children who have avoided PA all their lives, the role of parents could play a role in not leading the child to physical activities. The possibility of limited funding, i.e., socio-economic status (SES), concerned only one

respondent. However, according to the results of the study (Martins et al., 2015), it was found that lower SES leads to a demonstrably lower incidence of MVPA during the day.

The higher sports activity at older school age of boys compared to girls is pointed out by many authors of various studies. It is possible to consider the same tendency in the case of this research, but in this case the value ensuring the significance of the result was not achieved. Globally, there is a decline in activity during adolescence, which is more pronounced in girls than in boys (Barnett, Ridgers, & Salmon, 2015; Brin-golf-Isler et al., 2015; Brodersen, Steptoe, Boniface, & Wardle, 2007; Collings et al., 2015; Metcalf, Hosking, Jeffery, Henley, & Wilkin, 2015; Reilly, 2016). Martins et al. speak of higher evidence in the case of older adolescents boys (Martins et al., 2015).

However, four other studies (Corder et al., 2015; Harding et al., 2015; Mitchell et al., 2012) do not support the general view that the decrease in PA during adolescence is more pronounced in girls than in boys. Even in an older study by Gavarry et al. did not find a gender difference in different intensities of PA (Gavarry et al., 1997). In contrast, Collings et al. found a slightly higher decrease in boys than in girls (Collings et al., 2015).

The study of Rubín (Rubín et al., 2018) did not confirm significantly higher or otherwise different physical activity in Czech adolescent boys compared to girls. On the contrary, the results of a significant difference in PA in favor of boys were obtained by the Czech authors (Frömel, Novosad, & Svozil, 1999). The girls lagged behind in both intensity and volume of activity (Neuls & Frömel, 2016).

Very interesting results are summarized in the publication of Rychetský and Tilinger, where they compare participation in PA by gender using COMPASS methodologies from 1998 to 2015. In general, the difference in activity by gender was confirmed in terms of higher decline in girls, especially in the form of unorganized sport and PA. The authors summarize the facts into a general statement that boys are more involved in intense, organized activities than girls, who prefer unorganized PAs of lower intensity and frequency (Rychtecký & Tilinger, 2018).

Inconsistent results point to the complexity of defining a clear conclusion. The results are probably strongly influenced by a specific population sample. The issue of comparing studies is not only the possible implementation of different ethnicities, performance groups, but of course also different approaches to data acquisition. In general, questionnaires are often used in this field. However, these are slightly criticized for possible data bias. Pedometers seem to be more reliable, but they only provide data on the number of steps. Accelerometers appear to be the most suitable form. Larger studies use a combination of at least two measurement methods.

A slight indication of the difference between the activity of boys and girls also appeared in this study. This would be in line with the conclusions of the above-mentioned research by Rychetský and Tilinger, i.e. that boys prefer more intensive and organized forms of activities. This should theoretically explain slightly higher numbers in boys, both in terms of frequency and total PA volume (Rychtecký & Tilinger, 2018). However, the difference is not significant, as girls are not literally less active, but only select activities of lower intensity. We can also consider the higher responsibility of girls in their studies, or the effort for a better benefit compared to the common approach of the majority of boys.



While the level of fundamental motor skills (FMS) is demonstrably associated with the current level of PA and fitness of both younger school-age children and adolescents (Capio, Sit, Eguia, Abernethy, & Masters, 2015; Jaakkola & Washington, 2013; Lai et al., 2014; Morgan et al., 2013), the question is whether this is also the case in terms of future activity levels.

As a result, most studies on this issue repeatedly mention the importance of completing the “active start” phase providing early childhood (up to 6 years of age) training in FMS (skills). Barnett et al. even state motor competence in childhood as a predictor of activity in adolescence, however only evaluated by respondents independently (Barnett et al., 2015). The above-cited study indicates a significant relationship between physical training, i.e. obtaining a sufficient level of FMS and the activity of children and adolescents. However, it is assumed that activity levels and motor skills may be affected by other factors such as self-perception, socioeconomic status, and family attitude toward PA (Barnett et al., 2015; Freitas, Gabbard, Caçola, Montebelo, & Santos, 2013; McGrane, Belton, Powell, & Issartel, 2017).

## LIMITATIONS

The representation of respondents of individual age categories is strongly influenced by the approach of school management to filling in the questionnaire form. It is obvious that, especially for marginal age groups, the form was distributed only via school e-mail.

## CONCLUSION

Due to the global lack of exercise in addition to the prevalent sedentary lifestyle, there is a lot of research and studies mapping the issue. The positive result of this study is that the trend of decrease in the volume of physical activity with increasing age of the child was not confirmed. On the contrary, the results suggest that with increasing age, the frequency of physical activities in the studied population increases. This cannot be stated unequivocally in the case of girls in whom the increase in frequency does not reach the level of significance. For the total volume of activities, however, the results did not confirm a significantly higher activity in boys compared to girls. The significant dependence of physical activity on the completion of physical training was also not confirmed. Conformity with general findings, on the other hand, was found in the localization of the most frequent problems (pain, injury), which turned out to be predominantly in the lower limbs (esp. knee and ankle). However, psychosocial factors most often led adolescents to reduce or stop physical activity.

We see the importance of the results of the work mainly in the specification of the current situation of physical activity in the selection of the adolescent population. In a given sample of the population with increasing age, there is no significant reduction in the volume of physical activity. Support for activity therefore seems appropriate and beneficial for individuals who, for psychosocial reasons, leave the activity completely. In some cases, the solution could be offering the possibility to simply change the type of activity or level of performance to relieve pressure on individuals.

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# Inspiratory muscle training combined with pursed lip technique in women with chronic obstructive pulmonary disease: a case study

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## ABSTRACT

*Objective.* To improve pulmonary function, exercise capacity and quality of life of two women with Chronic Obstructive Pulmonary Disease (COPD).

*Material and Methods.* Study of two clinical cases, both women. An intervention of 8 weeks was performed, in which the patients performed 3 weekly sessions, of which 1 was performed with supervision of the physiotherapist and 2 sessions were performed at home. The treatment sessions consisted of inspiratory muscle training with an inspiratory threshold and controlled breathing exercises with the pursed lip technique.

*Results.* Quality of life of both women improved at the end of the study. In the woman with severe COPD, Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) increased after the intervention. The Peak Expiratory Flow (PEF) improved in both cases, but not the rest of the spirometric values. Dyspnea improved in the woman with moderate COPD but not in the case of the one with severe COPD. Finally, the distance walked in the 6MWT improved in both cases.

*Conclusions.* The training of the inspiratory muscles together with the pursed lip technique positively influences quality of life and exercise capacity of two women with COPD.

## KEYWORDS

chronic obstructive pulmonary disease; inspiratory muscle training; pursed lip; respiratory physiotherapy

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## INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) has been defined as a preventable and treatable process, characterized by air flow limitation not completely reversible, generally progressive and associated with an abnormal inflammatory response of the lungs to particles and harmful gases, mainly those produced by smoking (Celli, MacNee, Agsuti, 2004). COPD is a major cause of morbidity and mortality worldwide, in fact, it is estimated that there are more than 200 million people with COPD, older than 45 years and 3 million of them die every year from the disease (De Torres, Casanova, 2010).

For many years, COPD has been considered a disease mainly related to men, with a higher overall prevalence in this gender than among women (Ancochea, Miravittles, Garcia-Rio, Muñoz, Sánchez, Sobradillo et al., 2013). However, in recent decades in developed countries there has been an alarming increase in respiratory diseases in women related to tobacco use (De Torres, Casanova, 2010) and in underdeveloped countries due to the biomass combustion exposure (Gan, Man, Postma, Camp, Sin, 2006) with studies showing a prevalence of COPD in women of 8.5%, although with differences between geographical areas (Buist, McBurnie, Vollmer, Gillespie, Burney, Mannino et al., 2007).

Regarding the COPD characteristics, these are mainly dyspnea, cough and expectoration, but women in particular suffer from a greater degree of dyspnea, despite having a lower smoking rate, similar cough and less expectoration than men (Varkey, 2004; Carrasco-Garrido, Miguel-Diez, Rejas-Gutierrez, 2009). Some studies have suggested that women are more susceptible to the harmful effects of tobacco and toxic environmental factors with an earlier onset and a more serious illness (Becklake, Kauffmann, 1999). It has also been observed that women have narrower airways than men, they are on average 17% smaller than of men, and therefore each cigarette means greater exposure to tobacco smoke (Becklake, Kauffmann, 1999). Women have bronchioles with thicker walls in terms of epithelial and adventitial components and a narrower lumen than men. Therefore, women and men may respond differently in regard to the location and type of lung damage related to tobacco (De Torres, Casanova, 2010; Becklake, Kauffmann, 1999; Dransfield, Washko, Foreman, Estepar, Reilly, Bailey, 2007).

The EUROSCOP study showed that women with COPD with a  $FEV_1/FVC$  ratio lower than average lost lung function faster (32 ml/year) than women with minor obstruction. (De Torres, Casanova, 2010). Also, women with COPD have been described as more symptomatic and with less functional capacity and therefore, quality of life scales present worse results (Suh, Lau, Pokras, 2008; Ferrari, Tanni, Lucheta, 2010).

Respiratory rehabilitation (RR) is an essential part in the treatment of patients with COPD, which is why some authors defend that people with this disease who continue to be limited by their symptoms even though their pharmacological treatment is correct, should be included in RR programs (Güell, Díaz Lobato, Rodríguez Trigo, Morante Véleza, San Miguel, Cejudo et al., 2014). RR has proven effective with a high level of scientific evidence, and its main goals are: decrease of symptoms, improvement of functional capacity and quality of life (Güell, Díaz Lobato, Rodríguez Trigo, Morante Véleza, San Miguel, Cejudo et al., 2014; Spruit, Singh, Garvey, ZuWallack,

Nici, Rochester et al., 2013), improvement of dyspnea and decrease of the number of exacerbations and use of health resources (De Torres, Casanova, 2010).

Alterations such as gas exchange or increased respiratory effort cause the person with COPD to try to avoid physical activity. This is why exercise or muscle training is a very important part of the RR. Regarding the respiratory muscles, it is important to highlight the training of the inspiratory muscles, which can be performed using strength techniques or resistance techniques. Larson et al. (1988) were the first to demonstrate a significant increase in inspiratory muscle strength, respiratory muscle resistance and exercise tolerance in patients with moderate or severe COPD (Larson, J., Kim, Sharp, Larson, D., 1988). Since then, inspiratory muscle training has shown improvement of muscle strength and endurance in patients with COPD. RR programs therefore usually integrate specific respiratory muscle training and peripheral musculature training, with a minimum duration of 8 weeks or 20 sessions with a frequency of 2 to 5 sessions per week (Güell, Díaz Lobato, Rodríguez Trigo, Morante Véleza, San Miguel, Cejudo et al., 2014; Spruit, Singh, Garvey, ZuWallack, Nici, Rochester et al., 2013).

Some other of the physiotherapy techniques used in RR include respiratory control techniques (controlled slow ventilation; breathing with pursed lips; thoracic mobilizations and directed ventilation), ELTGOL (Total slow exhalation with lateralized open glottis), TEF (forced expiration technique), among others (Güell, Díaz Lobato, Rodríguez Trigo, Morante Véleza, San Miguel, Cejudo et al., 2014). Respiratory exercises such as diaphragmatic breathing and pursed lips breathing have an important role in the control of dyspnea in patients with COPD. These techniques, in addition to reducing breathlessness, improve ventilation and gas exchange, optimize thoracic wall movement and decrease hyperinflation (Güell, Díaz Lobato, Rodríguez Trigo, Morante Véleza, San Miguel, Cejudo et al., 2014). However, most of the studies have researched on men with COPD, or samples with both men and women.

We hypothesised that training the inspiratory muscles along with the pursed lip breathing could improve the pulmonary function, the strength of the respiratory muscles, the exercise capacity and, ultimately, improve quality of life in women diagnosed with COPD. Therefore, the aim of this study was to implement a program with respiratory physiotherapy techniques in order to improve quality of life of women with COPD, improving values of the spirometric parameters and the strength of the inspiratory muscles.

## **METHODS**

### **Participants**

Participants were recruited from the “Amics de La Nau Gran de la Universitat de València” association, which includes people over 55 years old. Inclusion criteria were: women diagnosed of COPD, with no need of oxygen therapy, availability to perform treatment. Exclusion criteria were: men with COPD, need of oxygen therapy, having any muscle or skeletal illness that made unable the performance of the treatment.

### **Study design**

An experimental case study was conducted from January 2019 to March 2019. Three women and one man were initially interested in participating in the study. The man



was discarded for not meeting the inclusion criteria; one of the women finally did not want to be included in the study because of personal reasons.

The two final participants were assessed in January and then they were treated over a period of 8 weeks, with 3 sessions per week of 45 minutes' duration each. One of the three weekly sessions was applied by a physiotherapist at the University. The other two weekly sessions were performed by the patients at home, and recorded through a follow-up file where the day that each session had been done should be marked so the physiotherapist could check.

The treatments at the faculty were applied by an experienced physiotherapist, with the necessary training and were carried out in the laboratories of the Faculty of Physical Therapy of the University of Valencia. Participants provided informed consent following an explanation of the study aims and procedures. The Ethics Review Board of our institution approved all the procedures (H1543313693557), which were performed in accordance with the principles of the Declaration of Helsinki of the World Medical Association.

## Outcomes

Background data, including GOLD stages, were obtained from patients and medical records at baseline. Pulmonary function, Maximal inspiratory and expiratory pressure measurements, Exercise capacity and Quality of Life were measured at baseline and post-treatment.

*Pulmonary function:* it was assessed via forced spirometry of dynamic lung volumes using a portable spirometer (PONY FX, COSMED), and it included: forced vital capacity (FVC), forced expired volume at 1 second ( $FEV_1$ ) and peak expiratory flow (PEF), accordance with ATS/ERS guidelines (Miller, Hankinson, Brusasco, Burgos, Casaburi, Coates et al., 2005; García-Río, Call, Burgo, Casan, del Campo, Gáldiz et al., 2013). The reliability of this instrument was reported by Lei Burton et al. (Lei Burton, LeMay, Saini, Smith, Bosnic-Anticevich, Southwell et al., 2015).

*Maximal inspiratory and expiratory pressure measurements:* maximal inspiratory (MIP) and expiratory pressures (MEP) were measured using an electronic pressure gauge ELKA PM-15 (Laboliser), following international regulations (Green, Road, Sieck, Similowski, 2002).

*Exercise capacity:* it was measured as distance walked during the six-minute walk test (6MWT). It is frequently used for measuring response to therapeutic interventions in COPD (Singh, Puhan, Andrianopoulos, Hernandez, Mitchell, Hill et al., 2014). The 6MWT was performed according to the standardized protocol (Holland, Spruit, Troosters, Puhan, Pepin, Saey et al., 2014). The dyspnea was measured by the Borg Scale which has shown to be a reliable tool for quantifying dyspnea in subjects with COPD undergoing a 6-minute walk (Belman, Brooks, Ross, Mohsenifar, 1991) and the oxygen saturation ( $SaO_2$ ) was measured by an pulsioximeter (Oxym 2000) (González Mangado, Rodríguez Nieto, 2016).

*Quality of Life:* measured with the St George Respiratory Questionnaire which is a standardized self-administered airways disease-specific questionnaire divided into three subscales: symptoms (eight items), activity (16 items), and impacts (26 items) (Jones, Quirk, Baveystock, Littlejohns, 1992; Jones, Quirk, Baveystock, 1991). For each subscale and for the overall questionnaire, scores range from zero (no impair-

ment) to 100 (maximum impairment) (Güell, Casan, Sangenis, Morante, Belda, Guyatt, 1998).

### **Intervention**

Intervention consisted of 8 sessions with the physiotherapist (one each week) that were repeated at home by each of the patients 2 more times per week.

Sessions 1 and 2: A brief explanation of chronic obstructive pulmonary disease was made. Then a 10 minute diaphragmatic abdominal breaths were performed: 5 minutes in supine position and 5 in sitting position, with the objective that the patients become aware of their breathing and try to perform abdominal and non-thoracic breathing. Subsequently, with participants in a sitting position they trained with the Threshold IMT® (Respironics) device with a 30% of the initial MIP of each patient, and 6 sets of 5 repetitions were performed each with 1 minute rest between sets (Barreiroa, Geaa, Marina, 2007). Later they performed the breathing exercise with pursed lips, in the supine position. During this exercise the patients had to inspire through the nose for 2 seconds and exhale with pursed lips for 4 to 6 seconds for 9 minutes, that is, 3 sets of 2 minutes of breathing with pursed lips with a minute of rest between sets (Gosselink, 2004; Mayer, Karloh, Dos Santos, de Araujo, Gulart, 2018). Finally, the inspiratory muscle training was repeated with the Threshold IMT®.

Sessions 3 and 4: The same exercises were performed as in the previous sessions, only the Threshold IMT® resistance was increased a 10%, from 30% to 40% of the MIP as suggested in previous studies (Fonseca, Cader, Dantas, Bacelar, Silva, Leal, 2010). The exercises with pursed lips in were performed, the first series in sitting and the second in standing.

Sessions 5 and 6: In both sessions the Threshold IMT® resistance was increased to 50% of the initial MIP. In the fifth session the pursed lips exercises were carried out in standing position, and in the sixth session they were performed while the patients were walking.

Sessions 7 and 8: The training resistance increased from 50% of the initial MIP in the previous sessions to 60%. In the seventh session, the patients performed pursed lips exercises as they went up and down the stairs. However, we had to discard the stairs due to dyspnea in both patients. Finally, the exercises were carried out while the patients walked in both sessions.

### **Statistical analysis**

A descriptive analysis was conducted, with results shown as mean and percentage of the measured variables before and after the treatment for each participant, as well as the percentage change. Statistical analysis was performed using SPSS v. 19.0 (SPSS Inc., Chicago, IL, USA) licensed from the authors' institution.

## **RESULTS**

The analysis was performed on 2 women with COPD with ages between 67 and 73 years old. Initial spirometry showed that at baseline Case 1 had a severe COPD ( $30\% \leq FEV1 < 50\%$ ) and Case 2 had a moderate COPD ( $50\% \leq FEV1 < 80\%$ ), according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD)

(Charususin, Gosselink, Decramer, McConnell, Saey, Maltais et al., 2013) scale. Demographic and clinical characteristics of the participants by participant are depicted in Table 1.

**Table 1** Demographic and clinical characteristics of the participants

	<b>CASE 1</b>	<b>CASE 2</b>
<b>Age</b>	73	67
<b>Gender</b>	Woman	Woman
<b>Height (cm)</b>	165	154
<b>Weight (kg)</b>	78.8	42.8
<b>BMI (%)</b>	29	18.1
<b>CPD*</b>	20	6
<b>Current smoker</b>	No	No
<b>Marital status</b>	Married	Divorced
<b>Academic level</b>	University degree	University degree
<b>Working status</b>	Retired	Retired
<b>Other conditions</b>	Atrial fibrillation Osteoporosis	Osteoporosis Arthrosis
<b>Physical activity</b>	Walking and Pilates (2–3 times/week)	Walking and bicycle (4–5 times/week)

\* Cigarettes Smoked per Day: heavy smoking as  $\geq 20$  CPD and mild smoking as  $< 20$  CPD

In relation to the pulmonary function, Case 1 showed that the FVC and the FEV<sub>1</sub> decreased by 2%, the FEV<sub>1</sub>/FVC decreased 7% and PEF had a 4.8% increase. Case 2 also showed quite constant results for spirometric parameters (FEV<sub>1</sub>, FVC decrease 2% and FEV<sub>1</sub>/FVC a 3%) with the only parameter with a more noticeable change being the PEF, with an increase of 6.4% at post-treatment (Table 2).

The measurements of the maximal pressures showed Case 1 improved in the strength of the respiratory muscles, with a 25% increase in the MIP and 9.4% in the MEP. However, Case 2 showed a decrease of 8.7% on the MIP and the MEP was maintained in similar results.

As for Exercise capacity, Case 1 increased by 12.12% in the walked distance (from 290 to 330 m) with similar SaO<sub>2</sub> and dyspnea. Case 2 increased in 90 meters the walked distance, that is a 18.75% increase.

In relation to Quality of Life the SGRQ showed that Case 1 had all items improved at post-treatment assessment, with the Activity score increasing by 12.3 points. The total score in the initial assessment was 27 and at the end of 25 this difference means that the quality of life after the intervention improved by 2 points. Case 2 had a decrease in the scores obtained, especially in the items that referred to the symptoms, which decreased by 10%. Also the Impacts of COPD on the patient’s life decreased nearly a 6%. For this case, the total score of the questionnaire improved by 7%.

At the end of the treatment both cases were at the same degree of COPD according to GOLD scale, that is Case 1 had a severe COPD and Case 2 had a moderate COPD.

**Table 2** Results of both cases at baseline and post-treatment

	CASE 1		CASE 2	
	Baseline	Post-treatment	Baseline	Post-treatment
<b>Pulmonary function</b>				
FVC (% of predictive)	50	52	60	57
FEV <sub>1</sub> (% of predictive)	43	41	51	50
FEV1/FVC (% of predictive)	85	78	86	89
PEF (% of predictive)	44.5	49.3	56.7	63.1
<b>Pressure measurements</b>				
MIP (% of predictive)	80	105	66.7	58
MEP (% of predictive)	56.5	65.9	45.7	45.6
<b>Exercise capacity (6MWT)</b>				
SaO <sub>2</sub> (%) (begin/end)	92/94	92/94	98/99	99/97
Dyspnea (BORG) (begin/end)	0/2	0/3	0/1	0/0
Distance (m)	290	330	390	480
<b>Quality of Life (St George Respiratory Questionnaire)</b>				
Symptoms	12	9	20	10
Activity	47.2	59.5	48.2	43.1
Impacts	19.7	10.6	7.3	1.6
TOTAL	27	25	22	15

## DISCUSSION

The present study analysed the changes on two women with COPD regarding their pulmonary function, exercise capacity, respiratory muscle strength and quality of life after an 8-week program of respiratory physiotherapy techniques. Results showed an improvement on their quality of life at the end of the intervention, since the total score in the SGRQ decreased at post-treatment, also the walked distance in the 6MWT increased, and the MIP and MEP values improved in Case 1 (severe COPD), but not in Case 2 (moderate COPD). No changes were noticeable in the spirometric parameters.

To the best of our knowledge this is the first case study to address specifically COPD in women, given that there are no articles in this regard in the existing literature. Although there is currently a growing interest in this subject, in the last five years most of the studies include both men and women in their sample or only men.

In relation to the pulmonary function, our results did not show much change post-treatment, except the PEF that improved in both women. However, the changes of the PEF did not reach the minimal clinically significant which is 12% for obstructive patients (Karras, Sammon, Terregino, Lopez, Griswold, Arnold, 2000). Previous studies with only 3-week programs did not show any improvement in pulmonary function (Beaumont, Mialon, Le Ber-Moy, Lochon, Péran, Pichon et al., 2015). However, stud-

ies with more intensity of treatment (using muscle training 2 times a day, every day) (Wu, Guan, Zhang, Li, Yang, Guo, 2017) did show improvement.

Regarding pressure measurements, Case 1, with a more severe COPD did improve her MIP in 25% and her MEP in 9.4%, as in previous studies (Nikoleitou, Man, Mustafa, Moore, Rafferty, Grant et al., 2016; Dellweg, Reissig, Hoehn, Siemon, Haidl, 2017). Case 2 did not improve these parameters. It is conceivable that the patient with a poor baseline lung function is at risk to enter a downward spiral of dyspnea, sedentariness, demotivation, and finally deconditioning (MacIntyre, 2008) and therefore had a greater motivation in the treatment.

Inspiratory muscle training is not only beneficial for muscle strength (Belman, Brooks, Ross, Mohsenifar, 1991), but also improves inspiratory muscle endurance (Larson, J., Kim, Sharp, Larson, D., 1988), walking endurance, dyspnea and quality of life (Gosselink, De Vos, van den Heuvel, Segers, Decramer, Kwakkel, 2011). This has been observed in our results since both women have increased the walking endurance while not having a high increase in dyspnea. So, as Charususin et al. (2013) concluded in their study, inspiratory muscle training with threshold is effective and could be incorporated into evidence-based treatment recommendations for clinical practice (Charususin, Gosselink, Decramer, McConnell, Saey, Maltais et al., 2013).

As for the 6MWT, not only the walking distance was increased in Case 1 and Case 2 between 12% and 18 % respectively, but also SaO<sub>2</sub> was maintained steady through the test after the treatment. This is important, since change in exercise performance is still considered one of the most important and easiest outcome measures adopted to evaluate the effects of RR in COPD patients (Van Stel, Bogaard, Rijssenbeek-Nouwens, Colland, 2001).

Our results are in line with other studies (Dellweg, Reissig, Hoehn, Siemon, Haidl, 2017; Mehani, 2017). Dellweg et al. (2016) with a sample of men and women, also found an improvement on the walking distance after only 4 weeks of inspiratory muscle training with threshold. In addition, in another study conducted by Mehani (2017) with a sample of only men, the improvement of the walking distance was 25% in 6MWT for the inspiratory musculature training group.

Dyspnea was measured in the 6MWT showing Case 2 had an improvement in the dyspnea post-treatment, but not Case 1. In a previous study (Wu, Guan, Zhang, Li, Yang, Guo, 2017), which included men and women, the dyspnea degree improved after 8 weeks of inspiratory muscle training with a resistive loading device. Taking into account that women have a higher degree of dyspnea than men (Varkey, 2004; Carrasco-Garrido, Miguel-Diez, Rejas-Gutierrez, 2009) it can be explained that Case 1 with more severe COPD did not improve. Therefore, future studies with bigger samples of women could help clarify how dyspnea affects in relation to gender.

As for quality of life, both women showed an improvement. This is similar to results found in other studies with samples of men and women (Valenza, Valenza-Peña, Torres-Sánchez, González Jiménez, Conde Valero, Valenza Demet, 2014; Borgue, Marit, Omenaas, Moum, Ekman, Lein et al., 2015). Valenza et al. (2014) conducted a study in which patients had to perform breathing exercises with pursed lips twice a day for 20 minutes, the results they obtained, as in our study, were a better score for the SGRQ. Besides anxiety, depression had improved after treatment (Valenza, Valenza-Peña, Torres-Sánchez, González Jiménez, Conde Valero, Valenza Demet, 2014).

In the research conducted by Borgue et al. (2014) it was also shown that breathing exercises with pursed lips improve the quality of life of men and women with COPD (Borgue, Marit, Omenaas, Moum, Ekman, Lein et al., 2015).

Limitation in exercise capacity represents an important feature of COPD and is one of the main factors that negatively affect the quality of life in patients (Esteban, Quintana, Aburto, Moraza, Egurrola, Pérez-Izquierdo et al., 2010). Considering that in our study both cases increased the walking distance, and therefore their exercise capacity, it can be explained that quality of life also had an improvement. Reduced exercise capacity is considered to be a consequence of airflow obstruction primarily because of dynamic hyperinflation occurring during exercise (Palange, Ward, Carlsen, Casaburi, Gallagher et al., 2007). Therefore, limited physical activity of patients with COPD, although a result of the disease, at the same time promotes worsening and progression of the disease and further decline in the patient's quality of life. As stated before, quality of life scales present worse results in women (Suh, Lau, Pokras, 2008; Ferrari, Tanni, Lucheta, 2010), and the obtained results may help encourage including intervention in this area in future research.

### Limitations

Some limitations of our study were first of all, the sample since only two women participated, so futures research with a bigger sample would be needed to improve the knowledge about COPD in women.

Also, a more intense treatment could be implemented, with 5 sessions per week and not 3, and with all of them being supervised by the physiotherapist.

Finally, the intervention was 8 weeks, however the benefits of pulmonary rehabilitation in women in many cases are observed at 3 months, therefore the treatment could be implemented longer.

### CONCLUSION

After the study and analysis of the two cases of women with COPD, we can observe that a combination of inspiratory muscle training with purse lips technique may influence positively quality of life and exercise capacity while maintenance of pulmonary function. However, future high quality research with women samples is encouraged to be implemented.

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# Somatic characteristics and body composition in Czech sub-elite female handball players

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## ABSTRACT

The somatic parameters and body composition are important indicators of physical fitness and general health not only non-athletes, but of athletes. The aim of this study was to determine the somatic characteristics and body composition in 15 Czech sub-elite female handball players (age  $21.5 \pm 1.8$  years, body height  $170.5 \pm 6.6$  cm, body weight  $64.7 \pm 10.2$  kg, BMI  $22.2 \pm 2.9$  kg m<sup>-2</sup>). Body composition was measured by a multifrequency bioimpedance method Tanita MC-980 (Tanita Europe BV). The monitored parameters were the following: fat mass (FM), fat free mass (FFM), muscle mass (MM), bone mass (BM), total body water (TBW), intracellular water (ICW), extracellular water (ECW) and segmental analysis of muscle distribution. In our female group, we recorded the mean value of FM =  $21.5 \pm 5.4\%$  ( $14.3 \pm 5.7$  kg), FFM =  $50.4 \pm 5.9$  kg, muscle mass =  $47.9 \pm 5.6$  kg, bone mass =  $2.6 \pm 0.3$  kg, TBW =  $56.2 \pm 3.2\%$  ( $36.2 \pm 4.8$  kg), ICW =  $22.6 \pm 3.5$  kg, ECW =  $13.6 \pm 1.3$  kg. Monitoring of muscle distribution in the extremities showed a significant difference in upper extremities ( $p < 0.05$ , ES  $< 0.2$ ) and in lower extremities ( $p < 0.05$ , ES  $< 0.2$ ). Our results confirm on previous data about the presence of anthropometric differences and body composition differences between individual players in handball team.

## KEYWORDS

handball; body composition; fat mass; fat free mass

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## INTRODUCTION

Since the 1960s, handball has established itself as one of the most popular team sports (Clanton, & Dwight, 1997). Professional and amateur handball is played in countries on every continent. World championships, continental championships, and international tournaments in handball take place regularly. Handball has been played in Olympic competition since the 1972 Games in Munich. According to the International Handball Federation, team handball is a fast-paced game involving two teams of seven players. Handball is therefore a contact sport where jumping, running, and arm throwing are prominent features of performance.

In modern elite sports based on the scientific approach to the training process, athletes have been ever more aligned according to their motor, morphological and functional characteristics, thus psychological features becoming ever more important for achievement of top results. In complex kinesiological activities such as sport games, successful performance is determined by a number of factors, first of all by anthropologic features of the players (Rogulj, Srhoj, Nazor, Srhoj, & Cavala, 2005). The physical and physiological characteristics are to some extent affected by the anthropometric characteristics of athletes (Čavala, Rogulj, Srhoj, Srhoj, & Katić, 2008; Chaouachi et al., 2009; Visnapuu, & Jürimäe, 2009). The topic of body composition in sport requires a great deal of attention. Body composition is often viewed as central to success in sport at many levels. Although the two-compartment model of body composition (body weight = fat-free mass [FFM] + fat mass [FM]) was used in many early studies of body composition among athletes, often with a specific focus on estimates of relative FM (%), body composition can be approached at several levels and advances in technology and methods have facilitated other assessment FFM (amount body water, muscle, bone etc.) (Malina, 2007). Body composition has been long known to be relevant to performance in sport, with special attention being paid to the total and regional proportions of fat and muscle (Leedy, Ismail, Kessler, & Christian, 1965). Morphological characteristics of the body certainly have a great influence on an outstanding performance in handball (Šibila, & Pori, 2009). Excessive adipose tissue acts as a dead weight in activities where the body mass must be repeatedly lifted against gravity during locomotion and jumping (Reilly, & Doran, 1996). Studies of various authors deal with somatic characteristics and their relation to performance not only in males, but also in females (Carvalho, Mourão, & Abade, 2014; Cichy et al., 2020; Chaouachi et al., 2009; Čavala et al., 2008; Malá, Malý, Záhalka, & Bunc, 2010; Malá, Malý, Zahálka, Tůma, & Bunc, Malá, 2011; Malý, Zahálka, Tůma, & Teplan, 2012; Milanese et al., 2011; Rogulj et al., 2005; Šibila, & Pori, 2009; Visnapuu & Jürimäe, 2009 etc.).

The aim of this study was to determine the somatic characteristics and body composition in 15 Czech sub-elite female handball players.

## METHODS

### Subjects

This study contained total amount of 15 in sub-elite female handball players, in the age range of 19–25 years. The average duration of training practice for the monitored players was 6 years. This study was approved by the Ethics Committee of the Faculty

of Physical Education and Sport, Charles University (reference number 177/2017) and measurements were performed according to the ethical standards of the Helsinki Declaration. The subjects were fully informed in advance regarding the objectives of the study, the study methods involved no risks, and written informed consent was obtained from each subject for participation in this study. All measurements were taken at the beginning of the competitive season in October. During the pre-season, sub-elite players had been training three sessions a week, 2.0 h per session.

### Body composition

The body height (cm) was measured by digital Stadiometer Seca 242 (Vogel & Halke, Hamburg, Germany) to the nearest 0.1 cm. The body weight was measured on a digital Scale to the nearest 0.1 kg. The body mass index (BMI, in  $\text{kg m}^{-2}$ ) was calculated. Body composition was measured by a multifrequency bioimpedance method Tanita MC-980 (Tanita Europe BV), which operates on frequencies (1, 5, 50, 250, 500, 1000 kHz). BIA analysing time was about 40 s. The monitored parameters were the following: fat mass (FM), fat free mass (FFM), muscle mass (MM), bone mass (BM), total body water (TBW), intracellular water (ICW), extracellular water (ECW) and segmental analysis of muscle distribution.

### Data Analysis

Basic descriptive statistics (mean, standard deviation) were computed for all variables, which were subsequently tested for normality using Shapiro-Wilk tests. Differences in segmental analysis from BIA were evaluated by Student's t-test (significance was accepted at  $p < 0.05$ ) and an index of effect size – ES (Cohen's d). The effect size (ES) was assessed as follows:  $ES < 0.20$  (small effect),  $ES = 0.50$  (medium effect),  $ES > 0.80$  (large effect). Statistical analyses were performed using Microsoft Excel (2010), SPSS version 22 (SPSS Inc., Chicago, IL, USA).

## RESULTS

Total amount of 15 sub-elite female handball players (average age –  $21.5 \pm 1.8$  years). Values of basic somatic characteristics of probands (body weight, body height, BMI) are shown in Table 1. Values of parameters indicating body composition – BIA Tanita MC-980 are shown in Table 2. All data were normally distributed.

**Table 1** Values of basic somatic characteristics of probands (n = 15)

	mean (SD)	(min – max)
Age (years)	21.5 (1.8)	(19.0–25.0)
Body weight (kg)	64.7 (10.2)	(46.8–87.5)
Body height (cm)	170.5 (6.6)	(155.8–185.7)
BMI ( $\text{kg m}^{-2}$ )	22.2 (2.9)	(18.5–28.7)

Note: Data are reported as means  $\pm$  SD.

SD – standard deviation; BMI – Body mass index.

**Table 2** Values of parameters from body composition – BIA Tanita MC-980 (n = 15)

	mean (SD)	(min–max)
FM (%)	21.5 (5.4)	(14.5–31.5)
FM (kg)	14.3 (5.7)	(8.4–27.6)
FFM (kg)	50.4 (5.9)	(38.4–59.9)
Muscle mass (kg)	47.9 (5.6)	(36.2–56.9)
Bone mass (kg)	2.6 (0.3)	(2.0–3.0)
TBW (%)	56.2 (3.2)	(50.4–61.6)
TBW (kg)	36.2 (4.8)	(26.7–45.2)
ICW (kg)	22.6 (3.5)	(15.8–28.8)
ECW (kg)	13.6 (1.3)	(10.9–16.3)
Left arm (kg)	2.45 (0.5)	(1.5–3.6)
Right arm (kg)	2.50 (0.4)*	(1.6–3.3)
Trunk (kg)	26.8 (4.9)	(20.9–30.2)
Left leg (kg)	8.12 (1.0)*	(6.0–10.1)
Right leg (kg)	8.01 (0.9)	(6.2–9.7)

Note: Data are reported as means  $\pm$  SD.

SD – standard deviation; FM – fat mass; FFM – fat free mass; TBW – total body water; ICW – intracellular water; ECW – extracellular water; \* – significant difference between left/right extremities at  $p < 0.05$ .

When comparing paired extremities of handball players we found significant differences in muscle mass proportion (difference between right arm and left arm – 0.05 kg,  $p < 0.05$ , ES  $< 0.2$ ; difference between right leg and left leg – 0.11 kg,  $p < 0.05$ , ES  $< 0.2$ ).

## DISCUSSION AND CONCLUSION

In general, to succeed in a sport, it is important usually to have specific bodily attributes (Malina, Bouchard, & Bar-Or, 2004). Handball players occupying different positions differ in many morphological parameters (Šibila, & Pori 2009). Only limited information is available on anthropometric differences between handball players characterised by their playing position (e.g. Rogulj et al., 2005; Šibila, & Pori, 2009).

In our group of female handball players, we measured these results of somatic characteristics (body height  $170.5 \pm 6.6$  cm, body weight  $64.7 \pm 10.2$  kg, BMI  $22.2 \pm 2.9$  kg  $m^{-2}$ ) and body composition (FM =  $21.5 \pm 5.4\%$  ( $14.3 \pm 5.7$  kg), FFM =  $50.4 \pm 5.9$  kg, muscle mass =  $47.9 \pm 5.6$  kg, bone mass =  $2.6 \pm 0.3$  kg, TBW =  $56.2 \pm 3.2\%$  ( $36.2 \pm 4.8$  kg), ICW =  $22.6 \pm 3.5$  kg, ECW =  $13.6 \pm 1.3$  kg). We found relatively large interindividual differences in the monitored somatic parameters (body height – difference 29.9 cm, body weight – difference 40.7 kg, BMI – difference 10.2 kg  $m^{-2}$ , FM – difference 17%, FFM – difference 21.7 kg, muscle mass – difference 20.7 kg, TBW – difference 11.2%). Monitoring of muscle distribution in the extremities showed a significant difference in upper extremities (difference between right arm and left arm – 0.05 kg,  $p < 0.05$ , ES  $< 0.2$ ) and in lower extremities (difference between right leg and left leg – 0.11 kg,  $p < 0.05$ , ES  $< 0.2$ ). Our results of segmental muscle distribution support the claim of Malá et al. (2012), that fluid distribution in the body

may indicate possible muscle imbalance as a result of unilateral physical exercise. The different segmental muscle mass proportion between preferred and non-preferred hand (leg) may represent a potential risk of a player's injury; therefore the detected asymmetries should be systematically monitored and compensated using specific exercises (Malá et al., 2012).

Comparison of the percent body fat values found in our sample with those in the literature is difficult, because the skinfold equations used by others tend to underestimate percent fat mass in comparison with BIA. Hasan et al. (2007) showed the mean somatic parameters of elite Asian female handball players (height  $170.0 \pm 6.8$  cm, weight  $64.6 \pm 7.7$  kg,  $FM_{\text{skinfold thickness}} = 20.8 \pm 4.4\%$ ). Čavala et al. (2008) found the mean somatic parameters of Croatian elite female handball players (height  $178.2 \pm 3.6$  cm, weight  $73.5 \pm 7.1$  kg). Milanese et al. (2011) showed the mean somatic parameters of handball players from the Italian championships (elite players – height  $169.2 \pm 6.1$  cm, weight  $67.0 \pm 7.9$  kg, BMI  $23.4 \pm 5.3$  kg m<sup>-2</sup>,  $FM_{\text{DXA}} = 23.3 \pm 5.3\%$ ; sub-elite players – height  $166.0 \pm 5.1$  cm, weight  $64.4 \pm 10.5$  kg, BMI  $23.3 \pm 4.0$  kg m<sup>-2</sup>,  $FM_{\text{DXA}} = 28.6 \pm 4.0\%$ ). The elite female players were higher, heavier and had a lower fat mass (%) than the amateur players. The authors concluded that a high body mass and specifically high fat-free mass is advantageous in handball. In contrast, a study of first division and second division Greek handball players showed no differences between divisions in terms of height or body mass (Bayios, Anastasopoulou, Sioudris, & Boudolos, 2001). Malá et al. (2011) found body composition of a national team of female handball players (height  $176.0 \pm 6.5$  cm, weight  $72.5 \pm 8.3$  kg,  $FM_{\text{BIA}} = 16.06 \pm 0.65\%$ ,  $FFM_{\text{BIA}} = 60.74 \pm 1.48$  kg,  $TBW_{\text{BIA}} 54.98\%$ ,  $ICW 67.88\%$ ,  $ECW 42.12\%$ ). In next study of Malá et al. (2012) were these results of body composition in female handball players (height  $175.9 \pm 6.5$  cm, weight  $72.5 \pm 8.3$  kg, BMI =  $23.4 \pm 2.3$  kg m<sup>-2</sup>,  $FM_{\text{BIA}} = 20.2 \pm 4.1\%$ ,  $FFM_{\text{BIA}} = 57.8 \pm 5.3$  kg,  $TBW_{\text{BIA}} = 42.6 \pm 3.9$  l, i.e. 58.7%). Cichy et al. (2020) found the mean somatic parameters of Polish female handball players (height 176.3 cm, weight 70.6 kg, BMI – 22.8 kg m<sup>-2</sup>,  $FM_{\text{BIA}} - 19.1\%$ ,  $FFM_{\text{BIA}} - 56.9$  kg,  $TBW_{\text{BIA}} - 59.1\%$ ).

There is a need for detailed anthropometric and body composition studies of handball players.

The measurement of physical (anthropometry, somatotypes, body composition) and physiological characteristics gives a great insight into the current status of handball players and allows coaches to evaluate such players (selection) and implicate the right training volume and intensity to raise their capabilities (preparation cycles programming) (Malá et al., 2011). And especially, the results could be useful in profiling players and identifying talents and/or could direct coaches' attention to improve specific body composition characteristics of athletes. Although body composition analysis are useful for providing reasonable guidelines for the percentage of body fat in this sport, caution must be exercised when interpreting such data due to the methods of assessing body fat (skinfold thickness measurement vs. DXA vs. BIA etc.).

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# Practical ways for coaches to reduce their stress and avoid burnout

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## ABSTRACT

Stress and the potential for burnout are a very real and present concern for coaches at all levels of competition. However, while stress is ever-present, many coaches have never received education or training on how to effectively cope with experienced stress. Therefore, the purpose of this article is to present practical ways for coaches to reduce stress and avoid burnout. A brief review of stress, burnout, and the stressors coaches often face are presented. This is followed by methods to help mitigate stress and avoid burnout including best practices for physical activity, meditation, connecting with mentors, connecting with family, renewal, setting limits, saying no, continuing education, and some unexpected methods to reduce stress. All coaches will experience stress, and its recognition, combined with the skills and tools needed to moderate its effects aid in longer and more successful coaching careers.

## KEYWORDS

coaching; coach; stress management; sleep; meditation; exercise

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## Practical ways for coaches to reduce their stress and avoid burnout

Wake up, coach, plan training, teach, complete other assigned duties and tasks, sleep a few hours, and repeat. This, or a similar pattern, may be familiar to coaches; the grind of a daily routine without balance repeatedly exposes them to stressors that, unless moderated in some way, can lead to burnout (Pearson et al., 2020). Research in the past decade has determined burnout is more than an emotional state; it is an employee's response to job stressors. These stressors, especially through long-term exposure, result in decreased productivity, feelings of role ambiguity and conflict, job overload, and emotional exhaustion (Purvanova & Muros, 2010; Sisley, 1987; Vladut & Kallay, 2010). Therefore, if a coach is experiencing levels of stress that cannot be balanced or moderated, burnout is likely to occur.

Coaches are highly visible members of the community and often face job performance demands not found in other professions (Schroeder, 2010; Van Mullem, 2015). Winning or losing is a very visible performance indicator of success, and when com-



bined with balancing the vast array of job requirements associated with the coaching profession, creates a stressful work environment (Rundle-Thiele & Auld, 2009). Among other duties coaches may serve as a substitute parent, disciplinarian, academic tutor, tactician, mentor, and friend (Davis, 2005). Coaches can be challenged to aid transitioning young adults into a new athletic and academic environment, and perhaps even a new culture or language when working with international athletes (Baghurst et al., 2018). Coaches are also charged with creating group cohesion, a sense of purpose, and developing the life skills of their athletes (Saavedra, 2013). These are just a few of the many behaviors, skills, and characteristics expected of those in the coaching profession that must be balanced with winning.

Employment as a coach is tenuous at best, and the job expectations of the profession may lead to stress and eventually burnout (Kelley & Baghurst, 2009; Tashman et al., 2010). Stress occurs when the demands of the job or a given situation exceed perceived capabilities and resources for an individual to be successful (Hjälms et al., 2007). Extreme stress, or repeated exposure to stressors, can lead to psychological, physical, and sociological concerns that in turn lead toward burnout. For example, psychological consequences include emotional exhaustion, frustration, reduced personal accomplishment or disillusionment, and negative feelings and beliefs (Freudenberger, 1974; Maslach & Jackson, 1982; Sonnentag & Jelden, 2009; Stickle & Scott, 2016). Physical ramifications such as fatigue, heart attacks, strokes, ulcers, substance abuse, and increased morbidity may also occur (Frey, 2007; Mazerolle et al., 2008). Socially, the coach may experience negative consequences such as interference with daily living, lack of a positive work-life balance, and difficulty with interpersonal relationships (Olusoga et al., 2009; Tekano et al., 2011).

Stress and burnout in coaches is well-documented throughout a variety of sports (Olusoga et al., 2019). With repeated stress, or extreme bouts of stress, and without the appropriate resources to cope with the stress, a coach may leave the profession (Anderson, 2010; Bradford & Keshock, 2009; Coy & Masterson, 2007; Kelley & Baghurst, 2009). Therefore, to battle stress, a coach must make a concerted effort to schedule time toward stress reduction and control (Stickle & Scott, 2016). The nature of the coaching profession is fluid and requires coaches to confront issues as they arise. This means taking time from a current task to battle a new crisis, whether an athlete walks into the office with a personal problem, or a contest needs to be rescheduled because of weather. Therefore, coaches must consider the time necessary to combat stress as sacred and not to be interrupted, or stress may continue to build.

Given that stress is ever-present within the coaching profession, and coaches across all demographics and experience levels report experiencing stress of different kinds (Pearson et al., 2020), it is important to consider what and how stress coping mechanisms could be adopted by coaches to help mitigate these stressors. Therefore, based on previous research and application, and presented in no specific order, we offer a variety of guidelines and suggestions that coaches can utilize to establish a personal tool kit of stress reduction techniques.

## **Exercise**

Exercise can be a valuable moderator of stress in coaching (Frey, 2007). It is interesting that very few empirical articles report coaches using exercise or physical activity

as a buffer of stress, yet exercise has been found to be very valuable in alleviating stress (Lawrence, 2005). Although age and injury may affect how much or how hard a coach exercises (Baghurst & Diehl, 2016), regular physical exercise even in the form of walking or the use of an elliptical provides physiological and psychological benefits (Michaelis, 2013).

Many sports are conducted indoors, and coaches likely spend considerable time in indoor offices. Therefore, coaches may be susceptible to a vitamin D deficiency, which has also been linked to stress levels (Lansdowne & Provost, 1998). Therefore, outdoor activity might be even more beneficial at reducing stress (Olafsdottir et al., 2017). Coaches should consider walks away from the training/competition facility, or consider engaging in low-impact outdoor activities such as yoga or tai chi.

### **Meditation**

Coaches must take time away from everyone and everything. Meditation, or the use of relaxation techniques, can be used to reduce stress. Long-term mediation has been found to improve cognitive function and improve the body's physiological relaxation as measured by heart rate and galvanic skin response (Singh et al., 2012).

If new to mediation, find a place that is comfortable and calming. An office could suffice if there are no interruptions. Listening to a guided meditation tape, soothing music, or a guided app can be helpful. Headspace is a popular app that provides a variety of relaxation exercises.

To meditate, focus on posture, being comfortable, and breathing. Losing "focus" is normal, but efforts should be made to return to the task at hand, which is to take a break from daily living and working. Mediation can help avoid "future fret" (Small & Vorgan, 2019). Meditation helps with decision making and reduces worry about an unknown future (Stahl & Goldstein, 2019).

### **Connect with a mentor**

Whether formal or informal, a mentor can help. Although not a daily activity, conversing with a mentor can help serve as a motivator and an impartial advisor (Sciarappa, 2010). In their study, Christie Jr. and Baghurst (2017) reported mentors provided assistance with personal and professional success, breaking through barriers, and assisted in developing leadership skills. Further, a strong correlation exists between those involved in a mentorship experience and a heightened sense of well-being (Kutsyuruba et al., 2019). Kutsyuruba and colleagues also reported that those who did not connect with a mentor revealed a significantly lower sense of well-being.

Time is a precious commodity in the workplace (Davies, 2014). Past research specific to those employed in the field of education found striking a balance between personal and professional duties is a difficult task (Lester, 2015). However, if a mentor strongly supports a mentee's healthy work-life balance, the less likely they are to experience associated stress (Nielson et al., 2001).

It is important to recognize that mentors may also be busy and experiencing stress themselves. Therefore, be cognizant of how often and when conversations take place. Recognize that within a scale that values time, a mentor's time is more valuable than that of the mentee's. Therefore, find ways to show appreciation for the mentor giving

up that time. Sending a handwritten note of thanks or a small gift goes a long way to ensure that the value is appreciated.

One coach, cited by Baghurst (2020), summarized why finding a mentor and networking was important.

Make an honest effort in getting to know other coaches, especially those that are veterans and have been around awhile. Most coaches will be open to you and give advice and ideas. It will also help you to network and be more involved in your profession. Some of the best tips, advice, scouting reports, and practice procedures came from veteran coaches. Do not be scared or embarrassed to ask for some help (p. 544).

### **Connect with family**

The conflict between work and family directly or indirectly affects a large portion of the global population (Kossek & Lee, 2017). Even those who are single will experience stress associated with family life, as they may be sons or daughters or are part of a group of friends that functions as a family (Kossek & Lee, 2017).

Coaches are no exception to this work/family conflict. Time management is one of the most difficult challenges of a coach, and sometimes time is given to work over other commitments, which leads to stress and burnout (Pearson et al., 2020). Therefore, it is important to make committed efforts to connect with family on a regular basis. Similar to connecting with a mentor, connecting with family can bring immediate improvement to mood states (Karakas et al., 2004). It may be one of the greatest joys in life and helps to build connections among and between generations toward a more shared future (Murakami & Jacobs, 2017).

Connecting deeply with a spouse, partner, family member, or friend helps to relieve stress in many ways, including sharing the challenges and burdens that might be being experienced. The feeling of profound connectedness with someone is calming (Eliuk & Chorney, 2017). So, whether face-to-face, on the phone, the computer, or by any other means, coaches should make efforts to connect regularly with family members, especially if they are those who can aid in reducing experienced stress.

### **Prioritize and set limits**

It can be easy for coaches to take on too many responsibilities (Lyst, 2019). However, it is important coaches set realistic limits of what you can accomplish (Valcour, 2016). Stress is created by expectations, whether personal or those placed on an individual by others, and is a key element in coaching stress (Radke, 2012).

Coaches should consider using day planners or task lists to get through the day. Calendar software or apps can also help to establish schedules and routines, including times for breaks (e.g., relaxation/meditation). Prioritizing tasks also assist in achieving work goals efficiently. Baghurst (2019) presented the suggestion of using the Eisenhower Box to make decisions. Decisions are assigned as *Urgent/Important* (e.g., meeting a project guideline), *Important/Not Urgent* (e.g., family time), *Not Important/Urgent* (e.g., booking a hotel), and *Not Important/Not Urgent* (e.g., using social media). Developing a plan and prioritizing accordingly will assist in time management, efficiency, and ultimately lower levels of stress.

## **Say no**

If tasks have been prioritized and limits set, saying no to extra tasks or assignments is important, especially if not part of the job description. Saying yes can come at a cost of time and additional stress. A coach may feel pressured into saying yes too frequently, especially if the coach is new to the position or is experiencing job insecurity. In addition, saying no might create feelings of worry as it pertains to a relationship with a superior, colleague, or even recruit. However, saying no is an important word to accept and use (Ury, 2007).

Practicing saying no may be of benefit. “I just can’t commit to that right now”, “I would love to help, but I have other priorities”, or “Could you ask me again in a week’s time? I am right in the middle of another project” are all example responses that could be offered. Regardless of the phrase used, learning to say no should be required of all coaches, and may be one of the most effective ways for leaders to shape their program or organization (Jamison & Neubauer, 2019).

## **Renewal**

Coaches should take time to rest and renew (Valcour, 2016). Vacation time should be used, not excused. For many coaches, this may prove difficult, especially if coaching multiple sports in a school or club setting or recruiting in the off-season. However, delegation of duties to others such as an assistant on occasion creates a time window and also provides the assistant with opportunity for growth.

Sleep is also an important component of renewal. Even a single night of sleep deprivation may result in poor decision-making and impact vigilance and motor skills (Stojanoski et al., 2019). Lastella and colleagues (2017) measured the sleep quantity and quality of a coach compared to his athletes and reported that the coach obtained less sleep with poorer quality than his athletes, markedly so before significant games. Rest and renewal serve to reduce exposure to stressors and help avoid burnout (Sonnentag & Jelden, 2009).

Spending some time on a favorite hobby can also reduce stress (Sabo, 2011). Examples of such hobbies include, but are certainly not limited to reading, listening to music, knitting, painting or other art projects, playing cards, board games or computer games, or watching a movie. Caution should be given to electronic forms of relaxation such as TV shows, movies, or computer games, as they can be addictive. For example, Carlston et al. (2006) reported online gaming as addictive as gambling; therefore, if selecting a form of relaxation that could be addictive, set boundaries and limits. Whatever activity chosen, it should bring pleasure and reduce stress.

## **Continuing education**

The more competent an individual feels about the task at hand, the lower the level of stress experienced (Aldrup et al., 2017). Therefore, coaches should seek opportunities to improve their skillset. Attending clinics, enrolling in academic programs, or even reading or watching educational content aids in developing new knowledge and ideas. Some universities offer courses online without fees, or others offer them for a more formal certificate. For example, the FSU COACH Center (n.d.) at Florida State University offers coaching certifications as well as free online educational content via YouTube ([www.youtube.com/fsucoach](http://www.youtube.com/fsucoach)). Of course, coaches must ensure that

there is sufficient time to achieve long-term educational commitments. Completing an academic credential can be stressful in and of itself (Hirsh et al., 2020); therefore, support systems should be built-in to aid in ensuring that stress levels do not exceed the resources in place to manage them.

### **Unexpected ways to alleviate stress**

A literature search of stress reduction methods for coaches revealed some unexpected methods that may or may not be beneficial based on the individual preferences of the coach. For example, research suggests that chewing gum has been found to lower stress, anxiety, and reduce fatigue (Smith et al., 2012). However, long-term chewing or chomping gum may result in jaw discomfort (Farella et al., 2001). Laughter and humor have been found to reduce stress (Yoshikawa et al., 2018), and viewing a video of a stand-up routine or reading the comics section of the newspaper will aid in relaxation and mood improvement. A final unexpected method to reduce stress is to watch fish swim in an aquarium (Cracknell et al., 2015). Viewing the animals swim, especially if the population of fish is larger, was found to increase a sense of well-being. Ultimately, there are a variety of ways to reduce stress, but each individual should find ways that work for them.

## **CONCLUSION**

The consequences of stress in the coaching profession can be severe. Stress exacts a psychological and physical toll on the body that includes a variety of personal, physical, and psychological effects (Bryant, 1992; Ferraro & Nuriddin, 2006; Khan, 2011; Kim et al., 2011; Olusoga et al., 2009; Tekano et al., 2011). Stress also adversely affects decision-making skills and quality of life (Ferraro & Nuriddin, 2006).

When, not if, a coach experiences stress, it may negatively affect work demeanor, attitude, and performance. Knowing stress exists in the coaching profession is the first step to confronting the dangers. Presented were a variety of methods to reduce levels of stress, but it should be noted that what works for each coach will differ. However, coaches should understand that all coaches will experience stress, even if the type that each might experience differs (Pearson et al., 2020). Therefore, coaches must develop stress reduction strategies that mitigate stress, or burnout will almost certainly occur.

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# Using an enhanced SERVQUAL approach to assess service quality in Czech fitness centers

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## ABSTRACT

This study is focused on the issue of sport service validation in the fitness domain; it aims to propose a systematic procedure for evaluating the quality of services in the Czech fitness industry. Cross-cultural transfer and validation of the SERVQUAL method (Parasuraman, Zeithaml, Berry, 1988), which was originally validated for American customers, is discussed practically. The modified Czech version of the SERVQUAL questionnaire was the main tool of data collection in the market research of six fitness centers chosen randomly with a sum of 697 participants. Upon completion of data collection, the reliability of the model was repeatedly evaluated by means of SEM – Structural Equation Modelling. Based on the SEM results a hierarchical structured model was designed with a general factor and four factors corresponding to questionnaire subscales.

## KEYWORDS

sport; customer satisfaction; questionnaire; structural equation modelling

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## INTRODUCTION

In 2016 the European fitness sector included more than 48,000 fitness centers and sports centers with over 50 million people, and generated almost € 27 billion in annual sales (Deloitte, 2017). The Czech Republic has over 2,500 registered fitness centers, but this service industry is still growing. In 2015 the Czech Fitness Chamber reported 18% growth in new users, and found that an additional 33% of people planned to start using the services of fitness centers in the upcoming year (Česká Komora Fitness, 2016). The fitness industry in the Czech Republic has rapidly expanded, but services are still running ahead of demand. The level of fulfillment of human needs is a decisive

factor for customer satisfaction and assessment of quality. Generally, if people are satisfied with the quality of services, they tend to use them more regularly and repeatedly. This is particularly necessary for organizations, such as fitness centers, which were created to provide regular services, and who are competing based on the assessment of their ability to satisfy customers.

Customer's expectations are constantly rising in every segment of society, including the fitness industry. So logically, as the range and quality of services increases, there is an increase in the demands of customers. These requirements are not always easy to meet. However, fitness centers must continually strive to do so, even though the competition is high-powered and winning new customers is increasingly difficult. Therefore, the current strategy of profitable sports organizations is orientated toward retaining current customers. Employees are in direct contact with these customers, and thus they can directly influence future purchase decisions.

To evaluate how services meet the needs and demands of customers, managers use different standards to measure service quality and customer satisfaction. These standards are constantly being sharpened across all related fields from practical marketing services to academia. One such evaluation tool was introduced by Parasuraman, Zeithaml, and Berry in 1985. This survey measuring five qualities of service has been adapted and applied various industries and contexts. In this article we explain the process of adaptation of the SERVQUAL model to the Czech fitness industry.

In recent years, experts are inclined towards the notion that service quality must be assessed by the customer for whom the service is intended. This type of evaluation is not always objective, and may not correspond with the opinion of the professional community. However, in the profit sector of the service industry, fitness centers being a good example, the satisfaction of experts or management is not necessary, in contrast to that of customers themselves. As mentioned above, it is the customer's satisfaction which increases their loyalty, and thus affects the profitability of organizations which provide services.

Generally, to assess quality of service, non-professionals, and in many cases even professionals, use methods which are not sufficient, neither verified statistically nor methodologically; thus the reliability and the validity of the results of such investigations is often speculative. This study was therefore primarily motivated by an effort to provide a high-quality diagnostic tool for assessing the quality of services in the field of fitness in the Czech Republic.

Sports managers should understand the point of their services. They should know which specific aspects of their services affect customers, customer satisfaction and perception of service quality.

### **The conception of quality of service**

The definition of quality of service varies based on different conceptual frameworks. Bitner and Hubbert (1994) described the concept of quality of service as the "total sum of features and characteristics of services that contribute to the ability to meet requirements" (p. 77). This definition is more oriented to the service itself than to customers. Quality is understood here as the sum, respectively, of the level of existing properties, and service quality evaluation is done on the basis of an assessment of objective criteria.

Modern marketing approaches, however, are more focused on customer needs and frequently the quality of services is defined as “a comparison of customer expectations and the actual performance of services” (Grönroos, 1984; Parasuraman, Zeithaml & Berry, 1985; Seth, Deshmukh & Vrat, 2005; Kotler, 2007; Javadein, Khanlar & Estiri, 2008). This understanding of the concept of service quality is based on the assumption that the requirements for a particular level are primarily determined by the customers themselves. Therefore, it is necessary to define the concept of quality relatively, i.e. from the subjective viewpoint of the customer.

### **Quality of service in the field of fitness**

In the process of searching for the best quality in the area of fitness, it is necessary to emphasize properties which are typical for services in this sector. Primary attention is paid to human performance, which occurs at the interaction between the customer and the provider of sports and recreational services (Grönroos, 1990; Zeithaml & Bitner, 1996; Nuviala, Grao-Cruces, Pérez-Turpin & Nuviala, 2012; Tsitskari, Antoniadis & Costa, 2014; Lim, ROMs, & Armentrout, 2016). In the process of providing services, it is assumed that the employee's behaviour, attitude, and experience influence the course and outcome of services for which a customer actively participates. Fitness services require a close relationship and a high level of engagement between the customer and the service provider. In these relations, there are not standardized services offered, and thus both the customer and the service provider must make a conscious effort to interact, to ensure adequate service provision. Overall, human performance is a core product and customer experience is the main output.

In the fitness industry, there is also a relatively high level of interaction between customers themselves. They influence each other and have an impact on the final quality of services provided. Managers of fitness centers should be aware of these interactions and avoid possible problems, especially during classes supervised by trainers or instructors. The described attributes are characteristics of traditional services – immateriality, inseparability, variability, transience, lack of ownership (Kotler & Armstrong, 2004). Sports and sports services provided by fitness centers can be explained by these distinctive characteristics very well.

Although the service is intangible, the material elements associated with it should not be forgotten. The environment and equipment of a fitness center are important factors which determine the level of quality perceived by customers. For example, modern amenities and artistic design of equipment in the fitness center can positively affect customer service quality assessment. Lakh and Mohanty (1995) interpret service as “the operations, systems, or commercial transactions involving tangible and intangible attributes carefully combined to maximize customer satisfaction and efficiency of the functional system” (p. 140). In other words, customers form their perceptions of quality through their overall impression of the service, equipment and facilities of the provider.

Reflecting on the quality of services in fitness, it is also necessary to consider the motives which lead customers to use the services of a fitness center. According to Grönroos (1990), customers purchase services to solve their problems. The intention of purchase is to gain subsequent benefits and results arising from the service, rather than the service itself. In the sports and recreation industry, the customer's experi-

ence is the main result. In the field of fitness, however, apart from the enjoyment of the physical activity itself, customers intend to use the service to solve real problems. Such problems may be that they are overweight, have poor fitness, flabby or shortened muscles, back pain, stress and other similar troubles. Therefore, it is desirable to identify the possible problems and motivations of customers who participate in fitness programs in order to effectively help them. Any improvement in their physical or mental state determines not only their perception of service quality, but also their level of satisfaction.

### Properties of service quality

In developing the SERVQUAL model Parasuraman, Zeithaml and Berry (1985) attempted to quantitatively measure characteristics of service quality. Their research is based on interviews with service providers and their customers, from whom they discerned why they were, or were not, satisfied with the services provided, and which situations or circumstances contributed to their positive or negative impressions. Based on the results of these and other studies, Parasuraman et al. suggest five characteristics of service quality which customers typically assess. There were *tangibles* – appearance of facilities, equipment and personnel; *reliability* – ability to perform the promised service reliably and accurately; responsible approach – *responsiveness* – readiness and willingness to help customers; *assurance* – knowledge and skills of employees and their ability to create the feeling of customer confidence and trust; and *empathy* – readiness and ability to empathize with individual customer requirements.

According to Grönroos (1984) there are two basic characteristics of quality of service, *technical and functional*. The technical characteristics refer to the relatively measurable elements of the service which a customer receives during their interaction with the service provider. They are a result of provided services. Evaluation of the technical quality of service seems to be easier, but sometimes it can only be objectively assessed by experts, or only be assessed after a certain period of time.

Customers, however, are also interested in the way the service is provided to them, this is referred to as the functional quality of services. Functional perception of quality is subjective. It is affected by the environment in which the services are provided, the behaviour of the employees of the organization, the length of time waiting, etc. Technical and functional qualities influence the organization's image, which has an inverse effect on the expectations which a customer connects to the service.

Now with regard to customer expectations and services performed, Berry (1986) defines two other characteristics of services – *routine and exceptional*. Indicators of routine characteristics describe the level of service which is provided under normal conditions. The customer has expectations of a typical routine of service provision and service providers which is familiar.

However, if unforeseen interferences occur during routine services, customers expect so called “outstanding characteristic quality of service”, i.e. the staff is helpful and able to advise in these unexpected situations. This may include handling customer's complaints; which may or may not be justifiable. In either case, however, a sensible and highly individual approach is required. These situations pose risk to the organization: the customer may be dissatisfied with the service, but also the opportunity that customers will be pleasantly surprised by how the service provider manages the

situation. Particularly these situations, when it is possible to meet or exceed customer's expectations, may leave the impression of exceptional quality, and thus further increase the loyalty of the customer whose complaint was solved.

Thus it is evident that many factors influence customer perception of service quality. The SERVQUAL method incorporates these into five characteristics of service quality as a standardized tool for evaluation (Parasuraman, Zeithaml & Berry, 1988).

### **Service quality measurement**

According to Oliver (1997), customer satisfaction is achieved when "a product or type of service or product service itself has provided or provides a pleasant level of satisfaction of its consumption" (p. 13). According to Patterson and Spreng (1997), customer satisfaction is the feeling when customers' needs are met and their expectations are fulfilled. Satisfied customers will probably use the service again or tell other potential customers about their positive experience. According to Cronin, Brady and Hult (2000), satisfaction may well be regarded as an event preceding the future intentions of the customer. Varying perceptions of customer satisfaction, and quality of service indicators, leaves room for a relatively wide range of approaches to measurement. Quality measurement can be done from the perspective of the service provider, or from a customer's point of view. In the first case, mostly objective criteria are assessed; while in the second case, the criteria are subjective.

According to Mateidese (2002) using objective criteria focuses on quality measurements more than on the service itself, especially in the case where there are clear indicators which can be verified by measurement (e.g., the status of the service in the process of being provided). In contrast, the subjective measurement is subordinate to the subjective criteria of the perception of quality assessors, including their subjective needs and expectations. The fact that quality is assessed on the basis of the subjective perception of reviewers – mostly customers – does not mean that the research is not objective.

The focus when measuring service quality must be on validity (meaning selection of the most suitable marketing research technology, which will provide the information the organization needs), and reliability (it is desirable to obtain similar results when the quality measurement is repeated under the same conditions).

Measuring quality using subjective criteria is based on the subjective assessment of the individual characteristics of service quality. These properties are evaluated by the customer and several indicators are used. It is assumed that the total evaluation of service quality is the result of an individual assessment of each indicator, and each feature of quality services, taking into account that not every property will have the same importance each customer. The SERVQUAL measurement model was built on this theoretical concept and is thus assessed to be an adequate tool for measuring service quality in the fitness industry, but requires adequate adaptation and refinement to the Czech market.

The SERVQUAL method is one of the most popular tools used by researchers evaluating the quality of services in various domains. In the sports industry it has also been used, tested and refined several times (Wright, Deray & Goodale, 1992; Cronin & Taylor, 1994; Howat, Absher & Milne, 1996; Howat, Murray, & Crilley, 1999; Kouthouris & Alexandris, 2005; Robinson, 2006; Tsitskari, Tsiotras & Tsiotras, 2006; Javadein,

Khanlar & Estiri, 2008). SERVQUAL has been culturally adapted to the sport context in multiple countries, including Greece (Alexandris, Dimitriadis, & Kasiara, 2001), Iran (Javadein, Khanlar & Estiri, 2008), Spain (Nuviala, Grao-Cruces, Pérez-Turpin & Nuviala, 2012), Cyprus (Tsitskari, Antoniadis & Costa, 2014), and Greece (Tsitskari, Tzetzis, & Konsoulas, 2017). To test the method in the Czech Republic it is necessary to first examine the rules for intercultural transfer of evaluation methods. There were several views taken into account, which means in many cases, carrying out tests from the social sciences for transfer, and these strictly require the development of concepts and tests based on local cultural realities. This direction is represented by the so-called “psychology indigenous movement” defined by Kim and Berry (1993). This movement refers to completely different cultural habits between Western and Eastern civilizations. The Czech Republic is ranked among developed countries and its culture is not different. Also, the range of services, equipment for fitness centers and service quality in this area is now at a comparable level to economically developed countries in Europe and the US, where the SERVQUAL method has been used most often. In order to design a model structure for the Czech version of SERVQUAL, the highest quality diagnostic method of structural equation modelling (SEM) is used. The purpose is to test models conceptualized by the currently accepted theory of the division of quality services to functional and technical (Grönroos, 1990), while the original model was evaluated according to the functional quality of Parasuraman, Zeithaml and Berry (1988), using five factors.

## METHODS

Based on the necessity of valid and reliable measurement tools for measuring service quality, the aim of this study was to use exploratory factor analysis to verify the diagnostic quality of a modified version of SERVQUAL in the Czech environment of fitness centers. On the base of the results, structural modelling was used to find a more suitable hierarchical structure of this model for the specific Czech environment.

Several necessary steps were needed to achieve these goals. The first step was the transfer of an intercultural SERVQUAL questionnaire, which had previously been adjusted to the fitness environment (Javadein, Khanlari & Estiri, 2008). It was necessary to compare the semantic, normative and conceptual equivalence of the translated version and the original one. In this work, attention is paid especially to conceptual equivalence.

To translate the questionnaire, modified direct translation was used. Translators worked with the original version of the questionnaire as well as with other versions (Javadein, Khanlari & Estiri, 2008; Tsitskari, Tzetzis & Konsoulas, 2017) adapted to the environment of fitness. The English version of items used to measure constructs are given in Table 1. The exact wording of the items in the Czech language was also consulted with experts in psychology, methodology, statistics and fitness. The psychologists considered possible standards of behaviour for Czech respondents. Consultation with methodology and statistics experts was aimed at understanding and complying with statistic methods; and fitness experts addressed the uniqueness of the fitness environment. Based on these outcomes several formulations of questionnaire items were adjusted. Then the entire questionnaire was validated in a pilot study on

a sample of 146 respondents from fitness centers located in the Prague 2 district. For the diagnostic evaluation of the quality of this pilot version of the questionnaire exploratory factor analysis was used.

**Table 1** Items used to measure constructs

Items	
T1	Modern equipment
T2	Visually appealing facilities
T3	Employees who have a neat, professional appearance
T4	Visually appealing materials associated with the service
R5	Providing services as promised
R6	Dependability in handling customers' service performed
R7	Performing the services right the first time
R8	Providing services at the promised time
R9	Maintaining error-free records
R10	Keeping customers informed about when services will be performed
R11	Prompt service to customers
R12	Willing to help customers
R13	Readiness to respond to customers' requests
A14	Employees who instill confidence in customers
A15	Making customers feel safe in their transaction
A16	Employees who are consistently courteous
A17	Knowledgeable employee to answer customer questions
E18	Giving customers individual attention
E19	Employees who deal with customers in a caring fashion
E20	Having the customer's best interest at heart
E21	Employees who understand the needs of their customers
E22	Convenient business hour
TQ23	It is successful to complete exercise
TQ24	The exercise can be completed without the interruption
TQ25	The coach's experience is good and his (her) exercise is excellent

Source: Javadein, Khanlari and Estiri (2008), modified by authors

The results of the pilot standardization were taken into account in the design of the second version of the questionnaire. Primarily by assessing the value of the factor loads of each indicator, some items of the questionnaire were changed. Their exact wording was again consulted with experts. A modified form of the questionnaire then became the main tool for data collection in the implementation of marketing research, in which 697 respondents participated from six fitness centers. Fitness centers were chosen using a random number generator (Random Number Generator) on a list of

sports facilities, which met two fundamental criteria: scope of services offered (gym, cardio zone and aerobic zone), and facility size (minimally 400 m<sup>2</sup>).

Marketing research is used to help detect weaknesses in the quality of services provided in the various sports facilities and as well as globally in the Czech context. However, first there must be a systematic procedure for evaluating the quality of services in the fitness industry. This was achieved using structural modelling.

### Conceptual equivalence

Empirical assessment of conceptual equivalence is realized by testing the similarity of factor structure. The extent to which the factor structure of the translated questionnaire is similar to the original vision is assessed. To compare the results of two exploratory factor analyses, there are no statistical tests; therefore, currently, explorative approach is not recommended, and is increasingly being replaced by confirmative approaches.

Confirmatory factor analysis, as opposed to explorative, often works with covariances, as well as correlations; it thus has a great advantage in that it can also determine the correlation between these factors. Therefore, we also used it in this work as part of structural modeling.

### Structural equation modelling

Structural equation modelling (SEM) is a parametric statistical method, which assesses structural theories of a particular factor or characteristics. It involves more than one statistical method; it includes a set of statistical procedures which help to judge the diagnostic quality of the tool. The MPlus structural model was used in this work. In this research, observable variables (i.e. *manifest* variables) were represented by questions in a questionnaire, and these are “indicators”. The second types of variables, *latent* variables, are represented by items which cannot be measured directly, and are called “factors” (Bollen & Curran, 2005).

Statistical estimates of the relationships between items from the questionnaire and factors are called factor loadings, and are generally interpreted as regression coefficients, which can be both standardized and non-standardized in form. Indicators in confirmatory factor analysis (CFA) are continuous variables. An important prerequisite is that a factor is also a continuous latent variable (McDonald, 1999).

The basic mathematical expression for the general factor model:

$$x = \Lambda f + \varepsilon,$$

where:  $x$  = directly observed response (answer from the questionnaire)

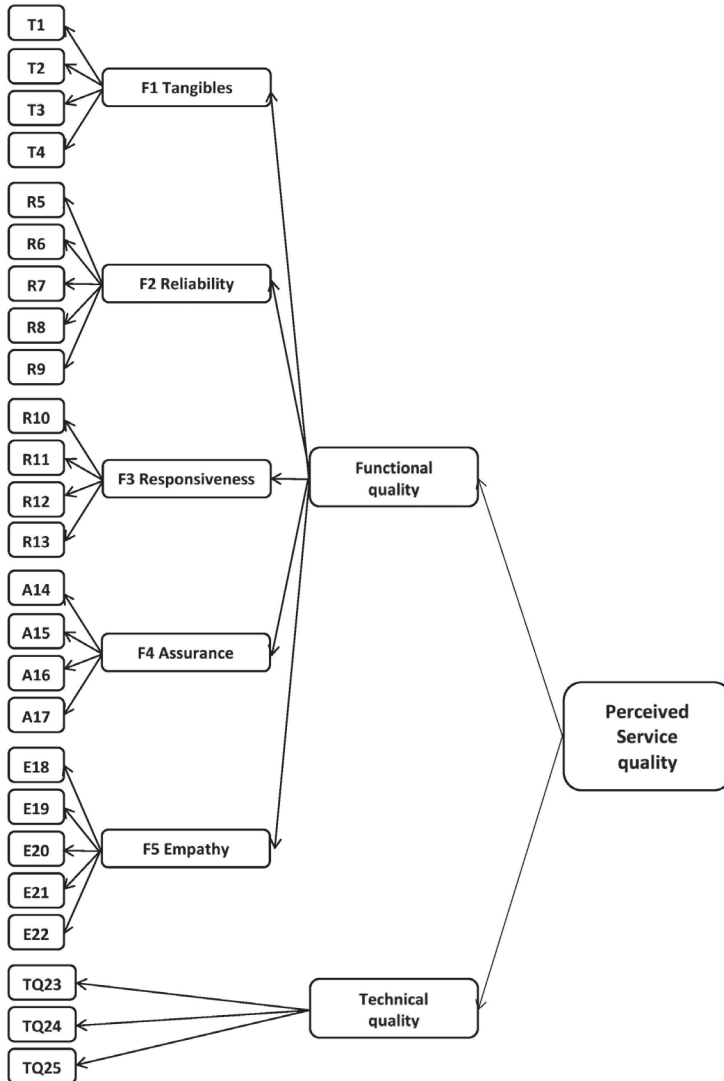
$\Lambda$  = matrix of factor loadings

$f$  = random vector of factors

$\varepsilon$  = random vector of singularities of variables

An important prerequisite is that the singularities do not correlate with factors. Such singularities can be specified as independent. This example is expressed by Figure 1, which shows a test model structure from the modified version of the SERVQUAL questionnaire for the fitness environment (E1–E25 show the singularities of factors, X1–X25 indicators and factors are from F1 to F5).





**Figure 1** Conceptualization of a SERVQUAL model adapted to the fitness area  
Source: Javadein, Khanlari and Estiri (2008), modified by authors

**Fit index**

The main objective of structural equation modeling is to test a theory of selected models which are conceptualized based on the currently accepted hypothesis in the field. These conceptualized models represent the prediction of this theory between latent variables, which are measured by appropriate indicators (Hayduk, Cummings, Boadu, Robinson & Boulianne, 2007).

According to Millsap (2007), in model testing it is important to realize that the analysis of the model in SEM solves the investigator’s theoretical questions regardless of whether the model, which was based on a developed theory, is maintained. Since

statistical models are only instruments of estimation, when testing models in SEM it often occurs that there is only one model whose “fit” (i.e. how well the model captures the data recorded by investigators) would lead to its absolute acceptance. Additionally, studies are conducted on different files which are not representative of the whole population, but only a part of it. Therefore, research with identical test patterns from the same population, but with different sets, also detect different model fit, and sometimes also different structures of the whole theoretical concept. The crucial question is how to proceed when there are multiple models which are based on differing alternatives for the structure, fit the data the same or with a high degree of similarity. According to Raykova and Marcoulidese (2004), the researcher can make the final decision based on knowledge of the theoretical concepts which were defined in the research. This decision, of course, is influenced by a subjective level of knowledge and understanding within the context of the theoretical concept. To determine the quality of the model so called “fit indexes” are used. These indexes determine how well the proposed model fits the data obtained from measurements by means of selected indicators on the research group (Kline, 2011).

SEM research does not generally use only one fit index to express the quality of the model. According to some authors (McDonald & Marsh, 1990; Hu & Bentler, 1999) the use of at least three indicators of fit is considered the standard. Given the type of indicators used in the SERVQUAL questionnaire, in order to determine the quality of the model, in this paper we used the following indexes: Chi-square, RMSE (Root Mean Square Error of Approximation), SPDC (Standard Root Mean Square residuals), WRMR (Weighted Root Mean Square Residual), CFI (Comparative Fit Index), TLI (Tucker-Lewis Index).

The **Chi-square model** indicates discrepancy or inconsistency between the expected and the measured result. This fit index reflects the so-called “fit imperfection” – the higher the value of chi-square, the worse the model fits. In contrast to other indexes, there is no direct reference range to which the index values should correspond. This statistic is based on the number of model parameters and file size. Additionally, if other indexes indicate a good fit, chi-square significance does not have to result in model rejection.

**CFI Index** (Comparative Fit Index) measures the relative improvement of the fit of the proposed model compared to the base model. CFI index values are in a closed interval from 0 to 1, with larger values indicating a better fit for the model. The recommended acceptable CFI index is 0.95.

**TLI Index** (Tucker-Lewis Index) represents a non-normed fit index where the values are not only in the closed interval from 0 to 1, but may be greater than 1. The recommended value of this fit index is 0.95.

**RMSE Index** (Root Mean Square Error of Approximation) expresses “approximate” model fit in the population. The lower the RMSE is, the better the fit of the model. Values of  $\geq 0.10$  represent a bad fit model. Values ranging from 0.08 to 0.10 represent the average model fit; values ranging from 0.05 to 0.08 are a good fit; and values  $\leq 0.05$  are a very good model fit.

**WRMR Index** (Weighted Root Mean Square Residual) is based on a comparison of differences between the observed and predicted covariances (model). The lower the index of WRMR, the better the fit of the model. The recommended value of this index is  $\leq 1$ .

Structural modelling was used initially in this work within the framework of the pilot study using the responses from 146 respondents. This method was used again upon completion of the research in order to find the best model for evaluating the quality of services through the Czech version of the SERVQUAL questionnaire. The results of the structural equation modeling are presented in the results section.

## RESULTS

The first verification structure based on structural equation modelling was completed in the framework of the pilot study based on answers from 146 respondents. The model was re-sorted to a new structural model based on answers from 697 respondents. Reliability assessment of the questionnaire, and modelling of its structure, went through several stages. The highest diagnostic quality was found by testing each model structure as presented stage by stage below.

**Table 2** Fit index of models analyzed

Model	Chi-square	CFI	TLI	RMSEA	WRMR
1-factor model	1189.43	0.92	0.91	0.069	1.526
6-factor model without correlations	10102.66	0.19	0.19	0.230	6.248
6-factor model with correlations	1074.03	0.933	0.923	0.067	1.428
4-factor model	1090.84	0.932	0.924	0.067	1.445
<b>4-factor model without questions 1 and 3</b>	<b>907.81</b>	<b>0.943</b>	<b>0.936</b>	<b>0.065</b>	<b>1.376</b>
1-factor model without questions 1 and 3	990.09	0.937	0.930	0.069	1.450

### **Stage 1–1 factor model**

A one-factor model was tested first, having a single general factor (the latent variable called *service quality*). This one-level unidimensional structure makes a strong assumption that all 25 items of the Czech version of the SERVQUAL questionnaire will measure one common feature. The model fit indexes shown in Table 2 show that this model is not entirely acceptable, and that the structure of the modeled theoretical concept is likely to be truly multidimensional.

### **Stage 2–6 factor model without correlations**

The second model tested was a 6-factor model. Even though this did not seem likely, the structure was defined so that the individual factors did not correlate with each other, and thus evaluate different attributes in the quality of fitness services. Based on current theory, the following individual factors were identified: *tangibles*, *reliability*, *responsiveness*, *assurance*, *empathy*, and *technical quality*. The results of the six-factor model with non-correlated factors were that although the factor loads of most indicators improved, the indexes of fit had unacceptable values. This significant deterioration of the model was due to the strict correlation limitation – zero relationship between factors. Therefore, these relationships between factors were freed for the next phase of structural modeling.

### **Stage 3–6 factor model with correlations**

In stage 3 the six-factor structure was retained with correlations between individual factors released, thereby significantly improving the model's fit. However, as shown in Table 1, the model still did not achieve fully acceptable reliability values. Indicators 1 and 3, which still had very low factor loads, continued to be problematic in the model. In addition, a strong dependence was found between factors to release correlations. The correlation between the *assurance* and *empathy* factors was 0.945, indicating that these two qualities of service quality are related, and customers are actually evaluating a second property when evaluating one property. Similarly, there is correlation between *empathy* and *technical quality* and between *responsiveness* and *security*. In all three cases, the correlation exceeded 0.9, indicating a strong dependence. Thus, the combination of the factors *responsiveness*, *assurance* and *empathy* into one was considered, as respondents by virtue of one factor actually affected the other two. This connection seemed logical also because the pilot study pointed out that fitness center customers themselves could not distinguish between what quality of service they were evaluating. Simply stated, they expected that the fitness center employees could empathize with their needs (*empathy*), act with respect to these needs (*responsiveness*) and thus gain customer confidence (*assurance*).

### **Stage 4–4 factor model with questions 1 and 3**

In stage 4, the structure of the model was modified based on the strong correlations between some factors seen in stage 3. The factors *responsiveness*, *assurance* and *empathy* were combined into one factor called *staff behavior*. The factors *tangibles*, *reliability* and *technical quality* were left alone. The model of this hierarchical structure showed no significant improvement, and the fit index values remained almost unchanged. The results continued to point to two problematic items in the *technical quality* factor. The factor loads of indicators 1 and 3 remained virtually unchanged.

### **Stage 5–4 factor model without questions 1 and 3**

The next phase of structural modeling was based on the reference to the low factor load of indicators 1 and 3. It was therefore decided to exclude these two indicators to assess the *technical quality* factor. Thus, the total number of indicators (questionnaire items) dropped to 23. In this case, the chi-square value decreased significantly and the other fit indices also improved slightly. Thus, it was found that in this model, indicators 1 and 3 were intrusive variables whose information did not relate to the theoretical concept being evaluated and to the quality of the proposed models.

### **Stage 6–1 factor model without questions 1 and 3**

The finding that indicators 1 and 3 were intrusive variables led to the next step of structural modeling. Due to the fact that a strong interdependence of factors was evident from the data analysis of the proposed models, it was decided to repeat the confirmatory factor analysis for categorical data in the form of a unidimensional model, as was already proposed in the first stage of SEM, with the difference that problematic items 1 and 3 were omitted. All remaining indicators in the form of individual statements in the questionnaire now measured only one factor named *service quality*. Indeed, the new measurement revealed improvement in most fit index values compared to

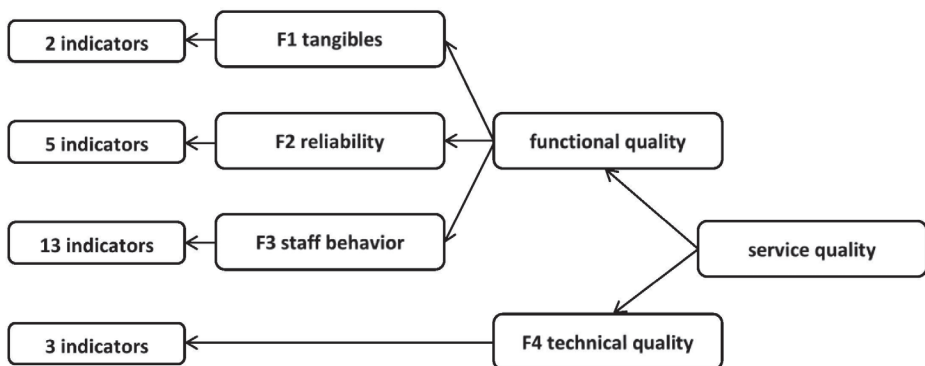
one-factor model values in stage 1. However, in the overall comparison of all results achieved, this one-factor model without the two interfering indicators is not as good as the previous 4-factor model. In particular, the chi-square index, which expresses the mismatch between the expected and measured results, and the RMSEA, indicating the approximate fit of the model to the population, was higher in comparison to the four-factor model indices without items 1 and 3.

**Enhanced 4-factor model with 23 indicators**

As the SEM stages above illustrate, the four-factor model without questions 1 and 3 has the best fit. It achieves the best values in all of the monitored indexes. Also, factor load factors (Table 2) for the four-factor model were the best. This was not true for all indicators, but the average factor load of all indicators of this model was 0.6, which was the highest of all analyzed models. Thus, the resulting design became a 4-factor model with 23 indicators.

Thus, quality of service is evaluated by respondents through four characteristics of service quality illustrated in Figure 2. Indicators belonging to *tangibles*, *reliability* and *staff behavior* can be described as functional quality. It is *how* the service is provided. Primarily, the interaction between customers, and all the staff customers deal with, is evaluated. However, abiotic elements are also judged, which strongly influence the customer’s perception of service. Among these are the equipment of a fitness center, interior and exterior appearance, and overall atmosphere. *Technical quality*, on the other hand, expresses *what* the customer is provided.

A “*tangibles*” factor is measured by only two indicators which evaluate the fitness center environment and its promotion. *Reliability* is assessed through five indicators, through which respondents judged how a fitness center keeps its promises, and whether it provides services without errors or shortcomings. *Staff behavior* is represented by a total of 13 items on the questionnaire. The respondents evaluate the staff and their attitudes, politeness, and willingness and ability to help. They also assess the degree of empathy, or how staff are able to empathize with the needs of their customers. *Technical quality* is expressed as an evaluation of structures and physical exercises as a result of the work of coaches, instructors and trainers.



**Figure 2** Structure model proposed for assessing the quality of services in the Czech fitness environment

## Factorial validity of the proposed model

**Table 3** Factor loadings of each indicator (items of questionnaire)

F1 Tangibles		F2 Reliability		F3 Staff behavior						F4 Technical quality	
X2	0.608	X5	0.604	X10	0.573	X14	0.749	X18	0.459	X23	0.594
X4	0.505	X6	0.685	X11	0.474	X15	0.609	X19	0.714	X24	0.624
		X7	0.685	X12	0.578	X16	0.493	X20	0.708	X25	0.624
		X8	0.403	X13	0.700	X17	0.641	X21	0.774		
		X9	0.558					X22	0.327		

The values in Table 3 represent the factor loadings – the correlation between individual statements in the Czech version of the SERVQUAL questionnaire with four latent factors (service quality characteristics). These values represent the factorial validity of the questionnaire items.

Factor loadings of all indicators are above the value of the correlation coefficient of 0.3, which represents the boundary between small and medium indicator impact. Another imaginary boundary is presented by a value of 0.5. Out of the 23 total questionnaire items there are five which fall below this threshold. Their influence on the factor can be described as medium. The remaining 18 items are higher than the 0.5 factor load, which represents a great influence.

## DISCUSSION AND CONCLUSION

The aim of this study was to propose a particular methodology for evaluating the quality of services in the field of fitness in the Czech Republic. As stated previously, there is no universal, generally true, and always applicable definition for the term “quality of service”. The current approach of marketing professionals expresses the consensus belief that the one who decides whether a given service is good or not, should always be the customer for whom the service is provided. Current marketing approaches reflect the particular demands of customers, using subjective measurement methods. Customers, at least partially, examine individual characteristics of service quality – i.e. factors. They assess these properties by using several characters – i.e. indicators. It is assumed that the overall evaluation of the quality of services is the result of an individual assessment of each character and each feature of service quality.

The diagnostic quality of the models was assessed using several fit indexes. An important role is played by the size of the research sample, and therefore structural modeling was undertaken twice – in the pilot study before the realization of marketing research, and after its completion, when questionnaires from 697 respondents were available. Since the data from the questionnaire were scored on a seven-point Likert scale (from –3 to +3) confirmatory factor analysis was used for categorical data.

The model that was used in the actual research, had relatively good fit indexes, however high correlation between these factors (service quality characteristics) indicated the possibility of merging some of the factors into one. There may be several

causes for the high degree of overlap between individual factors. One may be that the five factors of functional quality evaluation were represented by ten factors in the original version of the SERVQUAL questionnaire. The original authors of the questionnaire, Parasuraman, Zeithaml and Berry (1988), later reduced the number of factors to 7, and finally to 5, so that only the first two (tangibles and reliability) were changed. A high degree of correlation was thus expected. Another reason may be the subjective assessment of respondents – a positive evaluation of one aspect of the fitness center may also be transferred to another aspect without actually perceiving it. Respondents may also lose motivation during the process of filling out the survey, and thus tend to copy previous answers. Another frequently discussed issue is the use of a seven-point scale. Respondents in most cases use the extreme value of “+3”. Extension of point range scaled could provide respondents more margin for evaluation, and result in greater variability among responses. A respondent who marked an extreme value on the seven-point scale from  $-3$  to  $+3$ , for example, might not make the same decision on the ten-point scale. Using an array with an even number of points might also force respondents to avoid midpoint scaling which results in problematic interpretation.

The results of structural equation modeling highlighted the high degree of correlation between the functional and technical qualities. However, in reality they are distinct concepts. While the technical quality is focused on the program itself, its complexity, the work of trainers/instructors, and its operation; while functional quality focuses on the process of providing, operating, service, the work of other employees, the environment and services associated with attending a lesson. Since indicators for the technical quality were located at the very end of the questionnaire, their evaluation could be affected by reduced attention and motivation for thoughtful responses. Moving this section to the beginning of the questionnaire could avoid this problem. It could also be helpful to clearly separate this section from the rest of the questionnaire, and a short reminder to respondents that the subject of evaluation should be the quality of lessons. A methodical work progression was selected to respect the complexity of managing all connections with intent for further investigation. These are particularly necessary due to the necessity of verification of the proposed methodological procedure in various sports organizations, both for profit and non-profit.

This work is a contribution to the further development and improvement of quality service management in the field of sport. It summarizes the current level of knowledge, and presents a generalization from experience in the process of improving the management of sports organizations. Regardless, the perception of service quality in sport is likely to remain a rather controversial issue for the foreseeable future. The divergence of concepts between different methods supports the proposition that we cannot expect a generally valid and perfect concept for assessing the quality of services to be found anytime soon. The increasing demands regarding the quality of services provided, however, creates a need to further observe this issue professionally, and develop a methodology for service quality improvement in sport management. The Czech SERVQUAL questionnaire modelled, developed and tested in this study meets this current need in the current Czech sport context.

The Enhanced Czech language SERVQUAL questionnaire is available on request from the corresponding author.

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