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Original Articles

Wounded warriors: Multiple identities, physical activity and life satisfaction

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ABSTRACT

Purpose: The purpose of the current study was to examine a model specifying that military, athlete, exercise, and disability identities would predict life satisfaction as mediated by physical activity (PA).
Methods: Seventy-one military veterans ($N = 71$) with impairments participated and completed Exercise, Athlete, Disability, Military, identity scales and Life Satisfaction and PA questionnaires.
Results: A mediation model indicated the indirect effect of the four identities on life satisfaction through PA was not significant However, PA was predicted by the 4 identities, [F (4, 66) = 2.49, $p = 0.05$] and accounted for 13% of the variance, with disability identity having the only significant beta weight. Life satisfaction was also predicted by the 4 identities and PA ([F (5, 65) = 4.88, $p = 0.001$] and accounted for 27% of the variance. However, only the military and athletic identities had significant beta weights.
Conclusions: Our findings provide preliminary support for the value of military veterans maintaining a military identity and holding an athletic identity. The current findings suggest that sport psychologists and rehabilitation professionals take a more nuanced and open-minded perspective about veterans who desire to maintain a military identity when becoming civilians.

KEYWORDS
sport; exercise; quality of life; disability

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INTRODUCTION

According to identity theory, people have multiple identities (Martin, 2013). Military personnel hold military identities (Lancaster & Hart, 2015) and athletic identities are salient for individuals playing sport (Guerrero & Martin, 2018). Additionally, people who engage in exercise are likely to have exercise identities (Anderson & Cychosz, 1994). Finally, individuals with disabilities may have a disability identity (Hahn & Belt,

2004). Given the multiplicity of identities that people can hold, the purpose of the current study was to examine how the multiple identities of military veterans with impairments, are associated with physical activity (PA) and life satisfaction. In particular, a major purpose was to examine identity theory (Stryker & Burke, 2000) using a model specifying that all four identities would predict life satisfaction as partially mediated by PA. Our findings should help inform sport psychologists who work with veterans who are frequently recruited into Paralympic developmental programs (Martin, 2017).

Identity lays on a continuum from non-existent to very strong and meaningful. Individuals with disabilities may purposefully deny any links to disability and refuse to accept they have a disability or conversely, fully embrace a disability identity (Dunn & Burcaw, 2013). Strong identities can be adaptive because they provide mental health benefits when people are successful in domains commensurate with their identity (Stryker & Burke, 2000). For instance, a military veteran, with a strong identity, who is promoted, will experience pride. Similarly, a Paralympic athlete winning a Paralympic medal will feel happiness (Martin et al., 2019). At the same time, a strong athletic identity may make leaving sport difficult because much of an athlete's lifestyle (e.g., training) is tied into being an athlete. Holding a strong exercise identity may be frustrating for someone with a disability if they cannot exercise because of an inaccessible gym (Martin, 2017). In contrast, it may also drive adaptive exercise-linked behavior (e.g., speaking to gym owners about accessibility issues). Finally, possessing multiple identities helps people, such as retired military veterans, adjust to leaving the military (Steffens et al., 2016).

Many of the research studies we report on next, link various identities to life satisfaction and present plausible explanations for why such identities might influence life satisfaction. However, the mechanisms leading from identities to life satisfaction are rarely examined. The current study was designed to address that weakness. More specifically, we argue that possessing strong identities across the four domains is positively linked to PA, which in turn leads to life satisfaction. The findings of two reviews both support the PA to life satisfaction association in people with impairments (Diaz et al., 2019; Ravenek et al., 2012).

The well-documented social (e.g., friendship), physiological (e.g., increased fitness), appearance (e.g., body image), and functional benefits (e.g., reduced pain) as a result of PA, should all lead to increased life satisfaction. In one study of military veterans, a white-water rafting experience produced feelings of "awe" which were then attributed to an increase in well-being one week later (Anderson et al., 2018). We should note that we are hypothesizing partial mediation as it would be rare that PA would fully explain the influence of the four identities on life satisfaction. We are also not proposing complete mediation as constructs independent of PA (e.g., social support), that we have not assessed may also partially mediate the identity-life satisfaction link. In the following sections we define each identity, report on research, and based on logic, theory, and empirical findings proffer hypotheses for the current model.

Military identity is "the degree to which soldiers and officers are willing to internalize the expressed values and goals of the armed forces" (Johansen et al., 2014, p. 527). A military identity begins developing in boot camp and during subsequent military experiences. A military identity can impact how veterans view themselves and their

place in the world post-military. Researchers have shown a military identity is linked to both well-being and ill-being. Britton et al. (2012) found that non-depressed veterans were 39% more likely to be satisfied with life than non-depressed non-veterans. Britton et al. (2012) suggested that men who found meaning in their military service, reflected in a military identity, were likely to have high life satisfaction.

However, Lancaster et al. (2018) suggested that ongoing emotional attachment to the military upon leaving the military is strongly correlated with trouble reintegrating after separation. In another study of combat veterans, it was almost unanimously reported that they experienced conflicting identities after separating from the military, and "the greater the commitment to the soldier identity, the more significant the strain" (Smith & True, 2014). Importantly, this suggests that an individual with a strong military identity may have difficulty reintegrating into society, leading to poor life satisfaction.

In regard to PA, some researchers have suggested that military veterans generally see a decline in their moderate-to-vigorous physical activity (MVPA: Littman et al., 2015). Veterans were no more likely than nonveterans to meet PA guidelines, but veterans did reach moderate-to-vigorous activity more than their nonveteran counterparts (Littman et al., 2013). A major rationale for examining if sport produces psychosocial benefits for veterans is based on the similarities between sport and the military (Martin & Munroe-Chandler, 2015). Fitness and PA is central to being in the military suggesting they may also be significant elements of a military identity. Other common elements between the military and sport involve teamwork and the hierarchical nature of sport and the military. Hence, it is plausible that a strong military identity may be positively linked to PA. Unfortunately, researchers have not examined the military identity and PA link after military service concludes. Given the conflicting ways in which a military identity is linked to PA and life satisfaction, we view examining the potential military identity, PA, and life satisfaction associations, as an exploratory endeavor.

Athletic identity is defined as the degree to which athletes identify with the athlete role (Brewer et al., 1993). Martin and colleagues were some of the first sport psychology researchers to examine athletic identity in disability sport. In their research, Martin et al. (1994) and Martin et al. (1997) discovered a self and social identity via factor analytic techniques. In the current study we were interested in self-identity. Other researchers have substantiated the value of an athletic identity by finding it is commonly associated with adaptive behaviors and cognitions (Shapiro & Martin, 2010), although it may be maladaptive in some contexts (e.g., injury, retirement). In particular, athletic identity is positively associated with life satisfaction and PA, and negatively linked to depression and anxiety (Tasiemski & Brewer, 2011). Given the above findings we hypothesized that athletic identity would be positively associated with life satisfaction. However, we also hypothesized mediation such that life satisfaction is enhanced, in part, because individuals with athletic identities engage in PA, which then leads to greater life satisfaction.

Exercise identity is defined as the extent to which a person includes exercise as part of their self-concept (Anderson & Cychosz, 1994). This association to exercise with the self gives meaning to past behavior, as well as predicting future behavior. Engaging in exercise and having exercise behavior reinforced by others validates a person's iden-

tity as an exerciser (Anderson & Cychosz, 1995). Researchers have found the more the role-identity of an exerciser becomes part of one's self-concept, the more likely it will predict exercise (Anderson & Cychosz, 1995). Researchers have found that a strong exercise identity is linked to more frequent exercise participation regardless of age, gender, and BMI (Wilson & Muon, 2008). Additionally, Anderson and Cychosz (1995) and Anderson et al. (1998) found that this relationship held for minutes of exercise per week, weeks of participation, perceived exertion, body fat percentage, muscular endurance, and fitness levels. Affective reactions to exercise can also influence a person's overall well-being. Strachan et al. (2010) found that older adults who had the highest scores of exercise identity had greater life satisfaction compared to participants with lower scores. Based on our review, we expected exercise identity to have a strong positive relationship with both PA and life satisfaction, and PA would partly mediate the exercise identity and life satisfaction association.

Disability identity is a relatively new area of investigation resulting in limited research (Dunn & Burcaw, 2013). Researchers have found that disability identity is negatively associated with depression and anxiety, even after accounting for activities of daily living and age (Bogart, 2015). Based on a review of six qualitative papers, Dunn and Burcaw (2013) determined a key element of holding a disability identity was an affirmation of disability. Individuals with a strong disability identity accept their disability and find meaning in it. Individuals with strong disability identities also tend to have strong self-esteem (Dunn & Burcaw, 2013). In turn self-esteem has been positively linked to exercise and sport participants (Martin, 2017). In brief, having a strong disability identity is thought to promote positive cognitions (e.g., life satisfaction) and adaptive health promoting behaviors (e.g., PA). Hence, we hypothesized that a disability identity would be positively associated with PA and life satisfaction and PA would mediate the identity and life satisfaction relationship.

We specifically examined military veterans with impairments for six reasons (Dunn & Burcaw, 2013). First, it is unclear to what degree such individuals will retain a military identity after they have left the military. Second, for impaired veterans who are active through sport and exercise we also are unaware of how strong or weak their exercise and sport identities are. Third, authors have speculated about the mostly positive, but sometimes negative, influences all four identities have on physical behaviors and cognitions, but little empirical evidence exists. Fourth, while research on athletic identity in disability sport is common (e.g., Martin, 2017), research on the other identities is limited, particularly with respect to veterans. Fifth, multiple identities help retired people adjust to retirement and experience life satisfaction (Steffens et al., 2016). Sixth, our findings may be applicable to a large number of people. For instance, there are over 5.5 million veterans in the USA living with impairments acquired from their military service, constituting 29% of the veteran population (The United States Census Bureau, 2013). Almost 1 million veterans have serious impairments that substantially influence their quality of life (United States Department of Veteran Affairs [USDVA], 2013).

To summarize, our major purpose was to test identity theory by examining if a model specifying that military, athletic, exercise, and disability identities would predict life satisfaction as partially mediated by PA. A second important related purpose was to determine if the four identities directly predicted life satisfaction and PA.

METHODS

Participants and Setting

Seventy-one military veterans with impairments from the USA participated. Participants served in the Army (n = 48), Marines (n = 9), Air Force (n = 5), Navy (n = 5) or Coast Guard (n = 4) and ranged in age from 23 to 70 (M = 38.2; SD = 9.9) years. Breakdown by gender was 90% male (n = 64) and 10% female (n = 7). Ethnic breakdown was as follows: Caucasian or White (n = 54), African-American or Black (n = 8), Hispanic or Latinx (n = 8), and Asian (n = 1). Impairment was as follows: Traumatic brain injury (n = 17), amputation (n = 24), spinal cord injury (n = 16), and other (n = 14). The other category included a variety of conditions such as nerve damage, burns, loss of hand function, etc.

Measures

Demographic scale. Participants were anonymous but provided their age, gender, ethnicity, military branch and disability condition.

Instruments. All instruments have been used in previous research with a strong history of producing scores considered to be valid and reliable. Each scale is discussed in detail next.

Exercise Identity. Participants completed the three-item role identity subscale of the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994; 1995). Participants answered three questions on a 7-point Likert scale with 7 representing "strongly agree" and 1 representing "strongly disagree." A sample item was "I consider myself an exerciser." Wilson and Muon (2008) provided evidence indicative of construct validity and adequate internal consistency (α = 0.84).

Athlete Identity. Participants completed the two-item self-identity subscale of the Athletic Identity Measurement Scale (AIMS). The AIMS has been used extensively in disability sport research (e.g., Martin, 2013) and researchers have found the self-identity scale produces scores considered valid and reliable. Participants answered two questions on a 7-point Likert scale with 7 representing "strongly agree" and 1 representing "strongly disagree." Items were "I consider myself an athlete" and "I have many goals related to sport".

Disability Identity. Participants completed the four-item subscale, affirmation of disability, of the Disability Identity Scale developed by Hahn and Belt (2004). Participants answered four questions on a 7-point Likert scale with 7 representing "strongly agree" and 1 representing "strongly disagree." An example item is "I feel proud to be a person with a disability". Hahn and Belt (2004) provided evidence indicative of construct validity.

Military Identity. Participants completed two subscales that most closely aligned with a sense of personal identity from the Warrior Identity Scale (WIS) developed by Lancaster and Hart (2015). The two subscales were the three item military identity commitment scale (e.g., "I have a strong sense of belonging to the military") and the four item centrality of military identity (e.g., "In general, being a veteran is an important part of my self-image"). Participants answered questions on a 4-point Likert scale with 4 representing "strongly agree" and 1 representing "strongly disagree." Evidence of construct, convergent, and divergent validity have been provided by Lancaster et al. (2018).

Life Satisfaction. Participants completed the Satisfaction with Life Scale (SWLS) (Diener et al., 1985) to assess global life satisfaction. Participants answered 5 questions on a 7-point scale with 1 representing "strongly disagree" and 7 representing "strongly agree." A sample item was "In most ways my life is close to ideal." Diener et al. (1985) established good reliability ($\alpha = 0.87$) and previous work in disability sport has demonstrated convergent validity (e.g., Martin et al., 2015).

Physical Activity. Participants completed the Leisure-Time Physical Activity Questionnaire (LTPAQ: Godin & Shephard, 1985). Participants reported how many days they did each mild, moderate and heavy PA and the typical number of minutes for those days, all for the last 7 days. For each intensity, the number of days was multiplied by the minutes to obtain total minutes per week per intensity. Then mild, moderate and heavy intensities were multiplied by 3, 5, and 9 metabolic equivalents (METs), respectively, and the three totals were added to obtain a total METs score that represented PA. Reviews (e.g., Sallis et al., 1993) and previous research with individuals with disabilities (Martin et al., 2013) has suggested the LTPAQ produces scores considered to be valid and reliable.

Procedures

We received permission from the University Internal Review Board to conduct our study and followed all APA ethical guidelines. The survey was then advertised to various military support groups on the internet. Participants anonymously completed the scales, and received a $10 gift card upon completion. To insure our study was not underpowered to detect small to medium sized population effect sizes we conducted a power analyses using G-Power (Faul et al., 2009). We selected a multiple regression program with 5 predictor variables, 1 dependent variable, power set at 0.80, $p = 0.05$, and the ability to detect a medium effect ($f^2 = 0.25$; equivalent to Cohen's $d = 0.5$), and it was determined that an N of 58 was required. It should be noted that many experts recommend an effect size of $d = 0.40$ for psychological research (Brysbaert, 2019). Re-running the power analyses at $d = 0.40$ resulted in a required N of 70.

Data Analysis

Data were initially screened for missing data, outliers, and normal distribution characteristics. Descriptive statistics, internal consistency estimates, and simple correlations for all variables were then calculated. We then used model four from the Process SPSS macro to conduct our mediation analyses (Hayes, 2017). Bootstrapping was employed with 10,000 random resamples in order to estimate the potential true population with confidence intervals (CI), set at 95%.

RESULTS

Reliability and Descriptive Statistics

Cronbach alphas were calculated for all 5 scales and were deemed acceptable as seen in Table 1 (Cronbach, 1951). Means, standard deviations, skewness and kurtosis are also presented in Table 1. Participants expressed a neutral disability identity with a mean slightly under the midpoint of the scale. The overall mean and SD for a disability identity suggests many of the participants only weakly identified with being impaired. This

is not uncommon as Chalk (2015) found that only 28% of his sample endorsed a disability identity. Athlete and exercise identities were stronger as they were in the upper four range of the seven-point scale. Military identity appeared to be the strongest identity with a mean of three on a four-point scale. Participants did not express a high level of life satisfaction as the mean corresponded to the label "neither agree or disagree".

Table 1 Means, Standard Deviations, Skewness, Kurtosis, Alpha's and Pearson Product-moment Correlations for all Variables

Variable	1	2	3	4	5	6
1. Disability	–					
2. Exercise	*0.18*	–				
3. Military	*0.01*	*–0.07*	–			
4. Athlete	*–0.01*	*0.63***	*0.01*	–		
5. Physical Activity	*–0.20*	*0.25**	*0.07*	*0.25**	–	
6. Life Satisfaction	*0.07*	*0.03*	*0.27**	*0.31***	*–0.18*	–
Mean	*3.86*	*4.36*	*2.99*	*4.87*	*3694*	*3.97*
SD	*1.11*	*1.25*	*0.56*	*1.29*	*4635*	*1.23*
Range	*1.8–7*	*1.0–7*	*1.7–4*	*1.2–6.6*	*0.0–20,199*	*1.0–6.8*
Skewness	*0.75*	*–0.17*	*0.16*	*–0.67*	*2.39*	*–0.18*
Kurtosis	*0.86*	*0.17*	*–0.87*	*0.36*	*5.38*	*0.34*
Alpha's	*0.68*	*0.85*	*0.73*	*0.68*	*NA*	*0.85*

Note: ** $p < 0.01$, * $p < 0.05$.

Correlations and Mediation Analyses

Initial screening suggested that, in general, variables were normally to moderately distributed. For example, skew and kurtosis ranged from –0.87 to +0.86 (Cramer, 1998) for all psychological variables. Correlations can be found in Table 1. Among the predictor variables the only significant correlation was between athlete and exercise identity. Both athletic and exercise identities were positively related to PA as expected, and athletic and military identities were positively linked to life satisfaction.

The indirect effect of the four identities on life satisfaction through PA was not significant (b = 0–0.02, 95% CI [–0.08, 0.04], $p < 0.05$). This finding indicates that PA did not mediate the relationship between the four identities and life satisfaction. However, PA was predicted by the four identities, [F (4, 66) = 2.49, $p < 0.05$] and accounted for 13 percent of the variance and only a disability identity was significant.

Life satisfaction was predicted by the four identities and PA ([F (5, 65) = 4.88, p < 0.001] and accounted for 27 percent of the variance (see Tables 1 and 2). Military identity and athletic identity were significant predictors.

Table 2 Physical Activity: Model Summary

R	*R2*	MSE	*F*	df1	df2	*p*
0.3624	*0.13*	*19797228.9*	*2.494*	*4*	*66*	*0.05*

Variable	b	B	se	t	p	LLCI	ULCI
Constant	*–175.563*	*na*	*4025.962*	*–0.0436*	*0.960*	*–8213.7*	*7862.6*
Military	*707.434*	*0.085*	*961.137*	*0.736*	*0.460*	*–1211.5*	*2626.4*
Athlete	*412.826*	*0.114*	*530.604*	*0.778*	*0.430*	*–646.6*	*1472.2*
Exercise	*247.651*	*0.218*	*171.657*	*1.4427*	*0.150*	*–95.1*	*590.3*
Disability	*–983.714*	*–0.237*	*492.255*	*1.9984*	*0.040**	*–1966.5**	*–0.900**

Note: * p < 0.05 and confidence interval that does not contain 0.

Table 3 Life Satisfaction: Model Summary

R	*R2*	MSE	*F*	df1	df2	*p*
0.52	*27*	*1.18*	*4.88*	*5*	*65*	*0.001*

Variable	b	B	se	t	p	LLCI	ULCI
Constant	*0.7788*	*Na*	*0.9846*	*0.7910*	*0.4318*	*–1.1876*	*2.7450*
Military	*0.5855*	*0.2700*	*0.2360*	*2.4810*	*0.0158**	*0.1141**	*1.057**
Athlete	*0.4771*	*0.5000*	*0.1304*	*3.6600*	*0.0005***	*0.2168**	*0.738**
Exercise	*–0.0599*	*–0.1900*	*0.0426*	*–1.4050*	*0.1648*	*–0.1450*	*0.0253*
Disability	*0.0628*	*0.0600*	*0.1240*	*0.5070*	*0.6141*	*–0.1848*	*0.3104*
Physical Activity	*–0.0001*	*–0.2700*	*0.0000*	*–2.3590*	*0.0213*	*–0.0001*	*0.0000*

Note: ** p < 0.01, * p < 0.05 and confidence interval that does not contain 0.

DISCUSSION

The most notable finding from the current study involves the model predicting life satisfaction with the four identities and PA. Participants with the strongest military identities and athletic identities reported the highest life satisfaction. The positive link between athletic identity and life satisfaction supports a growing body of literature indicating the value of athlete's holding an athletic identity (Martin, 2017). However, the current study extends this finding to military veterans and supports

the promotion of sport programing to veterans. The positive link between a military identity and life satisfaction while in line with some research (Markowitz et al., 2019) contradicts other research, and a persuasive argument about the negative role of any identity when participants are no longer able to occupy or live a life commensurate with that identity.

The most common reason for why a strong military identity may be maladaptive is because veterans no longer fill a military role. Hence, obtaining affirmation from a job well done, giving and receiving social support, and being around fellow military personnel with similar values is missing; potentially leading to feelings of purposelessness, anxiety, and depression. Although such an explanation appears to have merit, people can hold on to identities and maintain well-being, even when they are no longer filling a role commensurate with that identity. For instance, many veterans maintain military identities and simultaneously prepare for transitioning back to civilian life by making plans for employment or going to school (Keeling, 2018). In one study, five of six participants adjusted well and continued to hold military values that helped with the transition (Keeling, 2018). Although transitioning to a civilian life threatened their military identity, letting go of a military identity was thought to contribute to emptiness and an "existential crisis" (Keeling, 2018, p. 33). In brief holding onto military values and a military identity gave participants' lives meaning and purpose. This is a critical finding for sport psychologists who may work with athletes with a military background who are struggling with transitioning out of the military and pursuing sport.

Other researchers have indicated that identities have temporal stability that links the past, present and future. Past accomplishments grounded in an identity that may have been strong in the past and weaker in the future can still provide feelings of pride and satisfaction. Furthermore, according to temporal self-appraisal theory, people are biased in how they use past failures and successes (Ross & Wilson, 2002). Past favorable events associated with past selves, feel closer and augment self-esteem, whereas past unfavorable events linked to past selves feel more distal and have less influence on self-regard. Given a military identity can provide positive feelings and feelings of purpose and meaning, the military identity and life satisfaction link seems entirely plausible, despite the prior noted challenges it may present to transitioning to civilian life. Using Cohen's f^2 as a measure of effect size accounting for 27% of the variance in life satisfaction equals an effect size of .35 (Soper, 2013). Based on Cohen's (1988) convention of 0.02, 0.15, and 0.35 for small, medium and large effect sizes, our R2 values approximate medium to large effect sizes (Fritz et al., 2012).

The direct links of the various identities and PA was significant and extends the literature on identity theory. The only significant identity was a disability identity and it was negatively associated with PA. This means that holding a strong disability identity was associated with less PA compared to having a weak disability identity. Contrary to our hypothesis, participants with the weakest disability identity engaged in the most PA. One plausible explanation is that a disability identity acts as a proxy for the severity of a veteran's disability, which in turn is a barrier to PA. Stated differently, veterans with minor disabilities (e.g., hand injury), that may not influence PA as much as a more serious impairment (e.g., SCI), may not identify with being disabled and do not endorse a disability identity. In contrast, participants with a serious disability that may have constrained their PA may also have had a stronger disability identity.

Using Cohen's f^2 as a measure of effect size accounting for 13% of the variance in PA is equivalent to a small effect size of 0.15.

A major purpose of our study was to determine if PA mediated the relationship between the four identities and life satisfaction. We found no support for this hypothesis. Other factors, that we did not measure, such as education, income, pain, social support, community integration, marital status, independence, transportation, etc., are likely to be potential candidates as important determinants of life satisfaction for individuals with disabilities (Chang et al., 2012). Future researchers are advised to consider such factors and factors specifically linked to PA that may be more predictive, than a global PA score like METs. For example, exercise self-efficacy has been linked to life satisfaction for individuals with multiple sclerosis (Goliottoni, 2009).

A few qualifications and limitations of our study are warranted. First, our exclusive focus on the four identities in the current study is not intended to be a dismissal of other important influences on PA and life satisfaction. Many individuals with impairments face a multitude of barriers to PA such as discrimination, inaccessible facilities, and chronic pain. Hence, even when possessing a strong identity that might motivate a veteran to engage in PA, he or she may be prevented from doing so for reasons out of their control. Similarly, holding a strong military identity that provides feelings of belongingness and pride, does not mean that veterans cannot also feel a sense of isolation, around civilians who they perceive as having little to no understanding of their military experiences. Such a nuanced understanding is important for psychologists to recognize. Although we tested mediation, our study was cross sectional in nature and a stronger design for testing mediation would be longitudinal in nature.

CONCLUSION

In conclusion, we found that a strong military and athletic identity predicted life satisfaction. This finding points to the value of continuing to hold a military identity after leaving military service and maintaining/acquiring an athletic identity. This perspective runs counter to research suggesting that a post-military identity may be problematic for adjusting to civilian life. Our findings suggest that support personnel take a receptive and open minded perspective in working with veterans who desire to maintain a military identity after becoming civilians. Like many identities (e.g., retired athlete) particularly identities where a role commensurate with that identity can no longer be fulfilled, it may be that thoughts and feelings linked to that identity can be both adaptive and maladaptive.

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Reliability of the saliva self-sampling with and without supervision

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ABSTRACT

One of the least invasive sampling methods suitable for self-sampling is saliva spitting. The aim of this study is to evaluate the suitability of saliva self-sampling for unsupervised testing. Two self-sampling strategies were compared on the basis of visual evaluation of samples, measurement of cortisol levels in samples and questionnaire survey. The saliva samples obtained by supervised self-sampling were found to be fully suitable for further analysis. In contrast, not all saliva samples obtained from unsupervised self-collection can be used: 13% non-compliance with the minimum required sample volume, 8% with some food/drink residues and 26% taken at the wrong day time. About 42% of the unsupervised probands made at least one significant error in the saliva self-collection procedure. These results indicate that the accuracy of the results based on the analysis of samples received from saliva self-sampling is limited. For clinical investigation, the presence of an inner standard (referring to the reliability of the sampling procedure) is required.

KEYWORDS

saliva sampling; cortisol responsibility; biosensors; hormones; immunoassays

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INTRODUCTION

Based on many researches, saliva can be considered a valuable matrix for determining a number of physiological changes in the body associated with sports (training) activities and the study of physical and psychological stress in general. Saliva contains proteins including immunoglobulins, mucins and enzymes, hormones, biomarkers as well as pathogens (Roblegg et al., 2019). The saliva analysis can provide immunological, inflammatory, endocrine as well as metabolic information, it is also a valuable alternative for the determination of drugs and other illegal substances in elite sports (Gröschl, 2017; Thieme, 2012). Very interesting and beneficial is the potential in determining the amount of cortisol, testosterone and microRNA.

The fundamental question is how to determine the basic (daily) level of these biomarkers. It is suggested to use a morning saliva collection. However not all biomarkers have an eligible level in the morning because of its circadian variance (see below, Fig. 1). In general, the resulting inaccuracy can be caused by self-sampling performed after waking up, i.e. usually without (professional) supervision. It is generally believed that the saliva sampling can be performed by individuals without special training and without the need for special equipment or facilities (Bellagambi et al., 2020). If the sampling step is provided by self-sampling of individuals, it can significantly reduce the cost of the whole analysis. On the other hand, is the self-sampling really self-saving? Are there any pitfalls, which may decrease the reliability of the results?

Non-adherence to the protocol in terms of time can be addressed with electronic collection devices that record the exact time and date of sample collection. In the case study (Kudielka et al., 2003) that investigated the reliability of self-sampling of saliva samples based on physiological changes in daily cortisol levels, the authors came to the significant conclusion that a well-informed proband is much more reliable (compliant) than an uninformed proband for keeping set collection times. This phenomenon was demonstrated by the steep increase in cortisol levels between the collection immediately after waking up and after 30 minutes (cortisol awakening response (Fries et al., 2009). For the probands who did not keep the time for some reason, the increase was minimal. It means that cortisol can be used as a reliable biomarker of either the reliability of the proband or directly as an internal standard to determine the exact time of collection in self-collections.

In addition to the higher price, the need to obtain two samples, problems with freezing, storage and transport of samples for analysis, there is a fundamental problem with that basic daily cortisol level. Cortisol is a circadian hormone (Ljubijankic et al., 2008; Miller et al., 2016) and its level stabilizes (if the organism is not exposed to stress) in later hours (Fig. 1). Therefore, if it is necessary to obtain these "starting" values, it is necessary to find out whether the probands do not violate other parts of the prescribed protocol during self-sampling. The main factor is keeping a distance from eating and stress.

The first aim of this short study is to bring the information whether the individuals without prior training are able (compliant) to follow the written and video instructions (self-sampling protocol) and provide saliva self-sampling without significant mistakes. The second aim is to describe and highlight the most typical mistakes of saliva collection (sampling). The third aim is to quantify the overall mistakes in self-collected saliva sampling. We have focused on compliance with sufficient amount of the sample, avoidance of drinking or eating before sampling, and keeping the sampling

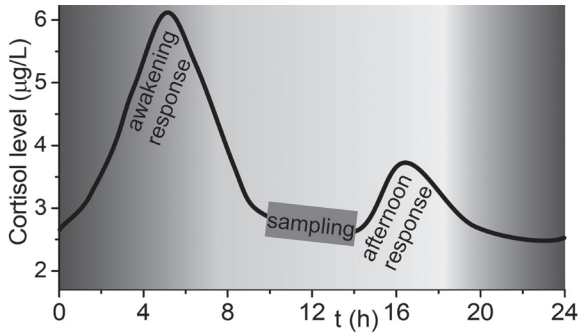

Figure 1 Daily course of cortisol levels with a marked baseline for sampling (adopted from Miller et al., 2016)

time. The timing of the sampling was checked by the amount of cortisol (Ljubijankic et al., 2008). Comprehension of the instructions was checked using a questionnaire.

MATERIALS AND METHODS

Saliva Self-Sampling

The test group in total number of 110 subjected volunteers (probands) was composed of men and women in the range of 21–54 years, either university students or graduates. Probands were randomly divided into two groups: probands providing saliva self-sampling under supervision (35) and probands providing saliva self-sampling without supervision (75). Both groups received the same instructions: 1) "do not eat or drink 30 minutes before sampling", 2) "the sampling has to be provided between 10 a.m. and 2 p.m." and 3) "the amount of saliva in the vial has to reach the red line at minimum" (Fig. 2).

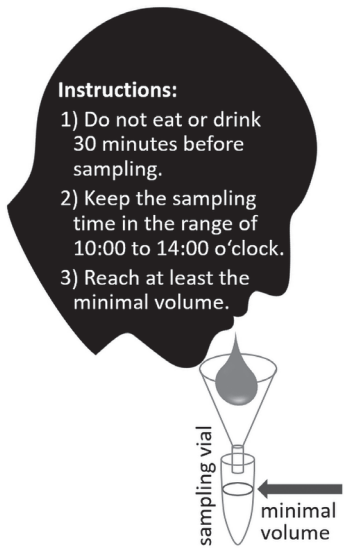

Figure 2 Instructions for saliva self-sampling

The instructions "how to self-collect the saliva" for both groups of probands were the same. Supervised group received the instructions from the supervisor directly. Unsupervised group received the instructions written and *via* video.

Control of the Self-Sampling Protocol

The probands (of both groups) received also the self-checking questionnaire (attached as supporting information – SI) containing questions for the checking the compliance with the self-sampling procedure:

1) The time of self-sampling: *"write the actual time"*.
2) Did I avoid drinking or eating before the self-sampling? Yes / No
3) Does the amount of saliva (without the froth) reach the red line? Yes / No
4) Was the saliva self-sampling stressful? Yes / No
5) Do you feel stressed today or recently? Yes / No

The saliva samples from the supervised group were collected and immediately frozen (–20 °C) to be stored until analysis. The probands from the unsupervised group were asked to freeze (in their home freezer) the samples immediately after sampling and deliver the samples to one of the three collection points within 5 days after the sampling.

Determination of Cortisol

All saliva samples were analysed for cortisol content in one day. The amount of cortisol was determined using enzyme-linked immunosorbent assay (ELISA) utilizing the 96-well microplate kit for salivary cortisol (Diametra Srl Unipersonale, Laboserv, Czech Republic) measured with a Microplate Photometer HiPo MPP-96 operated with specialized software QuantAssay. The cortisol content was determined using a calibration curve and the quality control was provided with inner control.

Cortisol was chosen to check whether the time of self-sampling was respected. Cortisol is a circadian hormone and its concentration in saliva (blood or urine) depends on the day time (Fig. 1) (Ljubijankic et al., 2008; Miller et al., 2016). For the probands, the time range 10 a.m. – 2 p.m., when the cortisol concentration reaches the daily minimum, was chosen. By this easy way, we can verify compliance with the sampling time. However, in some specific cases, the level of cortisol is not on its day plateau, e.g., people suffering from Cushing's syndrome (Raff, 2009), autism (Taylor & Corbett, 2014), people suffering from anxiety, fatigue (Powell et al., 2013), etc. have their specific diurnal trends. Therefore, in the (self-checking) questionnaire (SI), we ask about subjective (acute or long-term) feelings or if the proband suffers from a chronic or acute disease to exclude unsuitable samples.

RESULTS

Three parameters of the saliva samples were monitored: 1) appropriates of the sample amount, 2) absence/presence of food/drink residues in the samples, and 3) accuracy of the sampling time.

The evaluation of the first two parameters was evident. All probands declared a normal or low level of acute and long-term stress. None of the probands considered the saliva-sapling as stressful. None of the probands declare any chronic or acute disease.

In the first group (35 probands; saliva self-sampling with supervision – SSS) all the probands delivered their samples. The supervisor was present and picked up the samples. In the SSS group all the samples reached the required amount (the red line) and ere absence of food/drink residues. The average basal level of salivary cortisol was found 2.91 ± 1.36 μg/L, which corresponds with the basal level of day cortisol reached between 10 a.m. to 2 p.m.

In the second group (75 probands; saliva self-sampling without supervision – NSS), 13 of 75 (17%) probands did not deliver their sample to the sampling point. We expect that these 17% did not deliver their samples due to acute diseases, lack of time, or simply lost motivation to participate in the project. Therefore, in the second group, the number of probands decreased to 62. Of this number, 12.9% (8) of the samples from NSS group contained fewer saliva than required (and clearly marked), and 8.06% (5) of the samples were visibly contaminated with food/drink residues, 4.84% (3) samples had not contain enough sample for analysis together with food/drink residues. Samples containing food/drink residues and/or with insufficient amount of the sample (10) have not been analysed, it means that only 52 samples were analysed. urthermore, 25.8% of them did not follow the required sampling time (Table 1).

The average content of cortisol in the NSS group was 5.82 ± 4.94 μg/L. It was measured only in the samples, which were not contaminated with food/drink residues and contained enough sample for three replicates. Therefore the amount of analysed samples (probands) dropped to 36. The average value of basal cortisol found in the NSS group was much higher (5.82 ± 4.94 μg/L). This average basal level of cortisol in NSS is laden with great error in contrast to the average basal level of cortisol determined in SSS group. This error is caused by several very outliers. After eliminating these outliers in NSS, we get to the value of average basal cortisol 3.10 ± 1.52 μg/L, which is similar to the average basal level of cortisol found in SSS group (2.91 ± 1.36 μg/L). To reach the consent of baseline level of cortisol in both tested groups, 16 outliners (probands) had to be excluded. It means that only 36 samples from NSS group (75 probands at the beginning) were sampled appropriately.

Table 1 Summary of the frequency of non-compliance with the sampling protocol in the unsupervised group; CI stands for the confidence interval ($n = 62$, $p < 0.05$)

Protocol inaccuracy	% (95% CI)
Conditions not fulfilled correctly	41.9 (27.9–55.9)
Less amount of saliva	12.9 (7.2–18.6)*
Food/drink not avoided	8.1 (3.5–12.8)*
Sampling time not abided	25.8 (11.2–40.7)

* 4.84% of probands made a mistake in both parameters at the same time

DISCUSSION

The higher concentration of cortisol in the sample can be caused by the presence of disease and stress in general. However, probands did not declared any. Here it should be noted that for a truly accurate description of the proband, the questionnaire should contain a whole range of other personal information that could have an effect on the hormone level (Bhattarai et al., 2018). We also have to consider the possibility that the probands did not respond in accordance with the truth. However, a false answer should also be considered as the misuse of the sampling protocol. We have to also note that the time-checking system based on the determination of cortisol concentration cannot distinguish the samples taken in the evening from the samples taken between 10 a.m. and 2 p.m. In the evening, the level of cortisol drops to its second minimum (night minimum) (Fig. 1) (Miller et al., 2016).

In this study, the main objective was to estimate the ability of the large audience to follow easy instructions and follow exactly the simple self-sampling protocol independently. Among other things, there is a potential opportunity to record the resting cortisol level before sports performance. We proved that if the probands are under direct supervision, they can follow the sampling protocol exactly. However, such sampling might be in itself associated with certain discomfort and other (stressful) effects on the proband, therefore the supervising person has to minimize any discomfort of the probands, which might affect the sampling protocol of the basal cortisol level If the self-sampling process is provided without direct supervision (at home), 35.5% of probands have problems following the sampling protocol at least in one of the required items, 19.4% made two mistakes in the protocol, and one proband made three mistakes. Only 24 probands from 75 was able to deliver saliva sample, which was sampled properly. In a number of works, the authors also noted a fundamental difference in the required and actual sampling time in healthy probands (Bhattarai et al., 2018; Broderick et al., 2004; Kudielka et al., 2003). It is possible to use other or possibly more sophisticated methods, but the actual reasons and their simple solutions remain hidden. To prevent the unsupervised probands from making mistakes during the sampling procedure, we should understand the most probable reasons why the probands underestimate or do not comply with the sampling protocol. This theme opens the discussion in the field of behavioural psychology.

The instructions for saliva self-sampling were easy and well explained (required volume, required time, and avoidance of drinking/eating). Nevertheless, some significant part of the unsupervised probands had problems to follow them. We guess that the main reason why the probands omitted some of the sampling protocol requirements would be that they did not understand properly why it is important to keep them. They probably underestimated that some minimal volume for the analysis is required, that the presence of food/drink in the sample influences the results of the analysis, and that the sampling time is also important because it directly influences the content of cortisol.

From psychological, physiological and cognitive point of views, the non-follow-up of the sampling protocol in un-supervised group can be explained by:

1) **Haste** – probands had not enough time for saliva sampling during the day (from 10 a.m. to 2 p.m.) and they sampled saliva in different daytime (in the morning or more

probably in the evening) where the level of cortisol is not basal (Fig. 1). However, if the sample was sampled during the night, the cortisol level is at night minimum, which can hardly be distinguished from the day minimum. The presence of food/drink residues can also be caused by haste or insufficient time for sampling, in general.

2) **Saliva lack** – for some people it is not easy to spit. Moreover, the lack of saliva or dry mouth has also a physiological background – it is one of the physiological marks of stress (Bulthuis et al., 2018).
3) **Lack of understanding** – in some cases, the failure in the sampling procedure can be caused by bad/poor understanding of the instructions. It is known that many people pay little attention to reading the instructions or have a low level of comprehension of these instructions (Guthrie et al., 2004). To prevent this lack of reading we have prepared the video instructions. Nevertheless, there was no control that the probands saw the video, saw the whole video, and understood the instructions. However, the second part of the questionnaire (SI) provides feedback to the probands (and to us) that all the steps of the sampling protocol were exactly followed.
4) **Distrust** that strict adherence to the sampling procedure is really important. It is evident that a significant part of the probands do not trust that all the steps or requirements of the sampling protocol are important. In the questionnaire, all probands declared that they are unaware of any disruption of the sampling protocol – they respond to the questions "Did I avoid drinking or eating before the self-sampling?" and "Is the amount of saliva (without foam) reaching the red line?" positively – "yes", despite the fact that the true was evidently different for 24% or 16% of them, respectively. In addition, they filled in the self-sampling time in the required interval, although the actual sampling time was probably different for (at least) 16% of them. These facts can be alarming in broader perspective. Perhaps they were afraid to give the true answer as a confirmation of the sampling protocol failure, and their sample cannot be accepted for further analysis. Perhaps, expecting that it cannot be recognized, they did not follow the sampling protocol exactly. A fundamental difference in the behaviour of the probands is a comparison of healthy and seriously physically ill individuals, when the ill people try to follow the protocol thoroughly (Broderick et al., 2004).

It is also alarming that 13 probands from 75 (17% from the unsupervised group) did not delivered their sample at all. We expect that these people lost the motivation to participate in this experiment. There can be several reasons for not providing sampling or not delivering sample to our collection point. It could be the lack of effort to spend any time with sampling, sampling according to protocol, or delivering the sample. We have to notice that there was no penalization to quit the experiment in any point. The motivation for the probands to complete the sampling and deliver the sample to the collection point was the gained information about their level of cortisol and a gift per sample promised in advance.

CONCLUSION

Different results of the analysis of performed and submitted samples based on their comparison could be influenced by various reasons and factors. In particular, it was

a non-compliance with the saliva-self-sampling protocol (procedure); the absence of personal control (supervision) and direct visual instructions can have a significant effect.

All saliva samples collected from the supervised group of probands contained a sufficient amount of saliva, there was no presence of food or drink traces, and they were sampled in the required time. This result confirms that saliva self-sampling is easy and has a high predictive value if the self-sampling is supervised.

Approximately 35% of unsupervised probands, which delivered the sample, made at least one significant mistake and approximately 20% of unsupervised probands made at least two significant mistakes in the saliva-self-sampling procedure. The reasons, why some of the probands did not follow the instructions exactly, did not arise from the complexity of the procedure. The saliva-self-sampling procedure is very easy and understandable. On the other hand, a significant part of the probands tended to underestimate the significance of some steps of the sampling protocol. They probably did not believe the importance of these steps or did not believe that exact non-compliance with the sampling protocol would significantly affect the results of the analysis. This aspect has to be considered in the evaluation of reliability of all tests, which are based on some kind of self-sampling procedure. The self-sampling procedure has to contain a checking point – e.g. an inner standard, always present in correctly sampled samples.

Practice implications

This study has proven that approx. one third of adults have problems to follow the saliva-self-sampling procedure because of afore-mentioned reasons. This result is highly important and alarming in terms of rapid antigen self-testing strategies within epidemics as well as strategy of distance testing and collection of samples for basic research. The mistakes in self-sampling procedure without supervision can significantly affect the results of research. Researchers, physicians, or even politicians must be aware that the results of the test, which is provided in the self-testing regime, have limited informative value. Improper compliance with both separate steps: sampling protocol and analysis protocol fundamentally affects test results. In addition, it should be noted that the probands in our study had no conflict of interests in salivary cortisol results and their participation in the project was voluntary. Therefore, any conscious influence of the samples was excluded. However, people who are ordered to self-test for SARS-Cov2, for example, cannot be considered volunteers. The socio-psychological aspects play a role in epidemic-related testing. Many people may be concerned about the test result because it could affect their social position at work, with relatives, among friends. Employers should appeal to the personal (moral) responsibility of each employee while maintaining the quality and evidence of self-testing.

To provide the reliable results based on the unsupervised testing the presence of an inner standard referring to the compliance of the sampling procedure is required. The character of such inner standard has to be carefully chosen. Ideally, it is good to combine its determination with the detection method used for the main analyte; for RT-qPCR, it could advantageously be an RNA (gene) always present in saliva, for antigen testing it could be the presence of a hormone in saliva (e.g., cortisol).

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at the publisher's website.

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Productive efficiency of Premier League teams using an enhanced data envelopment analysis approach

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ABSTRACT
The study focuses on evaluating the economic efficiency of professional football clubs. It builds on the Haas Study, which examines the effectiveness of individual clubs through Data Envelopment Analysis (DEA). DEA analyses different types of inputs and outputs for homogeneous production units (in this case football clubs). The thesis proposes the modification of this model. The author considers the initial "hometown population" contribution of Haas as particularly outdated with regard to the increasing commercialisation of professional football and globalisation of the market, where the size of demand is primarily determined by the global popularity measured in terms of interest of the fans, sponsors, and television broadcasting companies. The global popularity of the club can easily be estimated at present using the number of fans in social networks. The clubs reflect this target on the side of the outputs – "increase of the number of fans in the social network". Facebook was chosen as the representative of the social networks. The proposed model is used in the paper for calculation of the economic efficiency of the participants in the English Premier League in the 2016–2017 season.

KEYWORDS
football club; social network; DEA-BCC

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INTRODUCTION

The efficiency evaluation of professional football clubs is carried out in many expert studies. Most authors agree that the highest league competitions can be described as imperfect competition with cartel elements (Kesenne, 2003; Fort & Quirk, 2004;

Andreff & Bourg, 2006). Professional clubs as a whole negotiate the conditions for the sale of broadcasting rights, and they act in the same way when entering into sponsorship agreements for the entire league competition. According to Szymanski & Kesenne (2004), they make use of the exclusivity principle, when they are the only entity on the given market offering the given product. Unlike industry sectors, however, sporting production would not exist without cooperation between companies and clubs that compete with each other (Fort & Quirk, 1995; Flynn & Gilbert, 2001; Pawlowski & Nalbantis, 2015).

The specificity of a sports cartel, according to Kesenne (2000), is that clubs need to compete in the sporting sense of the term (the winner and the loser), but they need to closely cooperate and support each other at the same time. This is not about maximising profit in a purely theoretical and economic sense. In order to maintain the league, clubs consciously renounce part of their profits, and there is a certain reallocation of profits within the league. This principle, according to Fort & Maxcy (2003), aims to slow down the growing gap between rich clubs and those that are less financially successful. Rosen & Sanderson (2001) discuss a curious combination of collaboration and competition that is natural for professional sport.

Despite the above, clubs must primarily focus on their investments and evaluate their effectiveness in achieving sporting or economic goals. According to several authors, this can be solved economically by means of a production function or production boundary (Scully 1974; Sommers, & Quinton, 1982; Hofler & Payne, 1997; Dawson et al., 2000; Carmichael et al., 2017). A club tries to achieve the highest possible value of outputs by means of input transformation. The goal of an economic entity is to make this transformation as efficient as possible. As professional clubs can be seen as economic entities, traditional economic models measuring effectiveness can also be applied to them.

Scully (1974) was the first to examine the relationship between the sporting performance of a baseball player and the size of their salary by means of production function. He responded to the 1972 player strike, which began solely because of the players' salaries. The result of the strike was the introduction of a salary arbitrage and a pension fund for players. The amount of players' salaries did not correspond to their economic contribution to the team, and Scully (1974) tried to resolve this issue. Scully (1974), by his work, has developed an initial methodology and laid down the foundations for examining effectiveness not only in baseball, but also in other sports. In the following years, many economists built on Scully's work, and the topic of examining efficiency with regard to sporting performance is still current today.

Sommers & Quinton (1982) in their research also focused on baseball players' salary and the performance of free players (free agents) this time, who, after signing a long-term contract, did not perform as expected by fans and experts. Zak et al. (1979) examined the production boundary at basketball clubs, using only game performance indicators as inputs and outputs.

We can also find a great deal of research in football evaluating effectiveness by examining multiple inputs and outputs, such as in Carmichael et al. (2000) early research, that explored the English Premier League clubs' performance. A study conducted by Carmichael et al., 2017, which examines effectiveness through game performance indicators in the English Premier League and Italian Serie A during the 2015–2016 season, can be viewed as very up to date.

The second group of research is focused on sports teams' coaches and managers. Dawson et al. (2000) examined the effectiveness of using various inputs by way of the example of the English Premier League. Koning (2003), on the other hand, examined whether the team's results would be improved after a coach was dismissed and a new one was hired. By way of the example of the Dutch Football League, unlike the previous findings within the literature, he found no economic support for claiming that the dismissal of a coach leads to better team results.

Research that examines long-term factors can be included in the last area evaluating the effectiveness of professional sports clubs. Most of the features are typical for one competition season, the number of points gained, total revenues, total costs, etc. We can point to the research by Carmichael & Thomas (1995) here, who created a production function for the evaluation of professional rugby teams, and to Hofler & Payne (1997) on the effectiveness of basketball clubs in the American NBA.

Dieter J. Haas is a pioneer in the research of football competitions, who applied findings from other sports research to football competitions in Germany, England, and the USA. Haas (2003a, 2003b) and Haas et al. (2004) examined the effectiveness of football clubs through Data Envelopment Analysis (DEA), specifically the Charnes-Cooper-Rhodes (CCR) and Baker-Charnes-Cooper (BCC) models.

In his first research, he compared the effectiveness of German Bundesliga football clubs during the 1999–2000 season. As an input, he chose annual salary costs and separated them for players and coaches. Among the outputs there was the number of points gained, the club's total income, and the stadium's occupancy during home matches. Haas (2003a) focused his other research on the Premier League and, unlike the previous research, added one additional input to the selected inputs – the population of the club's home city. At the same time, Haas (2003a) removed the stadium's occupancy during home matches from the examined outputs. In the research, he concluded that the club's sporting results alone would not guarantee its maximum efficiency. Ineffective teams most often spent too much money on the players' team and the coach's salary, which did not result in the expected achievements.

Other experts then built on Haas's (2003a) work. The effectiveness of the highest French competition using the CCR and BCC model was examined by Jardin (2009). The inputs of the DEA model included the total salary cost and the size of the population of the city where the club was based. The outputs included the number of points gained and the club's annual turnover.

The effectiveness of English Premier League clubs was examined by Barros & Leach (2006), who again applied CCR and BBC models, but used different inputs and outputs. The inputs for the purposes of their research included total wage costs and the club's net asset value. The observed outputs included the number of points, total attendance, and annual turnover.

One of the last survey studies concerning Premier League clubs is the work of Badmus et al. (2017). They measured the efficiency of clubs from 2005 to 2015. The variables on the input side included the total wage expenses, annual consumption of assets, and total number of club employees. The standard outputs of other studies (number of points, annual turnover) were expanded with the Rate of Attraction. This newly created indicator is the percentage of wins multiplied by the number of the population in the given country in which the football competition is taking place.

There is a lack of consensus among the individual authors regarding the phenomenon of optimal inputs and outputs for measurement of the productive efficiency of the football clubs. The presented efficiency assessment procedures are used for optional discussion of the economic approaches of the professional football clubs. This article should contribute to this discussion.

AIM

The study examines the productive efficiency of football clubs that played in the highest English Premier League competition during the 2016–2017 season. The goal was to introduce a new approach of measuring efficiency of a football club and determine the clubs that were effective (achieved the so-called "effective boundary") and the ones that were not effective. The effectiveness of individual clubs is examined through a multi-criteria decision-making method known as DEA. The model inputs include player salaries and coach salary. The outputs include the number of points gained in the season, total club revenue, and the increase of the number of followers on the Facebook social network. Based on a comparison of production units, the model will determine the effective and non-effective units.

METHODS

To measure the productive efficiency of football teams from the English Premier League, this study uses Data Envelopment Analysis (DEA). DEA estimates the effective boundary for the monitored set of units, determines which units are effective, and calculates deviations from this effective boundary for ineffective units (Charnes et al., 1994).

The use of the DEA method is particularly beneficial in cases where a large number of inputs and outputs need to be considered for a decision-making unit (DMU). The main advantage is the non-parametric character of the model, which makes it unnecessary to know the precise shape of the production function or the mutual functional relationships between the inputs and outputs.

The DMU in this study is a football club that participated in the Premier League competition during the 2016–2017 season. By comparing 20 professional football clubs, the following questions were answered: Which football clubs were effective in the analysed period and which could have worked better? What are the specific weaknesses of inefficient teams?

An important step towards the most accurate effectiveness assessment is the choice of appropriate inputs and outputs that must have significant impact on the performance of the unit. The selection of entries and outputs for individual football clubs was based on Haas' (2003a) study, which analysed the effectiveness of the Premier League clubs during the 2000–2001 season using the DEA. Two inputs were chosen for evaluation of the efficiency of the Premier League clubs in the 2016–2017 season – the salaries of the players and the salary of the manager, as described above. Both inputs may be very easily influenced by the club management. According to Freyer (1991), there are three production function outputs that reflect three objectives – sports, economic, and social. The sports objective of the club is represented by the number of points won

in the domestic league competition. The economic objective is represented by the club's overall income. The social objective is represented by the number of fans in the social networks. Specifically, the increase in the number of fans on the club's official Facebook site is monitored from 1 June 2016 to 31 May 2017. Facebook was selected as the sole representative of the social networks. It is the largest social network worldwide, has more than 1.5 billion active users, and has been fully translated into 84 world languages (in 2016). Moreover, from the work of Williams (2016) it follows that the ratio of fan representation in other social networks (Twitter, Instagram, YouTube) approximately corresponds with the ratio of representation on Facebook. The number of fans in the social networks primarily provides information about the global popularity of the club, not only in England.

To measure the efficiency for a selected sample of Premier League football clubs, the CCR and BCC models were chosen. Both are input-oriented models. These are applied as inputs change more easily than outputs in the context of football clubs.

The first model (CCR) assumes a constant return to scale in efficiency evaluation. The DEA models facilitate obtaining an efficiency rate estimate for units of the monitored set, but also, based on this rate, provide information on how the behaviour of the evaluated unit should be improved in order to make the unit effective. This is achieved by converting the primary model to a dual model.

The dual CCR model is input-oriented (1):

$$
\begin{aligned}
&\text{Minimise} && \theta_q - \varepsilon\left(\sum_{j=1}^{m} s_j^- + \sum_{k=1}^{r} s_k^+\right) && \\
&\text{subject to} && \sum_{i=1}^{n} x_{ij}\lambda_i + s_j^- = \theta_q x_{qj}, && j = 1,2,\ldots,m, \qquad (1)\\
& && \sum_{i=1}^{n} y_{ik}\lambda_i + s_k^+ = y_{qk}, && k = 1,2,\ldots,r,\\
& && s_k^+ \geq 0, && k = 1,2,\ldots,r,\\
& && s_j^- \geq 0, && j = 1,2,\ldots,m,\\
& && \lambda_i \geq 0, && i = 1,2,\ldots,n.
\end{aligned}
$$

where x represents the input units and y the output units, λ is a dual variable that is a constraint on the individual units. Another variable is θq, which determines the effectiveness of a given unit. Vectors s+ and s- are vectors of the slack variables for the inputs and outputs (Dlouhý et al., 2018).

By compiling this dual model, we determine the particular units forming a sample (virtual) unit set for the examined inefficient unit. The relative effectiveness rate of the examined unit can be calculated using these units.

The CCR model assumes a constant return to scale, and the effective boundary forms a conical cover. In 1984, Banker et al. (1984) proposed a modification of this

model that considers a variable return to scale (growing, declining, constant) – the BCC model.

To analyse the efficiency of units when considering variable return to scale, the model (1) extended by the condition of convexity (2) is now used:

$$\sum_{i=1}^{n} \lambda_i = 1 \quad (2)$$

For the purposes of this study, two programs were used which enable the problems of linear programming to be resolved: Microsoft Excel Solver and MDeap 2. Table 1 contains the input data. The data was collected from reputable sources.

Table 1 Raw data for the Premier League season 2016–2017

Final rank	**Club**	**Player's salaries × M £**	**Coach's salaries × 1000 £**	**Points**	**Revenue × M £**	**Increase of Facebook followers × 1000**
1.	Chelsea	221	6,500	93	368	1,901
2.	Tottenham	127	3,500	86	306	624
3.	Man. City	264	15,000	78	473	4,768
4.	Liverpool	208	7,000	76	364	1,476
5.	Arsenal	199	8,300	75	427	1,579
6.	Man. United	263	13,800	69	581	3,907
7.	Everton	105	6,000	61	171	315
8.	Southampton	112	3,200	46	182	180
9.	Bournemouth	72	750	46	139	72
10.	West Brom	79	2,000	45	138	81
11.	West Ham	95	3,000	45	183	467
12.	Leicester	112	1,500	44	233	813
13.	Stoke	85	900	44	136	406
14.	Crystal Palace	89	1,500	41	125	101
15.	Swansea	99	1,000	41	128	73
16.	Burnley	61	420	40	121	61
17.	Watford	75	1,250	40	124	65
18.	Hull City	61	1,000	34	117	41
19.	Middlesbrough	65	355	28	121	29
20.	Sunderland	84	3,000	24	126	164

Source: Annual Review of Football Finance 2017, www.footballtransfers.net, www.statista.com

RESULTS

Application of the CCR model

An efficiency analysis of Premier League football clubs was carried out according to the CCR input-oriented model. The model considers a constant return to scale and can be considered more stringent than the second BCC model used. The resulting efficiency values of individual teams are shown in Table 2.

Table 2 Efficiency in the CCR model

	Club	Effectivity
1.–7.	Tottenham	1
1.–7.	Manchester City	1
1.–7.	Manchester United	1
1.–7.	Leicester	1
1.–7.	Stoke	1
1.–7.	Burnley	1
1.–7.	Middlesbrough	1
8.	Bournemouth	0.97
9.	Arsenal	0.92
10.	Chelsea	0.91
11.	Hull City	0.88
12.	Everton	0.86
13.	West Brom	0.84
14.	West Ham	0.81
15.	Watford	0.80
16.	Liverpool	0.78
17.	Crystal Palace	0.69
18.	Southampton	0.67
19.	Swansea	0.63
20.	Sunderland	0.62

Source: own

The CCR input oriented model designated a total of seven clubs as efficient. These clubs achieved one hundred percent values and are marked number one in the table. 13 clubs are designated as non-efficient in the CCR model while the worst was Sunderland AFC, which coincidentally also ended last in the Premier League Table and was demoted from this competition.

DEA analysis also states ineffective clubs with information on the circumstances under which teams would be effective in the given season (Table 3).

Table 3 Input and output optimization in the CCR model

Club	Player's salaries	Coach's salaries	Points	Revenue	Facebook followers
Bournemouth	–3%	–3%	0%	+3%	+62%
Arsenal	–8%	–19%	+27%	0%	0%
Chelsea	–9%	–9%	0%	0%	0%
Hull City	–12%	–12%	+5%	0%	+270%
Everton	–14%	–59%	0%	+27%	+41%
West Brom	–16%	–16%	0%	+14%	+268%
West Ham	–19%	–22%	+7%	0%	0%
Watford	–20%	–20%	0%	+6%	+166%
Liverpool	–22%	–22%	0%	0%	0%
Crystal Palace	–31%	–31%	0%	+8%	+76%
Southampton	–33%	–35%	+11%	0%	+107%
Swansea	–37%	–37%	0%	0%	+39%
Sunderland	–38%	–52%	+48%	0%	+56%

Source: own

The fact that the model proposes to reduce the input level to achieve efficiency is based on the application of an input-oriented model. If a mere reduction in inputs does not lead to reaching the effective boundary for inefficient teams, the model also suggests an increase in inputs. Optimisation results suggest that only two of the teams (Chelsea and Liverpool) would achieve the effective boundary by solely reducing inputs.

The achieved objectives in the form of outputs are indicated in the case of the non-efficient clubs by the high salaries of the players and managers. Their reduction is the path to efficiency. The model recommends reduction of the salary expenses in three clubs by more than one third (Southampton, Swansea, and Sunderland), both in the case of the players and the managers.

Application of the BCC model

Table 4 Efficiency in the BCC model

	Club	Effectivity
1.–10.	Chelsea	1
1.–10.	Tottenham	1
1.–10.	Manchester City	1
1.–10.	Manchester United	1
1.–10.	Bournemouth	1
1.–10.	Leicester	1
1.–10.	Stoke	1

	Club	Effectivity
1.–10.	Burnley	1
1.–10.	Hull City	1
1.–10.	Middlesbrough	1
11.	Arsenal	0.97
12.	West Ham	0.91
13.	Everton	0.87
14.	West Brom	0.86
15.	Watford	0.83
16.	Liverpool	0.83
17.	Sunderland	0.78
18.	Southampton	0.74
19.	Crystal Palace	0.71
20.	Swansea	0.64

Source: own

The BCC input-based oriented model identified a total of ten teams as effective based on analysis (Table 4). The remaining ten clubs do not reach this value, and thus they are inefficient in this model. The worst of them was the Swansea team, which only achieved 64% of the required efficiency. Due to the assumption of variable return to scale, not only the number of effective units but also the order of the units in the table are different.

DEA analysis provides inefficient clubs with information on the inputs under which teams would be effective in case of the BCC model as well. The optimisation results for the model with variable inputs are shown in Table 5.

Table 5 Input and output optimization in the BCC model

Club	Player's salaries	Coach's salaries	Points	Revenue	Facebook followers
Arsenal	–6%	–3%	+5%	0%	+31%
West Ham	–9%	–35%	+6%	0%	0%
Everton	–13%	–70%	0%	+20%	+1%
West Brom	–14%	–62%	0%	+2%	+51%
Watford	–17%	–62%	+2%	0%	+9%
Liverpool	–23%	–17%	0%	0%	0%
Sunderland	–22%	–75%	+7%	+2%	0%
Southampton	–26%	–55%	+2%	0%	+37%
Crystal Palace	–29%	–62%	0%	+1%	0%
Swansea	–36%	–46%	+2%	0%	+14%

Source: own

Only Liverpool would achieve efficiency solely by reduction of the inputs. The remaining ten non-efficient teams must also increase the number of points won, size of income, or number of fans on Facebook in order to achieve the effective threshold. The level of the inputs for one hundred percent efficiency would again require the highest reduction in the case of Southampton, Swansea, and Sunderland, to which the BCC model also added Crystal Palace.

It is clear from the results that the BCC input-oriented model identified more clubs as effective than the CCR input-oriented model, which corresponds to the theory of DEA analysis as described by Cooper et al. (2004).

The average efficiency of a Premier League club in the CCR model is 87%, and even 91% in the BCC model. This high value indicates that the English clubs act very efficiently in the transformation of inputs to outputs. Moreover, the average value is substantially reduced by four clubs – Sunderland, Southampton, Swansea, and Crystal Palace, whose efficiency is not even 80%.

The DMUs make an effort to minimise the value of the inputs and maximise the value of the outputs with the objective to achieve the highest profit (or suffer the least losses). In spite of this, we can see from the results tables that the clubs can achieve the efficiency thresholds in very different ways. Clubs that use smaller inputs are at an advantage because the outputs need not reach a high level and, even in this case, the club can achieve the efficient threshold. An example may be Burnley F.C., which has the least total expenses in the Premier League in terms of players' and manager's salaries but is evaluated as efficient by both models. Another example may be AFC Bournemouth, whose input values also ranked among the lowest in the entire competition. Although it also had relatively low income on the output side, it ranked in the first half of the Premier League Table. Its function may be considered as efficient. The club fulfilled its sports objective, and successfully remained in the competition with relatively low salary costs. The club fans were also probably satisfied with this result.

Other Manchester clubs – United and City – achieved efficiency almost in the opposite way. They coped with all the economic indicators of the competition. Of all the Premier League clubs, they spent the highest amounts. Both clubs were also dominant on the income side and acquired the largest number of new fans on Facebook. The excellent results of these two outputs resulted in the models evaluating the clubs as efficient. Despite this, their fans may perceive the 2016–2017 season as unsuccessful because Manchester City ranked third on the table and United was sixth.

Tottenham achieved efficiency using a third approach that we can term as the middle course. It spent 127 million British pounds on players' salaries, which is only slightly higher than the entire Premier League average (123.8). This London club paid a salary in the amount of 3.5 British pounds to manager Mauricio Pochettino, which in comparison with other Premier League managers is below average. Tottenham achieved second place with this expenditure in the 2016–2017 season, which guaranteed the club's participation in the Champions League in the following season. It exceeded the average income of the clubs in the Premier League (228.15 million British pounds) by almost 80 million and the increase in the number of fans on Facebook was also above average as compared with other clubs.

Based on the results, we can say that there is no general way to enable efficiency maximisation for each club. The club's strategy must be adapted to its sporting and

economic potential, according to which the club must then set its goals and steps to achieve them.

DISCUSSION AND CONCLUSION

The study brings a new methodical approach to the assessment of the production efficiency of professional football clubs. Unlike the approach of Haas (2003a), who as an input for production analysis uses, among others, the number of the population in the area where the club has its seat, the study suggests exclusion of this input from the model and on the contrary to include the number of fans (increase or decrease) among the inputs. The clubs make an effort to not only actively win a larger number of fans through their own performance on the field, but also directly via their marketing activities.

Haas (2003a) justifies the inclusion of the city's population as an uncontrollable variable (clubs cannot affect it) because clubs come from different parts of the country where the population density, as well as the demand for the football product, is different, which affects the clubs' potential income. This idea is later supported by Jardin (2009), who states that a larger population means a bigger fan base, which brings higher income from entry tickets and stronger merchandising. The inclusion of the home city population in the Data Envelopment Analysis was justifiable at that time. The football environment was characterised by the fact that most of the club's fans were local residents. The residents of the city and the surrounding area attended the matches, bought club souvenirs, and were a significant source of the club's income. Especially for the Premier League's average clubs from the result and economic point of view, it was not unusual to be supported by larger groups abroad.

Since the original research (Carmichael et al., 2000; Haas, 2003a; Haas et al., 2004; Barros & Leach, 2006), professional football has changed, and globalisation has greatly influenced it. This trend is clearly visible by the example of the English Premier League.

The Premier League competition during the 2016–2017 season included players of 64 nationalities and was watched by 4 billion people from over 150 countries each week on TV (Eurosport, 2017). With the internet and social networks, clubs communicate with fans on an everyday basis, no matter which part of the world they come from. The geographical location of the fans is losing importance in today's interconnected world, and almost anyone can become a fan of the club.

Local residents are gradually losing the power they once had. This trend is most evident in big clubs, such as Manchester United, Chelsea, and Arsenal. The London club, Chelsea, has official fan clubs in 80 countries around the world, Arsenal in 79 countries, and Liverpool in 67 countries (Eurosport, 2017). The importance of foreign fans and sponsors is also highlighted by statistics of pre-season tours and camps that are used by clubs for marketing purposes, in addition to sporting preparation. Before the 2016–2017 reference season, the clubs visited 15 countries around the world during the pre-season tour. Countries with large populations including the USA, China, and Australia, where clubs see the highest number of potential fans and hence higher potential incomes (Eurosport, 2017), were the most visited.

Merchandising has a significant impact on the club's revenues. Not only in the brick-and-mortar shops but mainly on the Internet, which substantially eases sales worldwide. Clubs with large worldwide fan bases are also attractive to sponsors, often

from the ranks of the wealthy supranational companies. The interest of foreign fans is further reflected in rising revenues from the sale of TV rights. An increasing number of fans is therefore a logical objective.

The ideal feature according to which we can assess the current global interest in football clubs is offered by social networks. Each club in the Premier League has its official profile on Facebook, Twitter, and Instagram (Williams, 2016). Social networks today represent an indispensable tool for clubs to communicate with their fans. The total number of fans on the club's profile is then related to the club's popularity around the world.

The Facebook social network was chosen as the social network representative, and football clubs have the largest number of fans there (Williams, 2016). Twitter, Instagram and Youtube are among the other social networks used by the Premier League clubs. The proportion of fans of individual clubs on these other social networks approximately corresponds to the proportions of fans of individual clubs on Facebook (Williams, 2016). Additionally, a number of fans follow their favourite club on more than one of the social networks mentioned above, so there may be a misrepresentation of the resulting number of fans.

Differences in the number of clubs' Facebook followers are enormous. English clubs Manchester United, Chelsea, Arsenal, Liverpool, and Manchester City are known all over the world, and their profiles on Facebook are followed by tens of millions of people. It is not a coincidence that these clubs generate the highest income.

Inputs are the salaries of the players and the salary of the coach. The first input was selected based on Szymanski & Smith's (1997) approach, which evaluates the quality of the team based on the amount of the financial salary costs. However, Haas (2003a) distinguishes only players' and coach's salaries, not the salary of other staff that has no direct influence on team performance.

An important factor of the absolute amount of wage costs for players is not only the value of individual salaries, but also the size of the player's team. Successful clubs that participate in European Cups in addition to the League Competition are forced to have a larger number of players, so that the team is able to cope with the match load.

The team also has a larger number of coaches, but the main coach's salary was still only considered as the second input. We rather find the term "manager" in English clubs. It is solely this person who manages other coaches and cooperates with other club employees. The job of a manager can vary greatly across clubs, and it is impossible to claim that they influence the club's performance the most of the entire team.

Another problem situation for evaluating the effectiveness of the coach's (manager's) activity occurs when the club executives dismiss the manager during the season. However, in this study only the salary of a manager who started the 2015–2016 season with the club, even though they were dismissed or resigned, was considered. The immediate change of the coach does not necessarily lead to a guaranteed improvement in sporting results, as Koning (2003) says, and, in addition, it can be assumed that the amount of the new coach's salary will be similar.

The effectiveness of coaches is, particularly in team sports, a phenomenon that has often been studied. It is obvious that a coach (manager) influences team performance (Clement, & McCormick, 1989; Dawson et al., 2000). As in the case of players, the high demand for the best coaches forces club management to pay coaches increasingly higher wages.

Three outputs were selected for the requirements of this research. Achievement of the sports objective is represented by the number of points obtained in the league competition. The economic objective is represented by the total revenues of the club. The social (or marketing) objective in the form of acquisition of new fans is monitored through changes in the number of fans on Facebook within one year.

The first output represents the club's sporting success in the league competition. The number of points gained determines the ranking in the final table, on the basis of which the overall winner is designated and the clubs that have qualified for European Cups are designated. The three teams at the end of this ranking drop into the league competition below. It is obvious that ranking in the league table is the main sporting goal of each football club. It is a basic output that positively correlates with the fans' interest in the club and the amount of income earned.

The second output, the club's total income, serves as an indicator of the team commercial output and primarily consists of the share of the TV rights sale, income from sponsorship, merchandising, and the sale of tickets. Financial success is, to a large extent, linked to sporting success. Sporting success in both domestic and European competitions is linked to significant rewards for the achieved ranking. There is also an increase in fans' interest in the club, where the attendance at home matches or the sale of club merchandising increases. At the same time, sponsors are more interested in concluding a contractual partnership with the club.

The third output is change in the number of fans on Facebook. This output represents the modification of the current approaches to the assessment of productive efficiency. It takes into account the objective of the club to win new fans. Football is played for the fans. Without fans, football would lose its meaning.

The argument for modification of the current models was the ever-increasing commercialisation of football associated with globalisation, where people worldwide can become active club fans. Their allegiance to the club need not be expressed by their presence at the stadium, but also by support of the club on social networks. Through the social networks fans get the feeling of belonging to the club, which leads to motivation for long-term support of and identification with the club. The social objectives in a modern world full of social networks are becoming one of the most important factors, an integral part of the club's image and spread of club harmony (Going Global, 2017). The club's interest in winning new fans and keeping the "loyal" fans in the modern concept of professional sport is becoming another battlefield on which all clubs are competing. Of course, this leads to a competitive struggle between the clubs, and improvement of the quality of the offered products and services. The continuous efforts at improvement usually attract more fans of the given sport. According to Madden (2012) this increases the number of viewers, quality, and balance of the competition.

Regardless of the social aspect, the focus on the fans is also economically prudent. Every new club fan represents potentially higher revenues for the club in the form of ticket sales and merchandising. This also increases the interest of the sponsors who want to present themselves to the fans. The increasing interest of the fans in the clubs and in the entire competition is also manifest in the rising price of television rights. It is this interest that is dominant in the English Premier League.

As mentioned above, Data Envelopment Analysis (DEA) estimates the effective boundary for the monitored set of units. It also determines which units are effective

and calculates deviations from this effective boundary for ineffective units (Charnes et al., 1994). Ineffective units are clubs that did not reach the effective border. To prevent this, they would have to have a lower level of inputs, as indicated in Tables 3 and 5.

However, these results cannot be seen as clear recommendations of input reductions to clubs, for example, for the following seasons. For example, if the London club, Arsenal, achieved the adjusted values the following season, just as the model suggests, it would not guarantee it would achieve 100% efficiency. The values of other clubs would also change, a new situation would appear for measuring efficiency, and there would probably be an effective boundary shift. Thus, the results as indicated in Tables 3 and 5 only express the hypothetical situation in which clubs would be effective in the reference season. They can be the basis or inspiration for thinking about lowering input levels.

The model presented in this study, designed to evaluate the sporting and economic efficiency of clubs, cannot and does not seek to provide specific recommendations for future periods. The model only identifies a situation in which clubs would be effective and compares the club's effectiveness with other competition participants. The model sets out the conditions under which all clubs would be effective, although in reality it is unlikely.

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Managerial roles and their application in non-profit sports organisations

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ABSTRACT

This article focuses on leadership and the role of managers in the field of non-profit sports organisations, knowing that this area of activity is still largely neglected by research. The main goal of this research was to find out what roles managers currently play in the management of non-profit organisations in the field of sports. The method of a quantitative questionnaire survey was applied and the respondents were 270 non-profit sports organisation managers. The research shows that the roles of managers of non-profit sports organisations have significantly affected interpersonal activities to fulfil the mission of these organisations more than to strengthen their economic performance. The overshadowing of some managerial roles creates an incentive to focus on the creation of educational offers aimed at strengthening leadership, management of subsidies from public sources, and the possibility of using marketing in the field of creating their own financial resources.

KEYWORDS

practice of managing; institutional framework; HRM, performance of non-profit organisations; Henry Mintzberg

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INTRODUCTION AND THEORETICAL BACKGROUND

Management can be described as an economic activity of great importance. The beginning of this activity can be connected at the latest with manufacturing production. The range of activities referred to as management is constantly increasing, along with the growth of economic activity, whether in the form of process management, the output of which is tangible, or intangible products.

Management has gained a new dimension along with the development of information technology. However, it is also necessary to realise that the phenomenon of management consist of different of activities in for-profit and non-profit organisations, which significantly affects the modification of the training of experts – managers in economic

practice. It is basically a matter of classifying managerial roles and defining how important and numerous those used for managerial activity are. This article specifically addresses leadership and the role of managers working in non-profit organisations.

In a way, non-profit organisations are economic entities that have certain elements identical to for-profit organisations. However, they do not measure their success by generating a certain amount of profit, but by fulfilling the mission on which they are based. Their mission is of a different nature in relation to the needs of society. These are, for example, from church and sports organisations, those in the field of social services, schools, all the way to organisations of a specific nature, whose creation is based on legal norms – organisational units of the state, municipality, region, etc.

These organisations, like for-profit organisations, need a certain attractive vision, a charismatic leader, effectively managed processes, quality staff, satisfied customers, etc. Fulfilling the mission of non-profit organisations is associated with the need to secure financial resources. The management of these organisations thus strives for the economic prosperity of the organisation, which should be transformed into outputs of social value according to the interests and needs of society. Management must act in a business-like way while keeping social needs in mind. These sometimes-conflicting activities place great demands on the managers of these organisations and the fulfilment of their roles.

Non-profit sports organisations in the Czech Republic are characterised by the following principles similar to Salamon and Anheier (1992). They include:

- institutionalised organisations which show at least the rudiments of a formal organisational structure;
- private organisations which are not subordinated to state administration;
- non-profit organisations which are not established with the purpose of profit-making and do not allow profit distribution among the owners or management of the organisation; a profit, if any, needs to be used to achieve the goals of the given organisation;
- self-governing and independent organisations which are capable of self-governance and have established procedures and structures;
- volunteer organisations utilising the volunteer work of their participants.

The legal form of a non-profit sports organisation in the Czech Republic is a registered association. The creation and functioning of an association is governed by the Civil Code. A registered association is defined as an organisation that has its mission and its "main activity can only be the satisfaction and protection of those interests for which the association is founded. Entrepreneurship or other gainful activity cannot be the main activity of the association." (Civil Code, 2019)

A sports association acts as an organiser of sports events and sports offers, an owner or operator of a sports facility, a party in contractual negotiations, an accounting unit, tax or charge payee, an employee, an entrepreneur carrying out additional or ancillary economic activity, a participant in proceedings, a subject of the official definition of personal identity, identification and status of natural persons, and a participant in restitution transfers of (also immovable) property.

It is obvious from the above list that there is abundant space in which to play sports manager roles, i.e., the main theme of our research.

Sports clubs in the Czech Republic are dedicated to a single sport only (e.g. football clubs) and/or to several sports (namely in large towns/cities with more than

100,000 inhabitants). It is then significantly reflected in the organisational structure and position of sports managers.

In single-sport clubs, sports managers perform the roles of chairpersons (presidents) of executive committees, secretaries-general of clubs, economists, or members of executive committees responsible for the management of certain divisions (e.g. use and maintenance of the sports club's property). These are top management positions. On the lower level, they manage the respective sports activity in an individual team (operational management). This activity is performed by head coaches and trainers. The management is, therefore, two-level, which is namely performed by volunteer officials and, to a much lesser extent, workers in a certain employment relationship according to the applicable legal regulations.

Multi-sport clubs consist of separate organisational units having the form of sports groups. Each sports group independently organises its activity according to the rules of the respective branch of sport and conditions of the competition rules of the respective body of the association, while at the same time taking into account its own income, total resources of the sports club, and its material-technical base. The work of sports managers is, therefore, similar at the top management level of the sports club, and on the middle management level of the respective sports group. They again perform the roles of presidents, secretaries-general, economists, and other managerial roles in sports groups (top management), as well as the roles of chairpersons of sports groups, secretaries of sports groups, economists of sports groups, and other members of executive committees of sports groups and employees (middle management). The basic level is again represented by sports managers – athletics directors, head coaches, and trainers (operational management). The management is, therefore, three-level. Management is again performed both by volunteer officials and employees in various employment relationships.

As regards the main sources of funding of sports associations, they include in particular:

- contributions from their own members;
- income from sports, social, and charitable activities organised by the association;
- gifts and support from natural and legal persons;
- income from advertising, lease of property of the association, and sale of rights and property;
- income from ancillary economic activities;
- income from deposits and accounts of the association;
- proceeds from securities;
- subsidies, funding and grants from bodies of the association, bodies of umbrella sports organisations, from the state budget, municipal budgets, and from the European Union.

The presented research was carried out in non-profit sports organisations in the Czech Republic; these organisations have a long tradition in the country.

This research builds on a number of works in the field of personnel management: Čáslavová, Kraft, Voráček (2010, 2011), Čáslavová, Kraft, Voráček, Bártová (2014), and Čáslavová, Kraft, Omcirk (2018), which were part of grants P39 and Q19 of Charles University in Prague.

The issue of managerial work in non-profit organisations appears in literature in various contexts. Their personal characteristics, motivation, performance, the role of managers and the degree of specialisation are evaluated, often in comparison with the business environment. There are many authors who deal with these topics; for example, we present Goldman and Kahnweiler (2003), who prepared the profiles of successful executive directors of non-profit organisations according to their personality traits. Austin, Regan, Gothard, and Carnochan (2012) document the importance of personal identity and values in the context of the manager's role and their identity and values, namely within the framework of the great number of roles played by managers in non-profit organisations. Lukeš and Stephan (2012) compared the motivation of managers in non-profit and in for-profit organisations, whereas they claim that in the current market conditions it is necessary that even managers of non-profit organisations place an emphasis on a commercial approach. Di Zhang and Swanson (2013) present the difference in focus of for-profit and non-profit organisations, where non-profit organisations focus strongly on the social goals of the organisation and, as regards finances, focus namely on securing sufficient finances for operation of the organisation and achievement of its social goals. Damanpour and Schneider (2019) dealt with the influence of managers' characteristics (demographic, personal) on the approach to innovation. However, as regards managers in non-profit organisation, they say that leaders in their organisations, public administrators, and business managers alike can influence workers' motivation and job satisfaction, create a work and social climate to improve morale, and encourage and reward innovation and change.

In examining literary sources, we have not found any significant source to address managerial roles in non-profit sports organisations, although a number of papers are devoted to the performance of non-profits. Cornforth and Edwards (1999) focused on the relationship between the abilities and skills of top managers and the areas of their contribution to the strategic management of non-profit organisations. Micheli and Kennereley (2005) present selected methods of performance measurement for non-profit organisations, such as the Balanced Scorecards or Performance Prism. Mwenja and Lewis (2009) note the influence of various groups of factors on the perceived performance of a non-profit organisation, whereas they established that the strategic and the political dimensions have a stronger relationship with the perceived organisational performance in non-profit organisations as compared to the other dimensions. McMurray, Islam, Sarros, and Pirola-Merlo (2012) examined the impacts of leadership on non-profit organisation working team atmosphere and performance. As regards non-profit sports organisations, Novotný and Lukeš et al. (2008) present significant factors which affect the success of non-profit sports organisations. Nowy, Wicker, Feiler, and Breuer (2015) compare for-profit and non-profit sports organisations from the point of view of their focus and success in various dimensions of the organisation's performance, such as financial dimension, product dimension, customer dimension, and strategic dimension. This is despite the fact that a capable manager of a non-profit sports organisation is an important factor in its success and performance. It is remarkable especially in the sense that these sports organisations work with a large number of clients (club members, the general public); in addition to employees, they also engage volunteers and face more

challenges when working with a diverse structure of financial resources. They work with subsidies from the state and local government, with resources from their own activities, resources from entrepreneurs, membership fees, and gifts from individual donors. In terms of their own activities, sports organisations have income from the provision of sport and other services, admission to sporting events, consulting, and rental, as well as income from the rental of gyms and halls, accommodation, and advertising income. For these reasons, it is necessary to examine the role of managers of non-profit sports organisations as one of the factors of performance of these organisations.

The best-known division and classification of managerial roles is historically presented by Henry Mintzberg, who classified these roles on the basis of a study of the common work of managers in his book "The Nature of Managerial Work", which was published in 1973 (Kumar, 2015; Tengblad, 2006). Opinions on the difference of managerial roles from classical managerial functions and activities are presented and promoted in his publications practically to this day by Mintzberg (1989), Mintzberg (2004). Table 1 lists the Mintzberg roles mentioned.

Table 1 The role of managers according to Mintzberg

Interpersonal Roles	
Figurehead	The manager represents the organization in all matters of formality. The top level manager represents the company legally and socially to those outside of the organization. The supervisor represents the work group to higher management and higher management to the work group.
Liaison	The manager interacts with peers and people outside the organization. The top level manager uses the liaison role to gain favours and information, while the supervisor uses it to maintain the routine flow of work.
Leader	It defines the relationships between the manager and employees. Responsibilities are at the heart of the manager-subordinate relationship and consist of motivating subordinates, structuring and overseeing their development, inspiring their improvement, and balancing effectiveness.
Informational Roles	
Monitor	The manager receives and collects information about the operation of an enterprise. The monitor seeks internal and stakeholder's facts regarding problems which could affect the company. Responsibilities consist of a department's assessment of the threats and opportunities and assessing internal operations that may rise. All of the data received in this role needs to be stored and maintained.
Disseminator	The manager transmits special information to the organization. The top level manager receives and transmits more information from people outside the organization than the supervisor.
Spokesperson	The manager disseminates the organization's information into its environment. Thus, the top level manager is seen as an industry expert, while the supervisor is seen as a unit or departmental expert. The spokesperson transmits facts about the company to stakeholders and serves in a PR ability by lobbying others and using informing to keep key stakeholders up to date about the operations of the enterprise.
Decisional Roles	
Entrepreneur	The manager initiates change, new projects, identifies new ideas, and delegate idea responsibility to others.

Decisional Roles	
Disturbance Handler	The manager deals with threats to the organization. The manager takes corrective action during disputes or crises, resolve conflicts among subordinates, and adapt to environmental crisis. The disturbance handler takes corrective action when the company faces critical, unanticipated problems. A generalist position that is important when a corporation is all at once transformed or upset and support and requires calming.
Resource Allocator	The manager decides who is allocated resources, schedules, sets budget priorities, and chooses where the organization will apply its efforts.
Negotiator	The manager negotiates on behalf of the organization. The top level manager makes decisions about the organization as a whole, while the supervisor makes decisions about his or her particular work unit. The negotiator represents the company in primary negotiations affecting the supervisor's areas of duty and is a selected assignment this is fundamental for the representative, a figurehead, and a useful resource allocator roles.

Source: Mintzberg in Kumar (2015), Mintzberg in Altamony, Masa'deh and Gharaibeh (2017)

The Alexander (1979) study further specifies the role of Mintzberg at various levels of management in a profit-oriented environment, as shown in Table 2.

Table 2 Managerial roles according to the level of management in a profit-oriented environment

Role order	Top Management	Middle Management	Operational Management
1.	Leader	Leader	Leader
2.	Liaison	Disturbance Handler	Disturbance Handler
3.	Entrepreneur	Liaison	Liaison
4.	Monitor	Spokesman	Monitor
5.	Disseminator	Resource Allocator	Disseminator
6.	Spokesman	Entrepreneur	Resource Allocator
7.	Disturbance Handler	Monitor	Entrepreneur
8.	Resource Allocator	Disseminator	Spokesman
9.	Negotiator	Negotiator	Negotiator
10.	Figurehead	Figurehead	Figurehead

Source: Alexander (1979)

Other concepts of managerial roles are described in the study by Buckley and Monks (2004) However, they focus only on HR managers. They include, classification of HR manager roles according to Storey (1992) into four roles of "advisers", "change-makers", "handmaidens", and "regulators". Ulrich (1997) also defines four roles of HR managers: "strategic partner", "change agent", "administrative expert", and "employee champion". Rossheim, Kim, and Ruchelman (1995) developed role types on the basis of artistic innovation and access to financial resources, they identified four types of managers, "entrepreneur", "artist", "administrator", and "caretaker". However, this

classification is adapted to the area of Nonprofit Urban Arts Agencies. An interesting classification, which was specified in the area of management of cities and municipalities, is presented by Svara (1987), who gives the following managerial roles in the respective dimensions:

- Ceremony and Presiding: ceremonial tasks, spokesman for council, presiding officer,
- Communication and Facilitation: educator, liaison with manager, team leader,
- Organisation and Guidance: goal setter, organizer, policy advocate,
- Promotion: promoter, directing staff.

Quinn in Diskienė, Tamaševičius, and Kalvaitytė (2018) "focused on effective manager's performance and determined eight roles such as director, producer, monitor, coordinator, facilitator, mentor, innovator, and broker, which are significant for manager's activities". DuBrin in Diskienė, Tamaševičius, and Kalvaitytė (2018) extended Mintzberg roles to a final 17 (strategic planner, operational planner, organizer, liaison, staffing coordinator, resource allocator, task delegator, figurehead, spokesperson, negotiator, motivator and coach, team builder, team player, technical problem solver, entrepreneur, monitor, and disturbance handler) which reveal the complexity of managerial work. These 17 roles were conceptualised by Laud, Arevalo, and Johnson (2016) into four dimensions: leadership roles, workflow roles, manpower roles, and team roles. Diskienė, Tamaševičius, and Kalvaitytė (2018) further argue that despite all the different concepts of managerial roles, the Mintzberg framework of managerial roles still remains, despite some of its shortcomings, highly valid and widely applicable to managerial work description for most areas. The same authors then apply a reduced Minzberg concept in their research focusing on small and medium-sized businesses in Lithuania, which includes only six managerial roles: analyzer, representor, leader, innovator, decision maker, and networker.

While Snyder and Wheelen (1981) conducted a study in a non-profit-oriented environment, and applied the Mintzberg classification of managerial roles, including the same observation method. Kessler, Heron, and Spilsbury (2017) in specific health care industry and environment, identified and classified very specific managerial roles for the particular environment of the health care industry and environment. For our research, we used a classification for the Czech environment created by Stýblo (2007) in Čáslavová (2020, 14–15), which identifies a total of 11 managerial roles, representing various activities that managers carry out in their daily work. The list and basic activities performed for each role are presented in Table 3.

Table 3 Roles of managers and basic activities of individual roles

Role	Activity
Analyst	**Collection and Analysis of information** – estimation of trends on the basis of relevant data – working with data and graphs
Planner	**Creation, development, and implementation of plans**
Creator of changes	**Initiation, implementation, and enforcement of changes** – encouraging and leading people to change

Role	Activity
Resource allocator	**Deployment and networking of resource allocators** – taking care of available resources – monitoring the effectiveness of their use
Communication partner	**Influencing and persuading people** – creation of communication channels – sharing views with others – listening to others
Educator	**Leading people at work** – identification of people's educational needs – creating a favourable climate for business education
Disturbance handler	**Search and identification of problems** – creation and evaluation of decision-making and problem-solving variants
Helper to others	**Creating a climate of openness and support** – promoting open relationships between people in the organisation
Coordinator	**Demonstration and improvement of new systems and processes** – effective management of individuals, groups, and goal setting – systematic approach to management
Team builder	**Creating a team from individuals and groups** – creating an effective team of mutually supportive people
Executive manager	**Effective use of available resources in the management process** – support of systematic work – creating enthusiasm for new ways and methods of management

Source: Stýblo in Čáslavová (2020, p. 14–15)

The non-profit environment on which this research is focused has significant specifics for the work of managers, which can be reflected in the examined managerial roles. This specificity is stated by Čáslavová (2020, 26).

Advantages:

- less competitive work environment than in for-profit organisations,
- there are incentives for managers in the form of tax breaks,
- the existence of a large range of services and programmes.

Disadvantages:

- services and programmes are constrained by a tight budget,
- there is no standard career advancement,
- the management process of non-profit organisations is influenced by decisions and regulations of governmental organisations and state bodies and their financial support,
- voluntary and non-professional workers are also considered for work in managerial positions,
- following on from the previous ones, the performance of non-profit organisations often decreases.

The choice of managerial roles according to Stýblo in Čáslavová (2020, 14–15) seems to us to be suitable for the environment of non-profit sports organisations, where the emphasis is on the mission of the organisation, the meaning of work, and shared values.

Horch and Schütte (2003) classify the most frequent managerial activities in German sports clubs and organisations, whereas these activities consist namely of the core managerial functions (organizing, controlling, planning, analysing) together with Mintzberg roles.

RESEARCH OBJECTIVES

The previous research focusing on the work of managers in non-profit organisations carried out in Czech conditions (Novotný, Lukeš, 2008; Lukeš, Stephan, 2012) dealt with the personality traits and motivation of managers. However, it did not deal with how these categories are reflected in non-profit organisation management. This also applies to non-profit sports organisations, where we have no research data in this respect. The current conditions in Czech society require increased performance of non-profit sports organisations, which is fully in the hands of their managers. This can be specifically seen in how their activity is planned by sports managers, whether they are able to create a certain strategy, how they obtain and manage financial resources, and whether they work as actual leaders of a group of volunteer and professional workers of these organisations. What is the reality? An insight into the current status is provided by the actual managerial roles fulfilled by these workers.

The theoretical contribution of our research is firmly linked to the main objective of this research, i.e. to determine the differences in the frequency of managerial roles held in non-profit sports organisations in the Czech Republic and to establish the correlation between them, in general, by individual management levels (top, middle, operational), and by the type of employment relationship (full-time job, part-time job, volunteer, self-employed). The knowledge gained from the research results can be applied to the concept of its managerial activities, namely leadership, i.e., creative management of the work groups of these organisations.

The following research questions were formed:

1. Does a different management level or a different type of employment relationship of a manager result in a difference in frequency of held managerial roles?

The affirmative response is conditional on the ranking by frequency of roles at individual management levels (top management x middle management x operational management) or on the ranking by frequency of type of employment relationship (full-time job, part-time job, volunteer, self-employed). In the case of a variance in the frequency ranking, the statistical significance of the variance in measured values is examined using the ANOVA analysis.

2. Does a different management level or a different type of employment relationship of a manager result in a different correlation between managerial roles?

The response will be affirmative if with the determined different correlation, the correlation coefficients fall in another correlation power range according to Hendl (2015) – low = $\left| 0.1–0.3 \right|$, medium = $\left| 0.3–0.7 \right|$, high = $\left| 0.7–1.0 \right|$ – with minimum significance level $\alpha = 0.05$.

METHODOLOGY

A quantitative questionnaire survey was used for this research, the respondents of which were managers of non-profit organisations in the Czech Republic. The selection of or-

ganisations and their managers was therefore made as a deliberate sample, the main features of which were the scope of the organisation in the non-profit sector and the managerial position of the respondent in this organisation. The survey itself was conducted by a group of trained interviewers, who assisted the respondents in completing the questionnaires. The total sample size is 270 respondents. The respondents were further broken down (with a view to ensuring a more detailed analysis of the results) by the level of management at which they worked for their respective organisations, and by whether they were part-time or full-time employees. The resultant structure of the research sample was as shown in Table 4.

Table 4 Structure of the research sample

	Absolute frequency	Relative frequency
Management level		
Top management	101	37.407
Middle management	90	33.333
Operations management	79	29.259
Total	270	100
Part-time/full-time employees		
Full-time job	120	44.444
Part-time job	57	21.111
Volunteer	89	32.963
Self-employed	4	1.481
Total	270	100

Source: own data

The questionnaire contained a set of 11 activities and duties that managers perform. This set of activities and duties was created on the basis of an overview of managerial roles, as stated by Stýblo in Čáslavová (2020, 14–15). The individual activities listed in the questionnaire can be seen in Figure 1. These activities have always represented certain managerial roles.

Respondents reported on how often they perform these activities on an eight-point rating scale (1 – never, 2 – almost never, 3 – very rarely, 4 – occasionally, rarely, 5 – often, 6 – very often, 7 – almost every day, 8 – daily).

Several statistical methods are used to analyse the obtained data. The overall results of the managerial roles held in non-profit organisations are presented using mean values and standard deviations of the eight-point rating scale (see Table 5). The same statistical indicators are also used for individual categories of respondents (according to the level of management and according to the amount of work). The ranking of frequency of individual managerial roles is determined according to the resultant total average values, which answers research question No. 1. Furthermore, the individual groups of respondents (according to the level of management and according to the

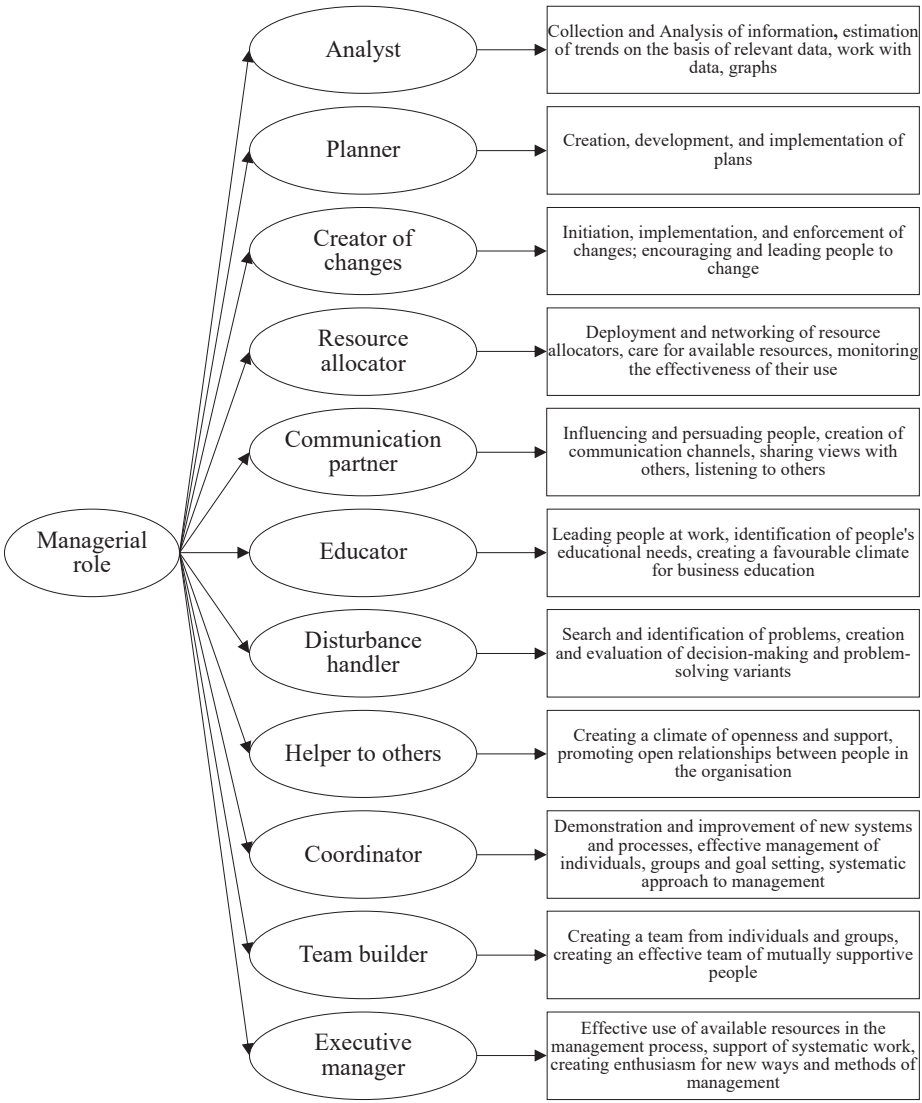


Figure 1 Operationalization of the managerial roles

Source: own processing according to Stýblo in Čáslavová (2020, p. 14–15)

amount of work) are compared as independent selections using analysis of variance ANOVA, again at the level of reliability $\alpha = 0.05$ (the critical cut-off p-value must therefore take on lower values in order to demonstrate a statistically significant difference between the tested groups of respondents).

In the analysis of the dependence of the managerial roles held at the level of management and on the amount of workload a correlation is used where one variable is the role of the manager and the other variable the level of management, or full-time/

part-time job. This dependence is also verified using the Chi-Square test for individual managerial roles. The confidence level considered in the test is 0.05.

To determine whether some managerial roles are related and conditioned, a mutual correlation between individual roles is used both in the overall results and for sub-individual categories of respondents. By means of correlation analysis, the colinear relationship between individual managerial roles was determined – i.e. the correlation between two roles (variables) was analysed using the "each with each" system. By means of the above correlation analyses, research question No. 2 is answered.

Given the overall scope of the resulting data, only the most important and significant findings and results are listed in the Results section.

RESULTS

As already mentioned, a total of 270 respondents (managers of non-profit organisations) in various managerial positions were included in the research. Directors, presidents/chairmen, vice-chairmen, owners, executives, financial directors, marketing managers, project managers, etc., were represented. A total of 30 managerial positions were represented.

Frequency of held managerial roles – RQ1

The overall general results show (see Table 5 and Graph 1) that the most common managerial roles in non-profit organisations are "communication partner" (5.83), "planner" (5.39), "helper to others" (5.33) and "educator" (5.11). In addition, the frequency of these roles is confirmed by almost the smallest standard deviations from all managerial roles (1.56 for the "communication partner", 1.51 for the "planner"), which demonstrates the great agreement between the respondents' answers. The least frequent roles in non-profit organisations are "analyst" (4.01) and "resource allocator" (4.14). However, there are high standard deviations for these two roles, so it cannot be said that there is too much agreement between the respondents' answers in this respect.

Table 5 Overall results of managerial roles in non-profit organisations

Role	Activity	Mean value	Ranking	Standard deviation
Analyst	**Collection and analysis of information** – estimation of trends on the basis of relevant data – working with data and graphs	4.01	11	1.79
Planner	**Creation, development, and implementation of plans**	5.39	2	1.51
Creator of changes	**Initiation, implementation, and enforcement of changes** – encouraging and guiding people to change	4.80	6	1.52
Resource allocator	**Deployment and networking of resource allocators** – taking care of available resources – monitoring the effectiveness of their use	4.14	10	1.82

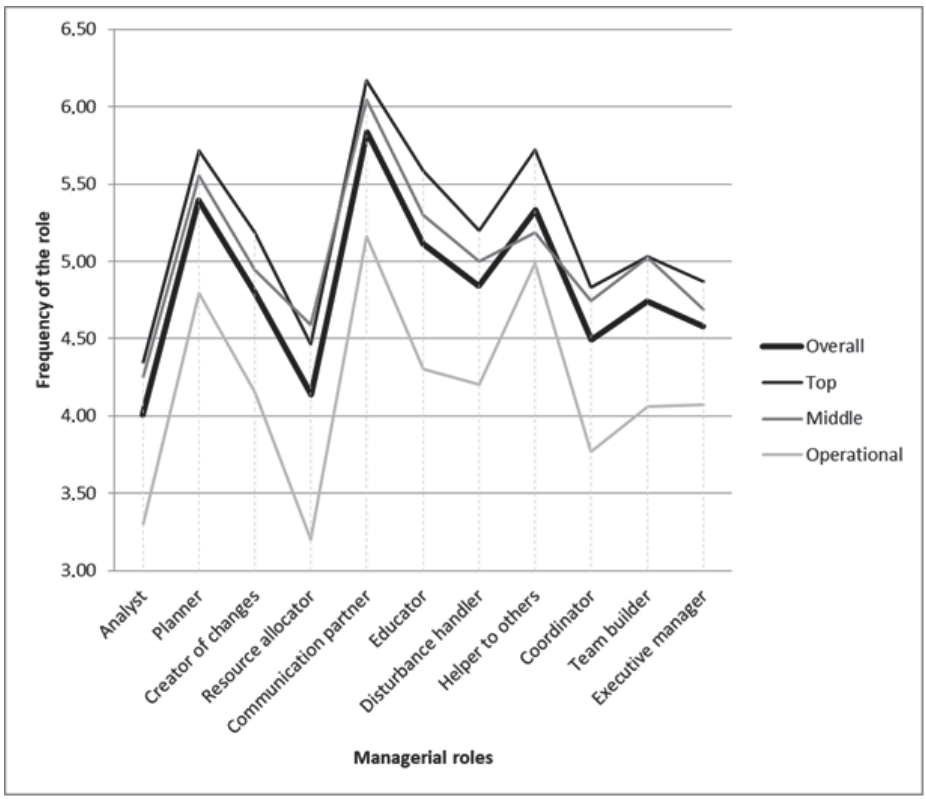
Role	Activity	Mean value	Ranking	Standard deviation
Communication partner	**Influencing and persuading people** – creation of communication channels – sharing views with others – listening to others	5.83	1	1.56
Educator	**Leading people at work** – identification of people's educational needs – creating a favourable climate for business education	5.11	4	1.93
Disturbance handler	**Search for and identification of problems** – creation and evaluation of decision-making and problem-solving variants	4.84	5	1.70
Helper to others	**Creating a climate of openness and support** – promoting open relationships between people in the organisation	5.33	3	1.72
Coordinator	**Demonstration and improvement of new systems and processes** – effective management of individuals, groups, and goal setting – systematic approach to management	4.49	9	1.75
Team builder	**Creating a team from individuals and groups** – creating an effective team of mutually supportive people	4.74	7	1.83
Executive manager	**Effective use of available resources in the management process** – support of systematic work – creating enthusiasm for new ways and methods of management	4.58	8	1.64

Note: 1 – never, 2 – almost never, 3 – very rarely, 4 – occasionally, rarely, 5 – often, 6 – very often, 7 – almost every day, 8 – daily
Source: own data with use of the managerial role classification according to Stýblo in Čáslavová (2020, p. 14–15)

Frequency of held managerial roles by management level

One of the specific tasks of the research is the analysis of held managerial roles according to the level of management in the organisation. The obtained data show that the managerial roles held at individual levels basically copy the overall results, with the only difference being that the higher the level of management, the higher the frequency of the roles played. Everything can be clearly seen in Graph 1. Detailed results are shown in Table 6. Although the main overall results apply, a small deviation can be seen in the role of "resource allocator", where this role is most often held by managers at the middle level of management in the organisation (4.59 vs. 4.47 in top management). Then, in the role of "team builder", the achieved average value in top management and middle management is almost the same (5.03 vs. 5.02); however, according to the standard deviation, the answers of individual respondents are more concentrated around the average values found in middle management. So even here it can be stated that the role of "team builder" is most often held at the level

of middle management in the organisation. At the operational level of management, all examined roles are significantly less frequent than at higher levels. However, the roles of "communication partner" and "helper to others" are most often held, which confirms the theory that at the operational level of management the most common work is with the employees themselves and therefore it is necessary to pay attention to these roles. The "helper to others" is then very close to the middle level of management in its frequency value.



Graph 1 Overall results and results by management level of managerial roles in non-profit organisations
Source: own data

Statistical measurement of the dependence of the roles held at the management level was performed using cross-correlation, which, however, did not show a medium dependence for any role (the correlation coefficient did not exceed 0.2712). For more accurate measurements, the Chi-square test was used, whose calculated values (see Table 6) at a confidence level of 0.05 indicated the existence of a statistically significant dependence on the managerial role "communication partner" at the top management level (0.0004) and at the operational management level for the roles of "analyst" (0.0299), "planner" (0.0020), "creator of changes" (0.0057), "resource allo-

Table 6 Held managerial roles according to the level of management

Role	Top management (n = 101)				Middle management (n = 90)				Operational management (n = 79)			
	Mean value	Ranking	Standard deviation	χ^2	Mean value	Ranking	Standard deviation	χ^2	Mean value	Ranking	Standard deviation	χ^2
Analyst	4.35	11	1.87	0.6391	4.26	11	1.59	0.4850	3.30	10	1.70	0.0299
Planner	5.71	3	1.51	0.1474	5.56	2	1.21	0.4660	4.80	3	1.63	0.0020
Creator of changes	5.19	6	1.44	0.3733	4.94	7	1.34	0.8000	4.15	6	1.59	0.0057
Resource allocator	4.47	10	1.85	0.3950	4.59	10	1.59	0.1002	3.20	11	1.68	0.0004
Communication partner	6.17	1	1.65	0.0004	6.04	1	1.07	0.3691	5.16	1	1.70	0.2364
Educator	5.58	4	1.97	0.2282	5.30	3	1.71	0.7982	4.30	4	1.87	0.0249
Disturbance handler	5.20	5	1.86	0.1058	5.00	6	1.41	0.3945	4.20	5	1.62	0.0442
Helper to others	5.72	2	1.78	0.0890	5.19	4	1.53	0.2282	4.99	2	1.75	0.2549
Coordinator	4.83	9	1.85	0.2260	4.74	8	1.55	0.4242	3.77	9	1.63	0.0142
Team builder	5.03	7	1.76	0.8830	5.02	5	1.54	0.5492	4.06	8	2.02	0.0216
Executive manager	4.87	8	1.68	0.2472	4.69	9	1.49	0.9370	4.08	7	1.64	0.0924

Note: 1 – never, 2 – almost never, 3 – very rarely, 4 – occasionally, rarely, 5 – often, 6 – very often, 7 – almost every day, 8 – daily
Source: own data

cator" (0.0004), "educator" (0.0249), "disturbance handler" (0.0442), "coordinator" (0.0142), and "team builder" (0.0216).

While differences in measured values between individual groups of respondents according to the level of management can be observed both in Graph 1 and Table 6, their statistical significance was subjected to ANOVA analysis at the level of significance p = 0.05. The results of the analysis confirm what can be seen in the mentioned Graph 1 and in Table 6. The P-values for each individual role were in the interval p = <0.0000002; 0.0107129>, which confirms the statistically significant difference of individual groups according to the level of management in the examined roles. A more detailed ANOVA then made it possible to determine that the group of managers at the lowest operational level of management is statistically significantly different for almost all managerial roles. In the case of differences between operational management and middle management for individual roles, P-values were in the interval p = <0.0000002; 0.0121720>, except for the role of "helper to others", where p = 0.4283605 (i.e., greater than 0.05). For statistically significant differences between operational management and top management, p-values were found for all managerial roles in the interval p = <0.0000050; 0.0064315>. Therefore, based on these results, it can be stated that managers at the level of operational management hold the examined managerial roles to a significantly lesser extent than at higher levels of management. The only role that managers play at the operational level of management to an extent similar to that at higher levels is the role of "helper to others" (mean value = 4.99). Together with the role of "communication partner" (mean value = 5.16), these two roles are most common for the operational level of management. These roles are also confirmation of the fact that managers at the operational level of management are closest to subordinates and end employees performing daily work in the organisation.

A statistically significant difference between the results of middle management and top management was demonstrated only in the role of "helper to others", where p = 0.0287672 (less than 0.05). For the other roles, these two groups of respondents did not differ significantly, the p-values were in the interval p = <0.2324264; 0.9753744>, i.e., always greater than p = 0.05.

Frequency of held managerial roles by type of employment relationship

The results of the analysis of managerial roles depending on the amount of work also copy many of the overall results; however, there are more minor differences than at management levels. Detailed results are shown in Table 7 and Graph 2. Only four respondents were represented in the research group who are in an employment relationship with a non-profit organisation as "self-employed", and therefore the results of this group cannot be considered informative and relevant. They are listed here only for the sake of completeness; however, only the results of the remaining three groups of respondents are worked with henceforth.

As with management levels, the frequency of managerial roles is highest for the highest working hours, i.e., full-time jobs. Managers employed on a full-time basis most often play the roles of "communication partner", "planner". and "educator". If a given managerial position is only a part-time job, the most frequently held roles of managers are "communication partner", "helper to others", and "educator". Volunteers in the position of managers are mainly "communication partners", "planners",

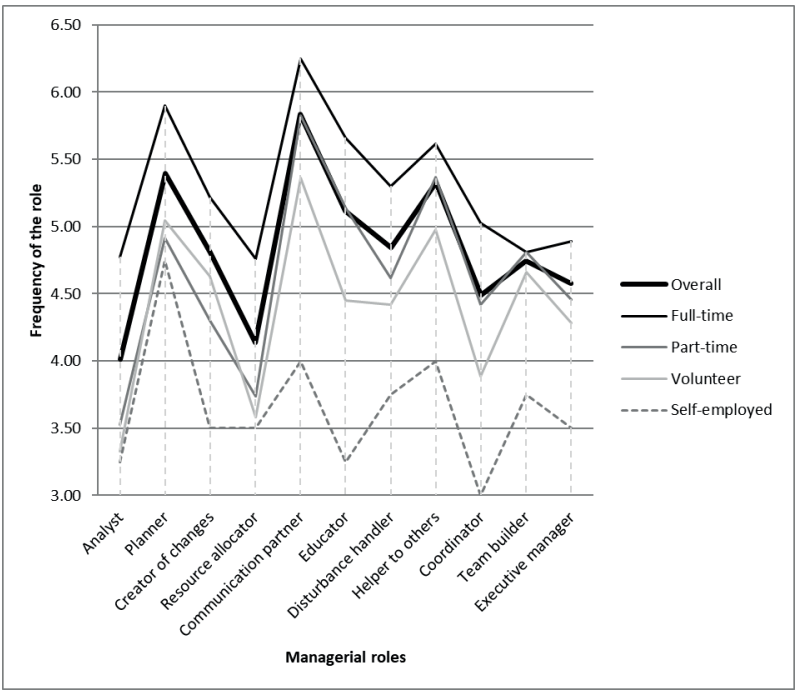
Table 7 Held managerial roles according to the amount of work

Role	Full-time job (n = 120)				Part-time job (n = 57)				Volunteer (n = 89)				Self-employed (n = 4)			
	Mean value	Ranking	Standard deviation	X^2	Mean value	Ranking	Standard deviation	X^2	Mean value	Ranking	Standard deviation	X^2	Mean value	Ranking	Standard deviation	X^2
Analyst	4.78	10–11	1.51	8.54E–08	3.53	11	1.73	0.1047	3.33	11	1.80	2.42E-04	3.25	9-10	1.30	0.3910
Planner	5.90	2	1.35	0.0251	4.91	4	1.45	0.4872	5.04	2	1.54	0.3607	4.75	1	1.30	0.0810
Creator of changes	5.22	6	1.32	0.1219	4.30	9	1.39	0.0749	4.63	4-5	1.67	0.2343	3.50	6-8	1.80	0.3788
Resource allocator	4.76	10–11	1.62	0.0135	3.74	10	1.73	0.5104	3.58	10	1.87	0.1686	3.50	6-8	1.80	0.8536
Communication partner	6.25	1	1.36	0.1074	5.82	1	1.48	0.7955	5.36	1	1.66	0.0920	4.00	2-3	1.87	0.0130
Educator	5.66	3–4	1.71	0.1224	5.14	3	1.70	0.7285	4.45	6-7	2.09	0.0314	3.25	9-10	1.92	0.3112
Disturbance handler	5.30	5	1.48	0.1426	4.61	6	1.76	0.8273	4.42	6-7	1.79	0.3516	3.75	4-5	1.79	0.2108
Helper to others	5.62	3–4	1.51	0.3411	5.37	2	1.82	0.6213	4.98	3	1.82	0.5839	4.00	2-3	1.87	0.4019
Coordinator	5.03	7	1.46	0.0404	4.42	8	1.83	0.9068	3.89	9	1.85	0.0728	3.00	11	1.22	0.5110
Team builder	4.81	8–9	1.76	0.9905	4.81	5	1.73	0.7946	4.66	4-5	1.94	0.9307	3.75	4-5	2.17	0.5584
Executive manager	4.89	8–9	1.55	0.4511	4.46	7	1.67	0.6047	4.28	8	1.66	0.6580	3.50	6-8	1.50	0.2955

Note: 1 – never, 2 – almost never, 3 – very rarely, 4 – occasionally, rarely, 5 – often, 6 – very often, 7 – almost every day, 8 – daily
Source: own data

and "helpers to others". Thus, regardless of the amount of work, interpersonal roles, or cooperation with people and their leadership in general are very common. Interestingly, the role of "team builder" is played as often in both full-time and part-time jobs. In team work, where it is necessary to work with the team constantly and in the most intensive contact between employees, this need would correspond to full-time work within the organisation, but it turns out that even part-time managers play the role of "team builder" to the same extent. Another interesting result is the fact that the roles of "planner" and "creator of changes" are more often held by managers in the position of volunteers (5.04 and 4.63) than in part-time jobs (4.91 and 4.30). The biggest difference in values between the levels of working time can be observed in the roles of "resource allocator", "educator", and especially "analyst". Especially for the role of "analyst", it is very important that the manager be employed within the organisation on a full-time basis, which can be expected for the analytical role.

No strong or medium correlation was found when measuring the correlation between the held managerial roles and the number of working hours by means of correlation. The correlation coefficient did not exceed 0.3610. However, using the Chi-square test, some statistically significant dependencies were found, also at a confidence level of 0.05. At the full-time job level, there was dependence on the roles of "analyst" (8.54E–08), "planner" (0.0251), "resource allocator" (0.0135), and "coordinator" (0.0404). At the level of part-time job there was no statistically significant dependence, at the level of volunteer in the roles of "analyst" (2.42E–04) and "educator" (0.0314).



Graph 2 Results of managerial roles according to the amount of work in relation to the overall results
Source: own data

Similar to management levels, the diversity of working hours is tested for the groups of respondents using ANOVA analysis. Due to the small number of respondents in the self-employed group, there was a statistically significant difference between the groups of respondents at the basic level of ANOVA analysis for all managerial roles (p values < 0.05), except for the role of "team builder", where the total value p = 0.6685430, which is greater than 0.05. In a more detailed ANOVA analysis between individual groups, statistically significant differences (p < 0.05) can be observed between managers for full-time job and part-time job, for the roles of "analyst" (p = 0.0000025), "planner"(P = 0.0000181), "creator of changes"(p = 0.0000371), "resource allocator"(p = 0.0001892), "disturbance handler"(p = 0.0077645), and "coordinator"(p = 0.0196374). A statistically significant difference is also evident between groups of full-time job managers and volunteers, where, in addition to the aforementioned role of "team builder", they reach p = <1.91E–09; 0.0070948>. There was a statistically significant difference between part-time job and volunteers only for the role "educator" (p = 0.0397952), otherwise for all other roles the value of p is > 0.05. As already mentioned, due to the small number of respondents in the self-employed group, the difference cannot be assessed here due to the insufficient informative value of the results of this group.

Overall, it can be summarised that some roles can be held both in a full-time and part-time jobs, or even as a volunteer. These roles include, in particular, the "communication partner", the "helper to others", the "team builder", and the "executive manager", i.e., interpersonal roles in particular. Conversely, for roles such as "analyst", "planner", "creator of changes", "resource allocator", "disturbance handler", and "coordinator", the manager needs to be employed full-time. These roles are held and required very often and for a large amount of time, so there is no suitable part-time or even volunteer position.

Correlation between held managerial roles – RQ2

No strong correlation was demonstrated between the individual managerial roles in the overall results. However, a medium degree of correlation can be observed between the following roles – Table 8.

Table 8 Correlation between the individual managerial roles in the overall results

Managerial roles		Correl. (Sig.)
Coordinator	Executive manager	0.5975***
Coordinator	Educator	0.5307***
Coordinator	Disturbance handler	0.5080***
Coordinator	Helper to others	0.5061***
Educator	Creator of changes	0.5633***
Educator	Communication partner	0.5298***
Analyst	Planner	0.5191***

Note: * p < 0.05; ** p < 0.01; *** p < 0.001
Source: own data

Overall, it can be said that the individual managerial roles do not affect each other and thus there is no strong connection between the examined roles. At the intermediate level, however, the role of "coordinator" is linked to other roles – "executive manager", "educator", "disturbance handler", and "helper to others". These connections are logically based on the characteristics of individual roles, where the "coordinator" takes care of the coordination of cooperation between employees and also the coordination of activities in terms of system management. The medium interrelationship between the "educator" and the roles "creator of changes" and "communication partner" is based on the constant need to communicate all changes correctly and appropriately between employees, or to inspire other employees to change. Also, the intermediate connection between the "analyst" and the "planner" is logical, given the systemic concept of planning, which should always be preceded by a thorough analysis.

Correlation between held managerial roles by management level

By means of partial correlation analyses, different correlations between measured managerial roles were determined at different management levels. Table 9 shows managerial roles between which different correlation levels were determined (low, medium, high – see RQ2) at different management levels.

Table 9 Correlation between the individual managerial roles according to the level of management

Managerial roles		Correl. (Sig.)		
		Top management (n = 101)	Middle management (n = 90)	Operational management (n = 79)
Analyst	Creator of changes	0.2986***	0.3135***	0.2634***
Analyst	Resource allocator	0.3735***	0.4065***	0.2753***
Analyst	Communication partner	0.3883***	0.0064	0.2188***
Analyst	Educator	0.3480***	0.2337***	0.2532***
Analyst	Disturbance handler	0.3577***	0.3462***	0.2536***
Analyst	Helper to others	0.1628**	0.3008***	0.1158
Planner	Resource allocator	0.5227***	0.3777***	0.2180***
Planner	Communication partner	0.3972***	0.0835	0.4445***
Planner	Disturbance handler	0.4108***	0.2852***	0.4227***
Planner	Executive manager	0.2934***	0.4162***	0.2852***
Creator of changes	Resource allocator	0.3428***	0.5191***	0.2679***
Creator of changes	Communication partner	0.4666***	0.2171***	0.3645***
Creator of changes	Helper to others	0.3419***	0.3082***	0.2002***
Creator of changes	Team builder	0.3767***	0.1399*	0.3039***
Creator of changes	Executive manager	0.3700***	0.4356***	0.1948**
Resource allocator	Communication partner	0.4847***	0.1538*	0.2718***

Managerial roles		Correl. (Sig.)		
		Top management (n = 101)	Middle management (n = 90)	Operational management (n = 79)
Resource allocator	Educator	0.3883***	0.2211***	0.2785***
Resource allocator	Disturbance handler	0.4077***	0.2321***	0.3949***
Resource allocator	Executive manager	0.3603***	0.2651***	0.4320***
Communication partner	Helper to others	0.5238***	0.2862***	0.2721***
Communication partner	Coordinator	0.4962***	0.0934	0.2873***
Communication partner	Team builder	0.3295***	0.2946***	0.3429***
Communication partner	Executive manager	0.3976***	0.1060	0.3955***
Educator	Helper to others	0.4265***	0.3232***	0.2827***
Educator	Executive manager	0.4242***	0.2988***	0.4182***
Disturbance handler	Team builder	0.3366***	0.2905***	0.2787***
Disturbance handler	Executive manager	0.5081***	0.2429***	0.3098***
Helper to others	Team builder	0.4970***	0.1540*	0.2502***
Helper to others	Executive manager	0.4294***	0.2362***	0.4282***
Coordinator	Team builder	0.4482***	0.2204***	0.4347***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Source: own data

At the top management level (as compared to other management levels), medium levels of correlation are typical especially between the managerial roles "planner" – "resource allocator" (0.5227, $p < 0.001$), "communication partner" – "helper to others" (0.5238, $p < 0.001$), and "disturbance handler" – "executive manager" (0.5081, $p < 0.001$). Middle management is characterised by medium levels of correlation, especially between the managerial roles "creator of changes" – "resource allocator" (0.5191, $p < 0.001$). Operational management is then characterised by the medium level of correlation between the managerial roles "planner" – "communication partner" (0.4445, $p < 0.001$). Table 9 clearly shows the response to research question No. 2, i.e., that in many cases a different management level leads to different correlations between managerial roles.

Correlations of held managerial roles by the type of employment relationship

Similar to the management levels, correlations between managerial roles were measured with different types of employment relationships. Table 10 shows managerial roles between which different correlation levels (low, medium, high – see RQ2) were determined for different types of employment relationship.

Table 10 Correlation between the individual managerial roles according to the amount of work

Managerial roles		Correl. (Sig.)		
		Full-time job (n = 120)	Part-time job (n = 57)	Volunteer (n = 89)
Analyst	Creator of changes	0.1916**	0.4317***	0.3219***
Analyst	Resource allocator	0.1548*	0.5268***	0.4211***
Analyst	Educator	0.2898***	0.3987***	0.2059***
Analyst	Disturbance handler	0.2467***	0.3082***	0.3955***
Analyst	Helper to others	0.0243	0.1724**	0.3359***
Analyst	Coordinator	0.1801**	0.3858***	0.3994***
Analyst	Executive manager	0.1208*	0.2884***	0.3355***
Planner	Resource allocator	0.3209***	0.2624***	0.5436***
Planner	Communication partner	0.3415***	0.2216***	0.5034***
Planner	Helper to others	0.1000	0.2439***	0.3530***
Planner	Coordinator	0.1241*	0.3642***	0.5606***
Planner	Team builder	0.0516	0.2720***	0.3537***
Planner	Executive manager	0.1140	0.4511***	0.5273***
Creator of changes	Resource allocator	0.2982***	0.4264***	0.4410***
Creator of changes	Communication partner	0.3056***	0.2052***	0.5246***
Creator of changes	Disturbance handler	0.2709***	0.3476***	0.5130***
Creator of changes	Helper to others	0.2559***	0.4141***	0.2423***
Creator of changes	Team builder	0.1799**	0.2939***	0.4720***
Creator of changes	Executive manager	0.2232***	0.4418***	0.3883***
Resource allocator	Communication partner	0.2328***	0.2220***	0.5119***
Resource allocator	Educator	0.1120	0.2864***	0.5296***
Resource allocator	Disturbance handler	0.2643***	0.2078***	0.5092***
Resource allocator	Helper to others	0.0543	0.1141	0.4037***
Resource allocator	Coordinator	0.1828**	0.4401***	0.5121***
Resource allocator	Executive manager	0.2482***	0.4307***	0.4294***
Communication partner	Coordinator	0.2583***	0.2488***	0.4161***
Communication partner	Team builder	0.3070***	0.2544***	0.4599***
Communication partner	Executive manager	0.2899***	0.1538*	0.4504***
Educator	Disturbance handler	0.2726***	0.6143***	0.5243***
Educator	Helper to others	0.3220***	0.4702***	0.2921***
Educator	Team builder	0.2896***	0.4620***	0.5898***
Educator	Executive manager	0.1968**	0.4852***	0.5276***
Disturbance handler	Team builder	0.2536***	0.4694***	0.3612***

Managerial roles		Correl. (Sig.)		
		Full-time job (n = 120)	Part-time job (n = 57)	Volunteer (n = 89)
Disturbance handler	Executive manager	0.4105***	0.2031***	0.4509***
Helper to others	Team builder	0.3909***	0.3006***	0.2779***
Helper to others	Executive manager	0.3348***	0.2568***	0.4651***
Coordinator	Team builder	0.2719***	0.5420***	0.4957***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Source: own data

From the point of view of type of employment relationship, it can be observed that in the case of full-time jobs a medium level of correlation between managerial roles, where the correlation coefficient would reach at least the value of 0.5, almost never occurs. This level of correlation between managerial roles can be observed in the case of part-time jobs between the roles "analyst" – "resource allocator" (0.5268, $p < 0.001$), "educator" – "disturbance handler" (0.6143, $p < 0.001$), and "coordinator" – "team builder" (0.5420, $p < 0.001$). In the case of volunteer work, a quite substantial medium level of correlation between managerial roles as compared to the other types of employment relationship can be observed. This includes especially correlations between the roles "educator" – "team builder" (0.5898, $p < 0.001$), "planner" – "coordinator" (0.5606, $p < 0.001$), and "planner" – "resource allocator" (0.5436, $p < 0.001$). Table 10 also shows (similar to management levels) the response to research question No. 2, i.e., that in many cases a different type of employment relationship leads to different correlation between managerial roles.

DISCUSSION

Although the classification of roles for non-profit organisations already exists in theory (Snyder, Wheelen, 1981), a classification that reflects the management conditions of Czech non-profit organisations was used for our research in sports non-profit organisations in the Czech Republic (Stýblo in Čáslavová, 2020). Some of the roles of Snyder and Wheelen (1981) seem incomprehensible to respondents – managers of non-profit sports organisations. It was, for example, the role of the Figurehead in comparison with the Leader or the role of Entrepreneur with regard to Czech legislation, which in non-profit organisations at most allows the position of a trade. And some roles describing the management activities of non-profit sports organisations towards the fulfilment of their mission were missing – for example, the Figurehead or the Leader.

Based on the obtained results, it can be said that the most common roles of managers of non-profit sports organisations – communication partner, helper to others, educator – reflect the environment of non-profit sports organisations. These are roles related to the mission of non-profit sports organisations – explaining the mission of the sports organisation inside and outside the organisation, educating young people through sports, attracting talent, working with volunteers, training coaches, instruc-

tors, and trainers. It can be said that the role of the planner is debatable and somewhat less clear. Although this is a role that came in second place, managers could keep different types of plans in mind, especially with regard to their duration. Overall, it is known about non-profit sports organisations that strategic planning in the Czech environment with regard to its turbulence and instability is used minimally (Novotný, Lukeš et al., 2008; Čáslavová, 2020). This would be evidenced by the order of the role of the analyst, who placed 11th. In contrast, each manager participates in the preparation of the budget and its approval for the current calendar year.

Roles such as executive manager and coordinator in 8th and 9th place prove that there is a somewhat differing view of non-profit organisations in motivating managers. It's not so much about performance motivation and the need for success, but about the motives associated with the roles that ranked highest.

The roles of communication partner, educator, helper to others, and planner, which are in the first four places, do not have a strong dependence on other roles. However, moderate dependence shows a connection between roles such as communication partner, educator, and helper to others with the coordinator, which is logical given the busy organisational activities for sports services lessons for own members, sports services courses for the public, and sports events.

The differences in the resulting roles did not vary even according to the levels of management. The only questionable moment can be observed in the role of resource allocator, which is more frequently mentioned by middle-level managers, even though it exceeds the top level. This is also similar in the for-profit environment, as shown by the study by Alexander (1979), where the roles at different levels of management also do not differ much. Given the higher inclination to strategically lead the organisation, it would be logical to expect the opposite result. Overall, the role of "resource allocator" ranked 10th. There are many possible reasons for this situation; due to subsidies from public sources, managers do not feel responsible for procuring other own resources, for example from sponsorship or business activities that Czech legislation allows. At the same time, they may underestimate the marketing activities of a sports organisation or may not have the appropriate knowledge and skills to carry it out. It would be necessary to verify this situation with future research.

The results according to the type of workload can be considered conclusive only for sports managers who are employed on a trade license (called "self-employed persons" according to Czech legislation). It is a specific form of business. Only four respondents were represented in the sample. Depending on the type of job, the representation of managerial roles changes, especially between full-time workers and volunteers, which is relatively predictable. An interesting result, however, is the roles of "planner" and "creator of changes", which are relatively important and strategic roles for the operation and development of the organisation. However, these two roles are more often filled by volunteers than part-time workers. Despite the statistically insignificant difference between the two groups, they confirm the importance of a full-time job for such crucial roles as the "planner" and the "creator of changes". However, the fact that among volunteers the roles of "planner", "team builder", and "creator of changes" are in 2nd or 4th–5th place (i.e., frequently held roles) indicates a significant role and value of volunteers for sports organisations. For future research, it is highly advised to explore the roles of managers working for non-profit organisations as self-employed

individuals, where greater differences in the roles can be expected compared to traditional employment.

RQ1: Does a different management level or a different type of employment relationship of a manager result in a different frequency of held managerial roles?

The ranking of frequency of held managerial roles by management level differs by at least two positions with two managerial roles (see Table 6). The first managerial role concerned is "helper to others", whereas at the top management and operational management levels this role ranks second, and at the middle management level it ranks fourth in frequency. The second managerial role with different frequency of the held role by management level is "team builder", whereas it ranks seventh in the frequency of the held role at the top management level, eighth at the operational management level, and fifth at the middle management level.

As regards ranking by type of employment relationship, the more significant differences in the ranking of frequency of held managerial roles concern the greater number of examined managerial roles (see Table 7). The roles include "planner" (full-time job – 2., part-time job – 4., volunteer – 2.), "creator of changes" (full-time job – 6., part-time job – 9., volunteer – 4.–5.), "educator" (full-time job – 3.–4., part-time job – 3., volunteer – 6.–7.), and "team builder" (full-time job – 8.–9., part-time job – 5., volunteer – 4.–5.).

RQ2: Does a different management level or a different type of employment relationship of a manager result in different correlations between managerial roles?

With many managerial roles, a different management level results in a different correlation between managerial roles (see Table 9). Likewise, a different type of employment relationship results in a different correlation between managerial roles (see Table 10).

CONCLUSION

The work of managers in non-profit sports organisations and their role in the management work of these organisations is not represented in previous research, so the research has focused on this issue. There are also practical reasons for this. These organisations in the Czech Republic have the legal form of a registered association. Entrepreneurship or other gainful activity cannot be the main activity of the association (Civil Code, 2019). On the other hand, it may, as a secondary economic activity, carry on business or other gainful activity, the purpose of which is to support the principal activity or use economically (Civil Code, 2019). The profit from this secondary activity can then only be used for the association's community service activities.

The subject of the research was to answer the question of what roles managers play in the management of non-profit organisations in the field of sports, because their interest is to fulfil the mission of the organisation, which covers the needs of society with regard to people's leisure time, fulfilling the role of health prevention, education with regard to the preference for positive values of human life, etc. On the other hand, these people must combine their mission with business activities and managerial knowledge typical of successfully managed companies.

The research shows that the higher the level of management, the higher the frequency of the managerial roles held at individual management levels played. As with management levels, the frequency of managerial roles is highest for the highest working hours, i.e., full-time jobs. The differences in the resulting roles did not differ much according to the levels of management. Depending on the type of job, the representation of managerial roles changes, especially between full-time workers and volunteers. As regards ranking by type of employment relationship, the more significant differences in the ranking of frequency of held managerial roles concern the greater number of examined managerial roles (see Table 7).

The presented research shows that the roles of managers of non-profit sports organisations have significantly affected interpersonal roles towards fulfilling the mission of these organisations more than strengthening their performance with regard to the economy in particular. The long-standing tradition of training employees of non-profit organisations in the processes of providing the activities of instructors, trainers, and coaches and the tradition of organising sports events in the field of sports for all are also evaluated here. However, the relegation of the roles – resource allocator, executive manager, and coordinator – provides an incentive to focus on creating training offers for management staff with regard to strengthening leadership, managing subsidies from public resources, and the possibility of using marketing to create their own financial resources.

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