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The role of organisational exercise climate for physical activity promotion of employees with metabolic syndrome: Testing a psychosocial mediator model

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Abstract

Introduction: Metabolic syndrome is a widespread disease mainly caused by physical inactivity and associated with a significant risk of cardiometabolic disease. From a company perspective, the increasing prevalence is also of socio-economic importance, which is why approaches to effectively promote physical activity are of great interest. The current study aimed to examine a moderated mediation model in which organisational exercise climate facets (values and expectations, practises, communication) predict total physical activity via habit strength for physical activity as a mediating mechanism, and the strength of these associations is moderated by the level of self-control.
Methods: In this cross-sectional study, a sample of 165 employees with metabolic syndrome was recruited through a paper-pencil survey at the main Volkswagen plant (Wolfsburg, Germany).

Multiple regression analyses, simple mediation analyses, and moderated mediation analyses were used to test our hypotheses.
Results: Analyses indicated two ways in which organisational exercise climate (OEC) relates to employees' physical activity. First, simple mediation analyses showed that communication (OEC) is indirectly positive related to total physical activity through habit strength as a mediating mechanism. Second, moderated mediation analyses showed that organisational practises (OEC) are directly associated with higher levels of physical activity given employees have a high self-control capacity.
Discussion: These results highlight the advantages of creating a favourable organisational exercise climate for improving physical activity. Organisational efforts to promote active lifestyles may particularly benefit from increased communication about physical activity and how to stay healthy by exercising, as well as organisational incentives for exercise (e.g., reduced membership in the gym, exercise breaks, running groups in the organisation).

Take-home message: To support changes in employees' lifestyles, creating a steadily supportive work environment via organisational exercise climate might be a useful approach.
Key words: metabolic syndrome; organisational exercise climate; physical activity; worksite health promotion.

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INTRODUCTION

The importance of an active lifestyle for individuals' health and well-being is beyond doubt in terms of empirical findings [1,2]. To promote health and prevent disease, adults are recommended to do either 150 to 300 min of moderate or 75 to 150 min of vigorous physical activity per week [3]. Digitisation and technological advancements, however, are causing increasingly sedentary working and living environments. According to the recommendations, more than one in four adults worldwide were insufficiently physically active [4]. Sedentariness and unbalanced nutrition leave an estimated 1.4 billion people vulnerable to various pathological abnormalities, including central obesity, hypertension, impaired carbohydrate metabolism, and increased blood lipid levels [5,6], which are clustered as metabolic syndrome. Numerous studies [7–10] found metabolic syndrome to be closely associated with cardiovascular diseases and type 2 diabetes, as well as with increased absence days, productivity losses, and socio-economic costs.

The need for action is obvious, particularly from the perspective of organisations faced with the additional challenge of a steadily ageing workforce [11]. In fact, the occupational context offers a variety of approaches to promote employees' physical activity, e.g., access to on-site facilities [12], job design [13,14], incentives for a healthy lifestyle, CEOs as role models, and policies modelling health behaviour [15]. A job characteristic covering most of the aspects above relates to the organisational exercise climate (OEC), which captures employees' perceptions of organisational values, practises, and communication surrounding exercise and physical activity [16]. From a social-psychological perspective, OEC thus describes common norms and expectations of a social group (e.g., a team, colleagues) regarding appropriate activity behaviour. It was found that employees' perceptions of work settings are linked to their attitudes and behaviours, highlighting the strong motivation of individuals to behave consistently with expectations and common practises at work [17,18]. Research also showed that OEC is not only positively associated with regular exercise behaviour and exercise identity [16,19], but is also likely to have a decisive impact on physical activity habits. In general, habits describe tendencies to repeat certain behaviours that are triggered by environmental cues, performed automatically, and experienced as low effort [20]. As behavioural scripts [21,22], they indicate which behaviour is appropriate for a given situation and significantly predict behaviour over and above antecedents such as intentions, volitional control, and social norms [23–25]. Notably, behavioural scripts are acquired by observing and imitating the behaviour of others in order to comply to accepted social standards and expectations [24]. It thus seems theoretically appealing that OEC, as employees' shared norms and expectations pertaining to appropriate physical activity, is related to habitual physical activity behaviour, although to our knowledge corresponding interactions have not yet been investigated.

Apart from environmental factors, self-control, defined as the capacity to reconcile behavioural responses with values, norms, and expectations [26], also contributes to a wide range of socially desirable behaviours, including physical activity. For example, a number of studies have shown that individuals with high self-control are more likely to be physically active [27–29]. It also has been reported that individuals with low trait self-control have comparatively strong habits for health risk behaviours (e.g., substance abuse) [30] and weak habits for health-promoting behaviours (e.g., physical activity) [31]. Additionally, it has been shown that people's capacity for self-control contributes to their adherence to social norms. Individuals with a low capacity for self-control have been found to be more likely to violate social norms that require effort to follow and more likely to engage in counter-normative behaviour, such as cheating and lying [32,33]. The previous considerations suggest two things: first, employees with elevated levels of self-control are more likely to behave congruently with OEC and therefore show higher levels of physical activity than those with low self-regulation capacity. Second, individuals with a high degree of self-control are more likely to form healthy habits for physical activity than those with poor self-control capacity. Interestingly, researchers revealed that exercise routines and self-regulation do not interact with the amount of time spent on sport activities [14]. Self-control is thus obviously necessary to establish habits but not to practise them, since they are performed automatically and without effort [34,35].

By examining the association between OEC and total physical activity in a sample of employees with diagnosed metabolic syndrome, we propose OEC as a promising approach to promote an active lifestyle. We test habit strength for physical activity as the mediating mechanism and investigate whether the relations between OEC, total physical activity, and habit strength for physical activity differ depending on trait self-control. Figure 1 shows the research model used in this study, which is based on the following hypotheses:

Hypothesis 1: OEC is positively associated with total physical activity.

Hypothesis 2: OEC is positively associated with habit strength for physical activity.

Hypothesis 3: Habit strength for physical activity is positively associated with total physical activity.

Hypothesis 4: Habit strength for physical activity mediates the positive relation between OEC and total physical activity.

Hypothesis 5: Self-control capacity is the boundary condition for the relationship between OEC and total physical activity. For employees high in trait self-control, OEC is positively associated with total physical activity, whereas there is no association for those low in trait self-control.

Hypothesis 6: Self-control capacity is the boundary condition for the relationship between OEC and habit strength for physical activity. For employees high in trait self-control, OEC is positively associated with habit strength for physical activity, whereas there is no association for those low in trait self-control.

Hypothesis 7: Self-control capacity is the boundary condition for the proposed mediation. For employees high in trait self-control, habit strength for physical activity mediates the relation between OEC and total physical activity, whereas there is no mediation effect for those low in trait self-control.

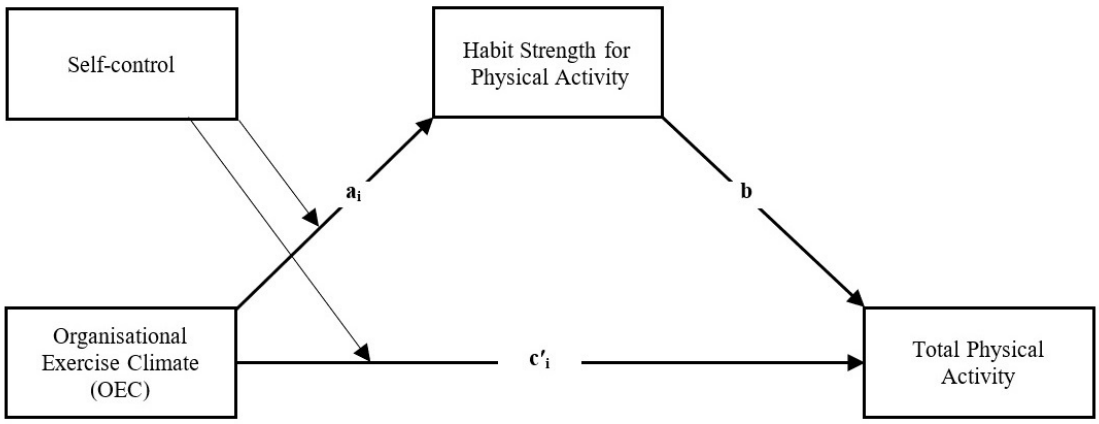

Figure 1. The proposed moderated mediation model.
Note: a_i = effect of OEC facet *i* on habit strength; *b* = effect of habit strength on total physical activity; *ind* = indirect effect of OEC facet *i* on total physical activity through habit strength (*ind* = $a_i \times b$); c'_i = direct effect of OEC facet *i* on total physical activity.

METHODS

Study design and procedure

The present study is a cross-sectional analysis done as a collaborative project between Volkswagen AG and Hannover Medical School. It was conducted following a randomised controlled trial (RCT) of company employees with diagnosed metabolic syndrome, which investigated the effects of a 6-month structured exercise intervention on metabolic syndrome severity [36]. Volunteers were recruited at the one-year follow-up of the RCT. For this purpose, study nurses and physicians initially informed trial participants about the survey study, its aims, and methods. By consenting to participate, a paper-pencil-survey package and an information sheet with a study description were distributed to each attendee. The data was collected between November 2018 and April 2019 at Volkswagen's main plant in Wolfsburg (Lower Saxony, Germany).

Study participants and sampling

We distributed survey packages to a total of 245 employees with diagnosed metabolic syndrome. The final sample size was reduced from 177 respondents who completed the questionnaires (response rate = 72%) to 165 participants (overall response rate = 67%) by removing cases with missing data in several core study variables and a weekly working time of less than 30 hours. This selection was made based on empirical findings indicating differences in several work attitudes and job-related perceptions between full-time and part-time employees, as well as between subgroups of part-timers [37,38]. The mean age of the sample was 49.49 years (*SD* = 8.22), with an average job tenure of 25.51 years (*SD* = 10.93). The participants were male by the majority (84%) and worked an average of 36.64 hours a week (*SD* = 2.83). Among all participants, one sixth worked in shifts (17%) or in a supervisory position (16%), respectively. The average body mass index (BMI) was 31.40 kg/m^2 (*SD* = 5.34).

Study instruments

Organisational exercise climate

The organisational climate pertaining to physical activity was assessed using the sub-scales *values and expectations* (e.g., "Exercise and physical activity for employees are considered by the management to be important in this organisation"), *communication* (e.g., "In this organisation, there are posters featuring exercise and physical activity"), and *organisational practises* (e.g., "Employees from this organisation pay reduced fees in fitness centres") from the Exercise Climate Scale [16].

Participants' ratings were based on a 5-point Likert scale from 1 (*completely in disagreement*) to 5 (*completely in agreement*) and summarised in three sub-scores, with high values representing an elevated level of the corresponding climate dimension. For application in a German sample, we translated the English version according to the guidelines and methods of intercultural translation [39,40]. Thus, the original items were first translated into German by three independent native English speakers. In a subsequent review process, the resulting variants were compared, discussed, and summarised to form a preliminary final version. In a next step, this German version was translated back into English. Based on preliminary final German translation and retranslation, the items were again reviewed and discussed for comprehensibility and originality by psychologists and health scientists. The results led to the item formulations used in this study. To examine whether the sub-scales are distinct constructs, a confirmatory factor analysis using correlated error terms for items with semantic and syntactic matches was conducted. One item ("I think that colleagues who stay physically fit are more respected than those who exercise less") was excluded from further analyses due to unsatisfactory modification indices. A three-factor model with items loading on whether a values and expectations factor, a practises factor, or a communication factor showed a satisfactory fit ($\chi^2 = 49.596$; $df = 37$, $p = .081$; $RMSEA = .046$; $SRMR = .044$; $CFI = .978$; $n = 165$) and fitted the data better than a one-factor model with all items loading on one single factor ($\chi^2 = 116.154$; $df = 43$, $p = .000$; $RMSEA = .105$; $SRMR = .071$; $CFI = .867$; $n = 165$). Cronbach's alphas computed separately for the sub-scales ranged between 0.69 and 0.78.

Habit strength for physical activity

Habits related to sports or physical activities such as jogging, brisk walking, cycling to work, etc., were measured by the German translation of the Self-Report Habit Index (SRHI) [41]. The SRHI consists of an introductory phrase (e.g., "Physical activity is something …") followed by 12 items that captured relevant behavioural characteristics, including history of repetition (e.g., "... that I have been doing for a long time"), automaticity in behavioural regulation (e.g., "... I do without thinking"), and physical activity as part of someone's own identity (e.g., '... that is typically me"). Responses ranged from 1 (*completely in disagreement*) to 5 (*completely in agreement*) on a 5-point Likert scale. An overall score was calculated, with higher scores indicating stronger habits. Results of confirmatory factor analysis, in which correlated error terms between semantically and grammatically equivalent items was allowed, showed a good fit of the one-factor model to the data ($\chi^2 = 58.521$; $df = 48$, $p = .142$; $RMSEA = .039$; $SRMR = .053$; $CFI = .973$; $n = 165$). Cronbach's alpha was .91.

Physical Activity

The Freiburger Physical Activity Questionnaire [42] was offered as a condensed version with eight items capturing the type, duration, and frequency of basic physical activities (e.g., climbing stairs), leisure time physical activities (e.g., dancing), and sports activities (e.g., jogging) in the last week or month. After converting the amount of time spent on each activity into hours per week, the total level of physical activity was specified as the summed weekly energy expenditure according to the formular: *metabolic equivalents of task (MET)* x *participant's body weight (kg)* x *total duration of activity (hours per week)*.

Self-control

For assessing dispositional self-regulation capacity, we applied the German adaptation of the Self-Control Scale [43] with a total of 13 items (e.g., "I am good at resisting temptation"). Participants' responses were recorded on a 5-point Likert scale (1 "*completely in disagreement*" to 5 "*completely in agreement*"), resulting in an averaged total score with high values indicating high levels of self-control. Dimensionality was examined using confirmatory factor analysis with correlated error terms between items with similar sentence structure and wording. A statistically poor-fitting item ("I find it hard to concentrate") has been removed. Assuming a single factor with 12 items, results revealed an acceptable model fit ($\chi^2 = 58.521$; $df = 48$, $p = .142$; $RMSEA = .036$; $SRMR = .053$; $CFI = .973$; $n = 165$). Cronbach's alpha was .83.

Control variables

We assessed age, gender, contractual working time, job tenure, leadership responsibility, shift work, height, and weight as single items with an open or dichotomous response format. The body-mass index (BMI) was calculated with the formula: *bodyweight (kg) / height* (m^2). Participants rated their intention to be physically active regularly in the last four weeks based on a 10-point rating scale (1 "*I did not have this intention at all*" to 10 "*I had this intention very strongly*"). They also completed the SF-36 questionnaire [44] for health-related quality of life, whose ratings were summarised in a mental and a physical component score, each ranging between 0 (minimum) and 100 (maximum). Using a formula developed by Gurka and colleagues [45], metabolic syndrome severity was calculated as a sex- and ethnicity-adjusted Z score ($M = 0$, $SD = 1$), with high scores representing increased severity. The calculation was based on waist circumference, blood lipids (HDL and triglycerides), fasting glucose, and systolic blood pressure from RCT follow-up data. The equation we used for the women in the sample was *–7.2591 + 0.0254 × waist circumference – 0.0120 × HDL + 0.0075 × systolic blood pressure + 0.5800 × ln(triglycerides) + 0.0203 × fasting glucose* and for men in the sample, it was *–5.4559 + 0.0125 × waist circumference – 0.0251 × HDL + 0.0047 × systolic blood pressure + 0.8244 × ln(triglycerides) + 0.0106 × fasting glucose.*

Data analysis

We used Wilcoxon-Mann-Whitney tests (for metric and ordinal variables) and Chi-square tests (for categorical variables) to analyse between-group differences, as well as Fisher's exact test for the significance analysis of the contingency tables. To counteract alpha error accumulation, Bonferroni correction for multiple testing was applied. By specifying one regression model each for total physical activity (primary outcome) and habit strength for physical activity (mediator), in which the control variables were the only predictors, we selected covariates that significantly predicted the criteria. Means (*M*) and standard deviations (*SD*) were calculated for the variables used in the main analysis, followed by two-way Spearman rank-order intercorrelations. We tested our hypotheses with hierarchical multiple regression analyses, simple mediation analyses, and moderated mediation analyses using the PROCESS macro for SPSS [46]. The estimation of the proposed simple mediation effects was based on 'model 4' of the PROCESS modelling tool. The conditional effects were estimated with PROCESS 'model 8'. For inferences about indirect effects, bias-corrected confidence intervals were generated, derived from 10.000 bootstrap resamples. In line with the CFA results, we treated the OEC facets as independent variables and performed separate sets of analyses accordingly. Statistical analyses were done with RStudio (Version 1.2.1335) and IBM® SPSS® Statistics (Version 24.0). Missing data were replaced by mean substitution. The statistical significance level was set at $p \leq .05$ but was adjusted in case of multiple testing.

Ethical aspects

The study was conducted according to the principles of the Declaration of Helsinki and was approved by the Ethics Committee of the Hannover Medical School (approval code: 7531, approval date: 14/07/17). Study participation was entirely voluntary and confidential. We obtained written informed consent from each participant. In the statistical analysis, pseudonymised data were used.

RESULTS

Preliminary analyses

Survey participant and non-participant characteristics are outlined in Table 1. When comparing samples' characteristics, neither the Wilcoxon-Mann-Whitney test nor the contingency analysis revealed significant differences between respondents and non-participants after Bonferroni-Holm correction. Likewise, the Wilcoxon-Mann-Whitney test showed that OEC, habit strength, total physical activity, and self-control did not differ depending on which groups the survey participants belonged to during prior lifestyle intervention. Using multiple regression analysis, pre-selection of covariates indicated that intention to be physically active was the only significant predictor for both total physical activity ($\beta = .22$, $p \leq .01$) and habit strength for physical activity ($\beta = .33$, $p \leq .01$); the other covariates were thus excluded from the main analysis [47].

Descriptive statistics and intercorrelations

Table 2 shows descriptive statistics and Spearman's rank-order correlations of all study variables used for hypothesis testing. Neither of the OEC facets was significantly associated with total physical activity. Communication (OEC) but not values and expectations (OEC) or organisational practices (OEC) correlated positively with habit strength for physical activity (r = .18, $p \le .05$). The correlation coefficient between habit strength and total physical activity (r = .42, $p \le .01$) indicated a moderate relationship. Self-control did not correlate with OEC, but with habit strength for physical activity on a medium level (r = .34, $p \le .01$). In addition, self-control correlated positively with total physical activity (r = .19, $p \le .05$). This supported the idea of conceptualizing self-control as a moderating factor.

Table 1. Characteristics of survey respondents and non-participants.

	All (*n* = 245)	**Respondents** (*n* = 177)	**Non-Participants** (*n* = 68)
Demographic characteristics			
Sex			
Women	32 (13%)	28 (16%)	4 (6%)
Men	213 (87%)	149 (84%)	64 (94%)
Age (years)	49.11 (8.24)	49.77 (8.08)	47.40 (8.45)
Clinical characteristics (baseline)[a]			
BMI (kg/m²)	32.96 (5.20)	32.77 (5.15)	33.47 (5.35)
MetS-Z score (unit)	0.97 (0.64)	0.95 (0.64)	1.01 (0.64)
Total physical activity (MET h per week)	25.10 (20.23)	25.19 (20.90)	24.86 (18.53)
Physical health (sum score)	49.21 (7.00)	48.92 (7.25)	49.97 (6.31)
Mental health (sum score)	49.39 (8.97)	69.38 (18.10)	49.30 (8.37)
Clinical characteristics (follow-up)[b]			
BMI (kg/m²)	31.55 (5.13)	31.43 (5.31)	31.88 (4.63)
MetS-Z score (unit)	.65 (0.69)	0.67 (0.73)	0.60 (0.56)
Total physical activity (MET h per week)	38.28 (27.00)	36.65 (25.35)	42.55 (30.68)
Physical health (sum score)	51.03 (7.55)	50.93 (7.99)	51.30 (6.32)
Mental health (sum score)	52.25 (10.28)	52.22 (11.22)	52.33 (7.38)
Clinical characteristics (Δ)[c]			
Δ BMI (kg/m²)	-1.41 (2.18)	-1.34 (1.80)	-1.59 (2.96)
Δ MetS-Z score (unit)	-0.32 (0.59)	-0.28 (0.54)	-0.41 (0.69)
Δ Total physical activity (MET h per week)	13.19 (28.20)	11.46 (27.24)	17.68 (30.31)
Δ Physical health (sum score)	1.82 (7.96)	2.01 (8.14)	1.33 (7.52)
Δ Mental health (sum score)	2.86 (10.98)	2.80 (11.35)	3.03 (10.04)
Work characteristics (follow-up)[b]			
Shift work			
Non-shift work	204 (83%)	150 (85%)	54 (79%)
Shift work	41 (17%)	27 (15%)	14 (21%)
Work hours			
Full-time	233 (95%)	169 (95%)	64 (94%)
Part-time	12 (5%)	8 (4%)	4 (6%)
Physical demands[d]			
Sitting tasks (percentage)	64% (26.45)	66% (26.04)	59% (27.28)
Standing tasks (percentage)	14% (16.37)	14% (16.67)	15% (16.98)
Physically active tasks (percentage)	22% (18.86)	20% (17.82)	25% (22.27)
Leadership responsibility			
Non- leadership responsibility		138 (84%)	
Leadership responsibility		27 (16%)	
Job tenure (years)		25.5 (10.93)	
Study group in pilot study			
Exercise group	118 (48%)	91 (51%)	27 (40%)
Control group	127 (52%)	86 (49%)	41 (60%)

Note: Number (%), mean (*SD*), or percentage (*SD*) are displayed.
[a] Data were collected at baseline of the pilot study (RCT).
[b] Data were collected at 12-month follow-up of the pilot study (RCT).
[c] Delta values represent the difference between the clinical values at follow-up and those at baseline.
[d] Values show the average contribution of sitting, standing, and physically demanding activities to total work tasks.

Table 2. Means (*M*), standard deviations (*SD*), and intercorrelations of study variables used for hypothesis testing (*n* = 165).

	M	*SD*	1	2	3	4	5	6
1 intention	7.81	1.99						
2 values (OEC)	2.29	0.79	-.12					
3 practises (OEC)	3.21	0.83	.07	. 49**				
4 communication (OEC)	2.80	0.81	.11	. 52**	. 46**			
5 habit strength	2.98	0.73	.39**	. 04	. 04	. 18*		
6 self-control	3.34	0.57	.32**	. 03	-. 03	. 07	.34**	
7 total physical activity[a]	36.70	24.96	.32**	-. 06	. 06	. 10	.42**	.19*

*Note: S*tandardised regression coefficients are displayed. OEC = organisational exercise climate; values (OEC) = values and expectations (OEC); practices (OEC) = organisational practices (OEC); habit strength = habit strength for physical activity. [a] Unit is MET h per week.
* $p \leq .05$; ** $p \leq .01$.

Tests of hypotheses

By running 'model 4' of the PROCESS modelling tool, we tested hypotheses 1, 2, and 4 using simple mediation models calculated separately for values and expectations (OEC), organisational practises (OEC), and communication (OEC). Model testing included two sets of regression analyses in each case: First, habit strength for physical activity (mediator) was regressed on the respective OEC facet (independent variable) while controlling for the intention to be physically active (control variable) (I). Second, total physical activity (dependent variable) was regressed on a respective OEC dimension (independent variable), habit strength for physical activity (mediator), and the intention to be physically active (control variable) (II). Based on the resulting regression weights, the indirect effects were calculated as the product of the regression coefficient for the OEC facet from regression analysis (I) and the regression coefficient for habit strength from regression analysis (II). Table 3 shows the standardised coefficients for the simple effects on habit strength and total physical activity; indirect effects and corresponding 95% bias-corrected confidence intervals are displayed in Table 5.

Regarding hypothesis 1, which proposes a positive relationship between OEC and total physical activity, none of the OEC dimensions were found to be significantly associated with total physical activity (see Table 3). Hypothesis 1 could therefore not be confirmed. Hypothesis 2 states that OEC is positively associated with habit strength for physical activity. Supporting hypothesis 2 partially, we observed a positive relation between communication (OEC) and habit strength ($\beta = .18$, $p = .05$). Despite this, neither values and expectations (OEC; $\beta = .12$, $p = .10$) nor organisational practises (OEC: $\beta = -.01$, $p = .91$) were associated with habitual physical activity.

In hypothesis 3, elevated levels of habit strength for physical activity were assumed to predict high levels of total physical activity. For analysis, we estimated a linear regression model in which total physical activity was only regressed on habit strength for physical activity while controlling for the intention to be physically active. Habit strength for physical activity was significantly positively related to total physical activity ($\beta = .27$, $p \leq .01$), as expected. Hypothesis 3 could thus be confirmed.

Considering the proposed mediation effect (hypothesis 4), simple mediation analyses showed that the 95% bias-corrected confidence interval of a single indirect effect excludes zero, suggesting significance (see Table 5). Habit strength for physical activity mediated the relationship between communication (OEC) and total physical activity (*ind* = .05, 95%-CI [.003 to .110]). Thus, high levels of organisational communication in relation to physical activity were significantly related to high habit strength for physical activity (over and above the intention to be physically active), which in turn was uniquely related to high physical activity levels. Habit strength, on the other hand, did not mediate the association with total physical activity for either values and expectations (OEC; *ind* = .03, 95%-CI [-.012 to .092]) or organisational practises (OEC; *ind* = -.00, 95%-CI [-.052 to .044]). Overall, hypothesis 4 was partially supported.

To test the hypothesised boundary conditions, we estimated the moderated mediation model depicted in Figure 1 separately for values and expectations (OEC), organisational practises (OEC), and communication (OEC) using 'model 8' of the PROCESS modelling tool. Model testing comprised the analysis of three possible conditional effects attributable to self-control (moderator), including moderation of the direct effects of OEC facets on total physical activity, moderation of the effects of OEC on habit strength for physical activity, and moderation of the indirect effects of OEC dimensions on total physical activity via habit strength. Table 4 shows standardised coefficients for the conditional effects of OEC on habit strength for physical activity and total physical activity.

As a first boundary condition, we assumed that OEC is only positively associated with total physical activity for employees high in trait self-control, whereas there is no association for those low in trait self-control (hypothesis 5). Supporting our assumption, analysis revealed a significant moderating effect of self-control on the relation between organisational practices (OEC) and total physical activity (β = .13, $p \leq$ .05). It showed that organisational practices (OEC) were positively related to total physical activity for individuals reporting high levels of self-control and negatively related to total physical activity for those low in trait self-control (see Figure 2). Nonetheless, neither the coefficient of the interaction term between values and expectations (OEC) and total physical activity (β = .09, p = .22) nor the coefficient of the interaction term between communication (OEC) and total physical activity (β = -.04, p = .62) were statistically significant. Hypothesis 5 was only partially supported.

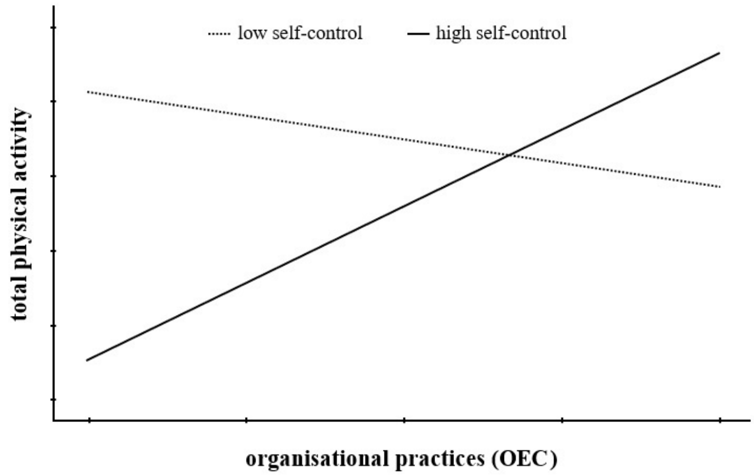

Figure 2. Interaction effect of organisational practices (OEC) and self-control on total physical activity.

We also proposed that OEC is positively related to habit strength in employees with high trait self-control, while it is unrelated to those low in trait self-control (hypothesis 6). Contrary to our expectations, none of the interaction terms between the OEC facets and self-control were found to be significant (see Table 4). Hypothesis 6 could not be confirmed. To test whether self-control capacity is a boundary condition for the proposed mediation (hypothesis 7), moderated indirect effects were examined using the *index of moderated mediation*, which represents the change in the indirect effect when self-control (moderator) changes by one unit [48]. As reported in Table 5, bootstrap confidence intervals for the indexes of moderation mediation of all three OEC dimensions included zero, meaning that the indirect effects of OEC on total physical activity through habit strength for physical activity was unaffected by low and high self-control conditions. Hypothesis 7 was not supported. Figure 3 summarises the standardised path coefficients for the moderated mediator model (controlled for the intention to be physically active).

Table 3. Standardised coefficients for the simple effects on habit strength for physical activity and total physical activity in a simple mediation model (*n* = 165).

	Values		Practises		Communication		Habit
	Habit	PA_{tot}	Habit	PA_{tot}	Habit	PA_{tot}	PA_{tot}
	ß	$ß_{(dir)}$	ß	$ß_{(dir)}$	ß	$ß_{(dir)}$	ß
intention	-.38**	.15	-.37**	.15	-.35**	.15	-.15
values (OEC)	-.12	-.05					
practices (OEC)			-.01	.09			
communication (OEC)					-.18*	.03	
habit strength		.28**		.27**		.27**	-.27**
R^2	0.152	0.132	0.138	0.138	0.169	0.130	0.129

Note: OEC = organisational exercise climate; values (OEC) = values and expectations (OEC); practices (OEC) = organisational practices (OEC); habit strength = habit strength for physical activity; PA_{tot} = total physical activity; $ß_{dir}$ = direct effect of OEC facet on total physical activity.
* $p \leq .05$; ** $p \leq .01$.

Table 4. Standardised coefficients for the conditional effects of OEC on habit strength for physical activity and total physical activity in a moderated mediation model *(n* = 165*)*.

	Values		Practises		Communication	
	Habit	PA_{tot}	Habit	PA_{tot}	Habit	PA_{tot}
	ß	$ß_{(dir)}$	ß	$ß_{(dir)}$	ß	$ß_{(dir)}$
intention	.30**	.15	.28**	.15	.27**	.16
values (OEC)	.11	-.05				
practices (OEC)			.02	.07		
communication (OEC)					.16*	.03
self-control	.25**	-.02	.28**	-.04	.25**	-.02
values (OEC) x self-control	-.07	.09				
practices (OEC) x self-control			-.08	.13*		
communication (OEC) x self-control					.03	-.04
habit strength		.30**		.30**		.28**
R^2	0.218	0.141	0.208	0.161	0.228	0.133

Note: OEC = organisational exercise climate; values (OEC) = values and expectations (OEC); practices (OEC) = organisational practices (OEC); habit strength = habit strength for physical activity; PA_{tot} = total physical activity; $ß_{dir}$ = direct effect of OEC facet on total physical activity.
* $p \leq .05$; ** $p \leq .01$.

Table 5. Standardised coefficients for simple and conditional indirect effects of OEC dimensions on total physical activity and limits of 95% confidence intervals (*n* = 165).

	Simple Effects			Conditional Effects								
				Low Self-Control			High Self-Control			Index of moderation		
		95%-CI			95%-CI			95%-CI			95%-CI	
	Ind	*LL*	*UL*	*Ind*	*LL*	*UL*	*Ind*	*LL*	*UL*	*Index*	*LL*	*UL*
values (OEC)	.03	-.012	.092	.05	-.010	.139	.01	-.061	.073	-.02	-.080	.022
practices (OEC)	-.00	-.052	.044	.03	-.041	.056	-.02	-.064	.028	-.02	-.064	.013
communication (OEC)	**.05**	**.003**	**.110**	.03	-.032	.098	.05	-.013	.134	.01	-.033	.061

Note: Conditional effects of OEC facets were estimated at self-control values, which correspond to a standard deviation below the mean (-1*SD*; low self-control) and a standard deviation of the mean (+1*SD*; high self-control). OEC = organisational exercise climate; values (OEC) = values and expectations (OEC); practices (OEC) = organisational practices (OEC); *ind* = indirect effect; 95%-CI = 95% confidence intervals; *LL* = lower limit; *UL* = upper limit; 95%-confidence interval are based on BC-bootstraps with 10.000 resamples. Statistically significant effects are marked in bold.

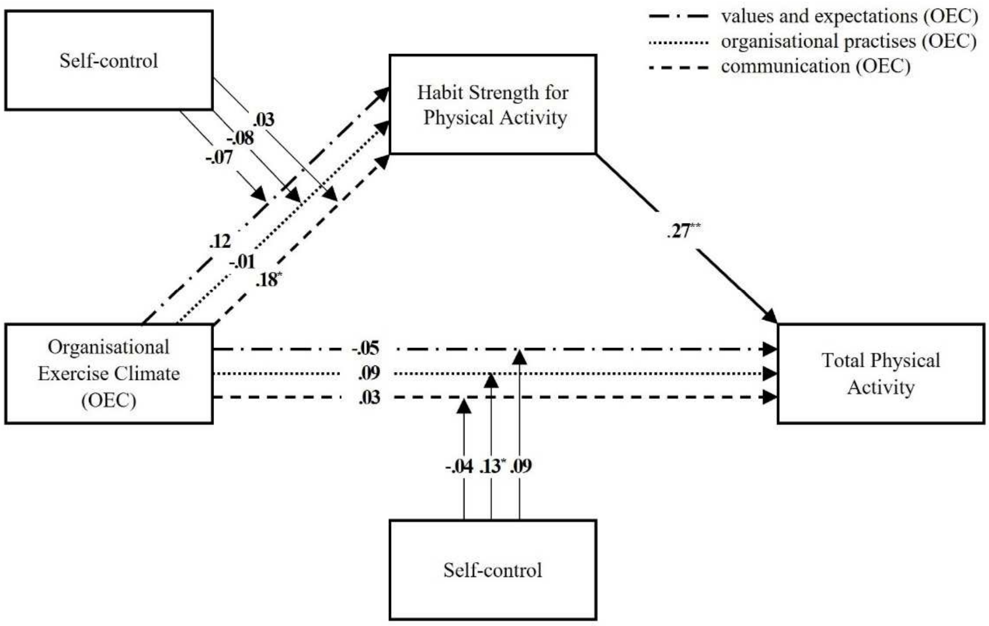

Figure 3. Standardized path coefficients for the moderated mediator model (controlled for the intention to be physically active).
Note: * $p \leq .05$; ** $p \leq .01$.

DISCUSSION

Although it has already been suggested 30 years ago that worksite health climate affects employees' health and health behaviour, very few studies have examined organisational climate in relation to physical activity promotion. With our study, we aimed to contribute to occupational health research by exploring the associations between organisational exercise climate (OEC), habit strength for physical activity, dispositional self-control capacity, and total physical activity in a sample of employees with diagnosed metabolic syndrome. Using a regression-based approach, three leading research questions were addressed: Does OEC relate positively to physical activity behaviour, including both total physical activity and habit strength for physical activity? Is the association between OEC and total physical activity mediated by habit strength? Does an individual's capacity for self-control moderate the abovementioned relations?

We found that OEC dimensions, including values and expectations, organisational practises, and communication surrounding physical activity, are not significantly related to physical activity levels. The present study thus contradicts the health-promoting effect demonstrated in previous research [49–51], according to which work site health climate is supportive of physical activity behaviour (e.g., exercise and participation in employee wellness programmes). However, a study of nearly 7,000 employees in 40 workplaces conducted by Basen-Engquist and colleagues also reported that perceptions of the health climate did not correlate significantly with employees' health behaviours [52]. Similarly, work health climate was not associated with physical activity in a survey study with correctional supervisors [53]. Considering the inconsistent empirical findings, we suggest that OEC, as an expression of social norms, might be primarily related to the motivational processes underlying physical activity, such as intention formation ("I intend to exercise regularly"), than to physical activity itself. This assumption is supported by a meta-analysis [54] based on the *theory of planned behaviour* [55], which successfully confirmed that physical activity norms do not directly determine physical activity, but rather intentions ("I intend to exercise regularly"), which in turn predict physical activity.

Communication (OEC) was significantly associated with habit strength for physical activity, meaning that employees who reported that their organisation openly addresses topics related to physical activity showed correspondingly high levels of physical activity habituation. The result found is in line with empirical evidence [16,19]. Notably, our result seems to underline theoretical reasoning [24] and research [21,22] depicting habits as a form of behavioural scripts formed by social norms and policies. We conclude that a work environment in which physical activity is a recurring topic of conversation may signal to employees that an active lifestyle is a high priority in their organisation and that physically active members are particularly valued. This may shape a kind of behavioural guideline that is gradually integrated into employees' habits. Notwithstanding, as jobs are ultimately chosen, reverse causality should also be considered. When looking for employment, job seekers usually accept those offers that they find most attractive based on their expectations of the future work environment or personal values [56]. It is therefore likely that active individuals are increasingly employed in work settings with high OEC levels. Conversely, values and expectations (OEC) or organisational practises (OEC) were not significantly related to habit strength for physical activity. We propose that the lack of significant associations is due to their lesser signalling effects, as both dimensions reflect the underlying social norm ("an active lifestyle") of a well-developed OEC less visibly and emphasise the importance of physical exercise more discreetly than communication (OEC). Consistent with recent research [57,58], higher habit strength was associated with an increased level of physical activity, over and above antecedents such as intentions and social norms, suggesting that habits might play a key role in physical activity promotion. However, the question of causality remains unclear, although a few longitudinal investigations indicate that habits have a direct impact on physical activity [59].

When simple mediation was tested, habit strength was shown to mediate the relationship between communication (OEC) and total physical activity. Employees who reported that there is a high level of communication about physical activity in their organisation also reported higher levels of habit strength, which in turn was associated with increased physical activity. Nonetheless, as habits were not a mediating mechanism for the relationship between values and expectations (OEC) or organisational practises (OEC) and total physical activity we propose to consider additional mediating factors, such as the intention to be physically active, health literacy, or awareness for health-promoting behaviour ("protection motivation").

Using moderated mediation analyses, we found dispositional self-control capacity to be a boundary condition for the relation between organisational practises (OEC) and total physical activity. Accordingly, employees' perceptions of activity-promoting infrastructures and offers were positively related to total physical activity for those with a high ability for self-control, but negatively related for those with low self-control. Given the non-significant interactions between self-control and values and expectations (OEC) or communication (OEC) on total physical activity, results are suggestive of two practical conclusions: Providing sports and physical activity opportunities for highly self-regulated employees (e.g., discounted gym membership, exercise breaks, or running groups in the company), on the one hand, seems to be a promising approach for promoting physical activity, since it presumably decreases inhibition threshold and lowers the barrier to physical activity. Organisational practises (OEC) are thus likely to facilitate physical activity to a greater extent – opposed to communication (OEC) or values and expectations (OEC). This conclusion is further supported by research on strategies for worksite health promotion, which demonstrates that creating an organisational environment that encourages employees to engage in physical activity has a positive impact on physical activity levels [60–62]. On the other hand, organisational practises (OEC) seem to be activity-enhancing only when employees are capable of self-control. This observation suggests that self-control bridges the gap between activity-related intentions attributed to organisational practises (OEC) and physical activity behaviour. Accordingly, previous studies indicated that higher trait self-control predicts both a higher adherence to social norms [32,33] and a smaller intention-behaviour gap [63,64].

Contrary to our expectations, the prediction of habit strength by OEC dimensions was independent of individuals' capacity to self-control, as was the proposed mediation. These findings may imply that employees' self-control capacity is not particularly helpful in forming healthy habits and understanding the links between OEC, total physical activity, and habit strength. However, it has already been shown in a cross-sectional analysis that high self-control increases the likelihood that individual health behaviour will match perceived peer health behaviour norms [65]. The mixed results suggest that the relationship between OEC and habit strength, and thus the respective mediation, is influenced by other factors. In particular, we propose that individual differences in the need for social acceptance and its interaction with self-regulation capacities determine the extent to which employees adhere to social norms expressed through OEC.

Limitations and future research

The results of our study must be seen in light of some limitations and have implications for future research. First, the primary limitation is the cross-sectional design underlying our study, which does not allow for causal conclusions. Longitudinal or quasi-experimental research is thus clearly needed. Second, all data relied on self-report measures, so common-method bias and socially desirable responses cannot be excluded [66]. Future research should therefore obtain data from a variety of sources, such as technical measures (e.g., fitness trackers) and third-party assessments (e.g., from co-workers and supervisors). Third, the homogeneous sample used in the study might be problematic. Volunteers were mostly male Volkswagen AG employees suffering from metabolic syndrome. We acknowledge that the findings of our study may not apply to the total population of employees or to other industries. Future studies should collect information from a wide range of business areas, economic sectors, and company types. Finally, the problem of measuring reactivity must be considered, whereupon study participation may already have been interventive and lead to changes in perceptions or behaviour [67]. Respondents may also have been exceedingly (in)active during data collection. It would therefore be desirable in future studies to control the representativeness of physical activity, e.g., "Have you been doing more or less physical activity or sport than usual in the last seven days?".

CONCLUSION

Our findings indicated two ways in which OEC may relate to employees' physical activity. First, we showed that organisational communication surrounding physical activity and exercise is indirectly related to total physical activity via habit strength for physical activity. Second, our results showed that employees' perceptions of organisational practises supporting physical activity were directly related to a higher level of physical activity, given that employees had a high self-control ability. In terms of practical implications, attempts to create steadily supportive work environments through favourable organisational exercise climates might be a useful approach to improve health behaviours like regular physical activity.

The results, opinions and conclusions expressed in this thesis are not necessarily those of Volkswagen Aktiengesellschaft.

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