

The Fitness Status of German Managers and Executive Employers: A Study of Self-Perception and Reality

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The adoption of a health-oriented lifestyle by executive managers is an important factor influencing the success of an entire company. To the best of our knowledge, no study has investigated self-reported health and fitness statuses among managers and compared them with objectively measured parameters based on standardized exercise tests. Thus, the purpose of this study was to evaluate the congruence of the self-perceived and objectively measured health statuses of managers. Data for the retrospective cross-sectional study of 54 managers (51 males, 3 females, age: 46.1 ± 7.0 years, BMI 26.0 ± 3.2 kg/m²) were collected through medical health check-ups. Besides the measurement of medical data, the managers estimated their own fitness and health in a questionnaire. The differences and associations between self-reported and objective measures (endurance and strength performance as measured through a to-exhaustion ergometer test and VO₂max) were analyzed. Subsequently, the cohort was divided into four groups: realistic inactives, realistic actives, underestimators and overestimators. Significant associations were found between VO₂max and self-rated endurance capacity ($r = 0.41$) and between performance, reached in the to-exhaustion ergometer test, and self-estimated strength ($r = 0.29$). The majority of subjects rated their endurance capacity (69%) and strength (65%) realistically with a tendency towards underestimation. The present study revealed that most managers had a satisfying health status and were able to rate their own physical endurance and strength performance correctly, with a tendency towards underestimation. These findings are important for prevention and health promotion programs for managers.

Keywords: *Fitness status, managers, self-rating, performance test, health.*

Introduction

Physical fitness confers both a prevention and protection effect against cardiovascular disease. The assessment of physical fitness can be a complicated procedure and it is not always standardized. Given this, it is important to consider socioeconomic and educational factors when determining whether self-perception is associated with objectively measured health and fitness parameters. Holtermann et al. (2015) showed in the Copenhagen City Heart study that higher self-rated cardiovascular fitness correlated significantly with lower mortality. Thus, this

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self-assessment is an important, independent prognostic parameter that could increase risk stratification in primary prevention.

Relating this issue to executives, the success of a company is often related to the adoption of a health-oriented lifestyle by managers. It is well known that, in particular, managers tend to overestimate their own abilities and skills (for example, in areas such as leadership competency), as well as supporting a realistic self-image of safe and healthy leadership of employees. As such, if managers could estimate their own health and fitness correctly, it would have several advantages and positive effects for themselves, their employees, and the company. A health-conscious manager might have better leadership characteristics, focus more on employee well-being and be more willing to invest in professional worksite health promotion programs (Hayward et al. 2004). Based on this background, this study investigates the congruency of self-ratings and objective health values in the cohort of managers.

Literature Review

Health Orientation in Managers

It is well established that the valuation and promotion of health-related aspects in modern companies are essential for employers' and employees' performance and well-being (Jung et al. 2012, Schulte et al. 2015). Thus, the success of the company is, amongst other things, dependent on the adoption of a health-oriented lifestyle by executive managers. They act not only as a supervisor, but also as a motivator and idol. In particular, it is the group of managers that tends to work under consistent time pressure and permanent availability (Dunning et al. 2004, Plante and Bouchard 1996). For executive managers in this capacity, a high level of self-esteem is essential for success in their careers, but may also potentially result in overestimations of their own abilities and behavior (Dunning et al. 2004, Malmendier and Tate 2003). To rate one's own skills and abilities accurately is difficult, and misperceptions might have serious consequences, especially for chief executive officers (CEOs). However, no analysis has been carried out thus far on whether managers can appropriately perceive their own health and fitness realistically.

Overrating as a Common Phenomenon

There is a general tendency towards an overestimation of one's own capabilities in the general population (Dunning et al. 2004, Fischhoff et al. 1977). Previous studies have reported that inaccurate self-assessments not only take place in laboratory experiments, but also in real-world settings, such as private life and work. This may concern one's own skills (e.g. leadership, job performance), future behaviors (e.g. quit smoking, exercise more), business development (e.g. reaching desirable outcomes, economic growth) or medical issues (e.g. health status, personal fitness) (Dunning et al. 2004). The potential

reasons for this overestimation are varied and include: a desire to give positive impressions and avoid negative images of themselves (Baumeister and Newman 1994, Dunning 2001), the so-called above-average effect (Odean 1998, Friedrich 1996), the overconfidence effect (Dunning and Story 1991, Fischhoff et al. 1977), or perceptions of uniqueness, consensus or psychological mechanisms being used as means to hide a lack of expertise or incompetence (Dunning et al. 2004).

Overconfidence or overestimation of abilities has the greatest impact on tasks that are difficult, forecasts where the outcome has a low predictability, and undertakings that lack fast and clear feedback (Barber and Odean 2000). Such effects are also relevant to health issues, though they have been studied in a different manner. For example, comparable results for overrating on complex health-related topics exist regarding the documentation of fruit or vegetable consumption (Lechner et al. 2006, Lechner, Brug and De Vries 1997).

Self-ratings as a Tool in Research

Past research on the self-evaluations of one's cardiovascular and muscular fitness has shown positive agreements with practical, physiological testing methods (Borodulin et al. 2006, Keith et al. 2014, Ortega et al. 2013, Holtermann et al. 2015, Ronda et al. 2001, Mabe and West 1982, Martinez-Gomez et al. 2012, Aadahl et al. 2007, Mikkelsen et al. 2005). Monroe et al. (2010) reported statistically significant associations between self-reported and measured cardiorespiratory fitness, muscular fitness and flexibility, using the Physical Self-Description Questionnaire (Marsh 1996). Similarly, Holtermann et al. (2015) evaluated data from more than 8000 participants concerning mortality, longevity and self-reported cardiorespiratory fitness as related to instances of cardiovascular disease as part of the Copenhagen City Heart Study. Their results showed that self-rated fitness and health status were significantly correlated with the study's objectively measured values. Thus, self-reported cardiorespiratory fitness as an independent prognostic parameter is related to a considerable survival benefit and might be helpful for improving risk stratification in primary prevention. However, in this same study by Holtermann et al. (2015), the questionnaire regarding cardiorespiratory fitness was not validated against an objective measurement using exercise testing.

Aadahl (2007) compared the $VO_2\max$ of 102 Danish adults with their self-assessed physical activity levels and found that the amount of daily intense activity (>6 MET) was strongly correlated with $VO_2\max$ ($P = < 0.01$, $R^2 = 0.76$), whereas the total volume of daily physical activity showed a slight, but not statistically significant, connection with $VO_2\max$ ($p = 0.10$, $R^2 = 0.69$). Based on these measures, they stated that subjects were capable of estimating their own fitness quite precisely.

Purpose of the Study and Research Questions

To the best of our knowledge, there has not been a previous study investigating self-reported health and fitness statuses among managers and

comparing them with objectively measured parameters based on standardized exercise tests. Self-ratings concerning health and fitness parameters measured via questionnaires may give supplemental, valuable information in addition to objective measurements via exercise tests. New findings, together with those from previous studies, examine the usefulness and potential of self-estimations as tools in occupational and public health contexts. Therefore, it is the purpose of the study to compare measured and self-estimated health statuses of managers. In accordance with previous studies, it is hypothesized that managers tend to overrate their own health and fitness capacities.

To achieve the purpose of this study, the authors examined the following research questions:

- (1) How do executive managers rate their own fitness and health in comparison with objectively measured health data?
- (2) Is there an association between self-rated endurance and $VO_2\text{max}$, as well as between self-rated strength and performance in a to-exhaustion ergometer test?

Methodology

Subjects

Fifty-four managers (51 males, 3 female, age: 46.1 ± 7.0 years, BMI 26.0 ± 3.2 kg/m²) from the first or second hierarchy within a senior working level were recruited from major national and international enterprises with 850 to 330,000 employees. They underwent health check-ups at the German Sport University in Cologne, Germany. In the context of this medical screening process, all subjects were thoroughly examined prior to exercise performance tests.

Study Design

Medical data for the study were collected between 2012 and 2016 by researchers of the Institute of Cardiology and Sports Medicine at the German Sport University in Cologne. For the purposes of this paper, these were analyzed retrospectively. In addition to the assessment of medical data (anthropometric values, fitness exhaustion test, sports medical examinations), subjects completed a questionnaire concerning their health, fitness and involvement in leisure time physical activities and recreational and/or competitive sports.

Ethics

The local ethics committee of the German Sport University in Cologne, Germany (Number: 099-2016, DRKS registration number: DRKS00010986) has approved the present study, which was conducted in compliance with the Declaration of Helsinki 1964. All subjects provided informed written consent prior to participation in the study and agreed to anonymous use of their data.

The participation was voluntary, and withdrawal was possible at any time without any disadvantages for the subject.

Instruments Measuring Physical Activity

Physical Work Capacity (PWC), as shown by the performance levels reached during the bicycle ergometer test, was measured in Watts (W) and assessed by an incremental, stepwise increase in the workload until exhaustion (Ergometrics 900, Ergoline GmbH, Bitz, Germany). The fitness test used in this study has been shown to be valid and reliable (Vassiliadis 1999). The workload started with 30W and was increased every 3 min by 40W without pauses. The reference values used were based on healthy untrained participants and were 3.0 W/kg for men 20–30 years of age, with a decrease of 10% for every subsequent decade, and 2.5 W/kg for women 20–30 years of age, with a decrease of 8% for every subsequent decade (Tanaka et al. 2001).

Endurance and performance in this study were measured by absolute VO_2max (ml/min) and relative VO_2max (ml/min/kg), respectively. The software AMEDTEC ECGpro® v.3.66 (AMEDTEC Medizintechnik Aue GmbH, Aue, Germany) was used to analyze this data. VO_2max was analyzed via spirometry with simultaneous measurement of breath-to-breath oxygen intake in 15-second periods (ZANTM® Messgeräte GmbH Deutschland, Oberthulba, Germany). These measures were evaluated via the software Cardio-Pulmonale Funktions-Diagnostik Software (nSpire Health GmbH, Oberthulba, Germany). Reference values concerning personal endurance and performance determined via relative VO_2max have been published elsewhere (Fletcher et al. 1995).

Measurements of Self-Reports

Subjects gave information about their leisure time physical activities in a medical anamnesis history and subjectively estimated their general health and fitness status on a Likert scale using a standardized questionnaire. Validation of a questionnaire as a tool revealed a reliability of 0.7 (Cronbachs Alpha) (Jedlicka et al. n.d.), a mean item discriminatory power of 0.3 (range 0.1–0.8) and an item difficulty of 73.3 (range 49.8–79.4). The question used in this study was as follows: “How do you estimate your current health status and, in particular, your endurance and strength performance on a scale from 1 (very bad) to 10 (excellent)?”

Statistical Analyses

Statistical analyses were performed with SPSS Statistics 24 (IBM, Armonk, USA). All data are described in terms of mean, standard deviation of the mean, MIN for minimum values, MAX for maximum values, numbers and percentages.

Differences between self-reported (endurance, strength) measures and objective data (VO_2max , ergometer performance) were tested via the Mann-

Whitney-U-Test, and associations were identified via the Spearman correlation coefficient.

Based on the results of the objectively measured VO_2max and ergometer performance, subjects were assigned into two groups: “fit” and “unfit.” These were determined based on whether subjects reached gender and age specific reference values for relative VO_2max (ml/min/kg) (Fletcher et al. 1995) or relative performance (W/kg) (Tanaka et al. 2001) during the exhaustion test. The self-ratings via questionnaire also divided subjects into two groups. Answers were possible from 1 (very bad) to 10 (excellent) concerning one’s own endurance and strength. “Fit” refers to ratings from 6–10, while “unfit” refers to ratings from 1–5. By doing this, subjects were grouped into a 2×2 table based upon the agreement between their self-rated and objective physical activity measures. This resulted in four awareness groups: realistic inactives, realistic actives, overestimators and underestimators (Table 2, Table 3). The difference between overestimators and underestimators was calculated via McNemar's Chi-square (Binomial Test) test. A value of $p < 0.05$ was considered significant (Bortz 2005).

Findings and Results

In total, 54 subjects participated in the study. The participants’ medical data are presented in Table 1. Forty-eight managers stated that they are active in sports (89%), with most of them reporting between one and six hours of activity per week ($M = 5.5$, $SD = 3.5$). These activities mainly included endurance sports and strength training.

Table 1. *Medical Data of Subjects*

Variables	M	SD
Age [years]	46.1	7.0
Body height [cm]	181.3	6.1
Body weight [kg]	85.2	13.9
BMI [kg/m^2]	26.0	3.2
Waist circumference[cm]	92.4	11.9
Absolute ergometer performance [W]	224.7	39.9
Relative ergometer performance [W/kg]	2.7	0.5
PWC ₁₃₀ [Watt/kg]	1.7	0.6
PWC ₁₅₀ [Watt/kg]	2.1	0.7
Absolute VO_2max [ml/min]	3.1	0.6
Relative VO_2max [ml/min/kg]	35.9	6.5
Self-rated health status [points]	7.9	1.5
Self-rated endurance [points]	5.8	2.0
Self-rated quality of life [points]	8.4	1.2
Self-rated strength [points]	6	2
Sports activity [hours per week]	5.5	3.5

Concerning performance diagnostics, the mean absolute performance reached in the to-exhaustion ergometer test was 224.7 W ($SD = 39.9$), whereas the mean relative ergometer performance was 2.7 W/kg ($SD = 0.5$), PWC₁₃₀ 1.7 W/kg

(SD = 0.6) and PWC₁₅₀ was 2.1 W/kg (SD = 0.7). It was found that 78% of the subjects reached at least their age and gender specific reference values concerning their individual performance. The mean absolute VO₂max was 3.1 ml/min (SD = 0.6) and relative VO₂max was 35.9 ml/min/kg (SD = 6.5). Eleven subjects (20%) did not reach their age and gender specific reference values for relative VO₂max (Table 1).

The means of the subjects' self-ratings were 5.8 (SD = 2.0) regarding endurance performance and 6.0 (SD = 2.0) regarding strength. The descriptive results of parameters used for the correlation analysis are described in Table 1. There were eight subjects who did not want to complete the questions for personal reasons.

In regard to self-assessed endurance, the differences between groups (objectively "fit" versus "unfit" for relative VO₂max) were tested. Data revealed a statistically significant difference between objectively "fit" (6.3 ± 1.8) and "unfit" (4.5 ± 2.4) participants ($p = 0.02$). Data concerning relative ergometer performance were also significantly different between objectively "fit" $6.3 (\pm 2.1)$ and "unfit" $5.1 (\pm 1.4)$ (W /kg) ($p = 0.049$).

Spearman rank correlation reflected significant associations ($p < 0.05$) between objectively measured and self-rated parameters of health and fitness. Correlations with significance at a level of 0.01 (both sides) were self-rated endurance (points) and relative VO₂max (ml/min/kg) with $r=0.4$ and self-rated endurance (points) and relative ergometer performance (W) with $r=0.5$. Correlations with significance at a level of 0.05 (both sides) were self-rated endurance (points) and absolute ergometer performance (W) with $r=0.3$, self-rated strength (points) and absolute ergometer performance (W) with $r=0.4$, and self-rated strength (points) and relative ergometer performance (W) with $r=0.3$. There were no significances for the absolute VO₂max.

Table 2 shows the classification of subjects into four awareness groups for endurance and VO₂max. It was found that 69% of the subjects rated correctly whether or not they reached gender and age specific reference values for endurance based on relative VO₂max (51% realistic assessment of being "fit", 18% realistic assessment of being "unfit"). Furthermore, eleven participants (24%) who also reached the age and gender specific reference values classified themselves as "unfit" (underestimators). There were three participants (7%) who overestimated their objective endurance performance by missing their age and gender specific reference values. The difference concerning their endurance capacity between overestimators and underestimators was not significant ($p = 0.06$).

Table 2. Classification of Participants into Awareness Groups for Endurance and VO₂max (n = 45)

Self-rated endurance [points]	Fit (6–10 points) (1) 26 (58 %)	Objective endurance performance [rel. VO ₂ max]	
		Fit (1)	Unfit (2)
		Unfit (1–5 points) (2) 19 (42 %)	Realistic endurance fit 23 (51 %)
		Underestimators 11 (24 %)	Realistic endurance unfit 8 (18 %)

Values are numbers (percentages).

Table 3 shows the classification of subjects into four awareness groups for strength and ergometer performance. Data revealed that 65% of the subjects correctly rated whether or not they reached gender and age specific reference values for relative ergometer performance (50% realistic assessment of being “fit”, 15% realistic assessment of being “unfit”). Furthermore, twelve participants (26%) who reached the age and gender specific reference values classified themselves as “unfit” (underestimators), and four participants (9%) overestimated their objective ergometer performance strength by missing their age and gender specific reference values (overestimators). The difference concerning their strength capacity between overestimators and underestimators was not significant ($p = 0.08$).

Table 3. Classification of Participants into Awareness Groups for Self-Rated Strength and Ergometer Performance (n = 46)

Self-rated strength [points]	Fit (6–10 points) (1) 27 (59%)	Objective ergometer performance [Watt / kg]	
		Fit (1)	Unfit (2)
		Unfit (1–5 points) (2) 19 (41%)	Realistic ergometer performance fit 23 (50%)
		Underestimator 12 (26%)	Realistic ergometer performance unfit 7 (15%)

Values are numbers (percentages).

Discussion

Parameters related to performance diagnostics such as the Physical Work Capacity (ergometer performance in Watt) or maximal oxygen consumption (VO₂max in ml/min) have not been evaluated previously in this cohort. Thus predictions for this project were made based on other previous research. Particularly, in accordance with previous psychologically-oriented studies in this field of research, it was hypothesized that managers would overrate their fitness and health status in self-reports compared to objectively determinable

values. Against the initial hypothesis, however, the data showed that the majority of managers in this study made realistic estimates concerning their fitness and health, with a tendency even towards underestimation.

Overall, this study revealed that the majority of managers had a satisfying health status as shown by reaching their age and gender specific reference values for endurance and strength measures (75% relative VO_2max , 76% relative ergometer performance). In this study, the majority of managers estimated their endurance and strength performance realistically, having only a small percentage of overestimators (7% for self-rated endurance performance, 9% for self-rated strength). Furthermore, correlations showed positive associations between relative VO_2max and self-rated endurance performance ($r_{\text{SP}}(44) = 0.41, p < 0.01$), as well as for the relative ergometer performance and self-rated strength performance ($r_{\text{SP}}(46) = 0.29, p < 0.05$).

In the literature, between 40% and 65% of the individuals in the general population overestimated the amount of their physical activity (Ronda et al. 2001, Lechner et al. 2006, van Sluijs et al. 2007, Watkinson et al. 2010), indicating that physical activity misperception is a common phenomenon. Again, only questionnaires and no objective assessments had been used in this past research. Schaller et al. (2016), Rudolf et al. (2016) and Prince et al. (2008) found similar results.

Similar analyses showcasing tendencies towards overestimations were also made by Godino et al. (2014) who analyzed data of 453 middle-aged men from a population-based, observational study. In that study, the self-rated physical activity was measured dichotomously by asking participants if they believed they were achieving the age and gender specific recommended level of physical activity, while answers were compared to objective physical activity afterwards. It was found that 29% overestimated their objective physical activity level, reflecting a stronger tendency towards overrating.

On the other hand, Ortega et al. (2013) compared self-perceived versus measured fitness to predict cardiovascular disease (CVD) risk and validated the International Fitness Scale (IFIS). The questionnaire revealed not only a good correlation between self-perceived and objectively measured fitness (field-based fitness tests and 20m shuttle-run test), but also a strong association between a high self-perceived fitness level with a good cardiovascular prognosis. The correlations for muscular fitness (reported via questionnaire and objectively measured via handgrip test and standing long jump) were similar, although lower. The differing results obtained in this study, demonstrating rather realistic self-perceptions, might be due to the following factors:

The managers examined here were on average 46 years old and therefore belong to a generation which may have a higher tendency towards self-reflection and criticism, in contrast to older managers (Franken 2016, Kuhlmann and Horn 2016, Kienbaum Management Development 2017). It can be speculated that these managers had been in their leadership positions only for a relatively short period. In addition, measures of occupational health management, which are aimed at enhancing individual health competences, could also be responsible for the results of this study. Different organizational structures of the enterprises

the managers work for might be a further explanation of the results of this study. It is possible that subjects of this study have already participated in specific courses offered within the company to promote their health literacy. Results from training programs or courses, e.g. leadership characteristics, perceptions or self-images, might be transferred to various other aspects of their lives, such as health.

In our study, realistic managers and underestimators performed the highest number of weekly hours of leisure time activities and vice versa for the overestimators. The observation that physically active participants or managers with an athletic background showed greater ability to perceive their health status than inactive participants is in line with previous scientific reports (Condello et al. 2016, van Weering et al. 2011). Furthermore, participants' socio-economic backgrounds may have influenced their ability to produce a realistic self-perception (Jung et al. 2012). The managers observed in this study had rather higher socio-economic statuses, thus contributing to this capacity for accurate self-assessment.

Strengths and Limitations of the Study

Strengths

The exercise tests used in this study took place between 8–11 a.m. in the morning and were carried out according to highly sophisticated and standardized techniques, guaranteeing valid results. The subjects were not influenced in their response behavior or performance in the exhaustion test. Data accuracy and reliability were enhanced by experienced, trained, medical staff in the center. This is the first study to compare self-estimated assessments with objectively measured health parameters in managers from the first or second hierarchy at a senior working level.

Limitations

It is unclear whether the managers investigated in this study are representative of the total population. Furthermore, the number of female executives was quite small, though this does reflect the real situation in high-ranked management positions. A further limitation of the study is the cross-sectional design of the study, as it cannot give information about possible cause-effect relationships. It remains unclear whether the motor component force, which is assumed here, is represented in sufficient form by our tests.

Conclusions

In summary, the obtained data in this study demonstrate that the majority of managers had a satisfactory objective health status, along with the ability to realistically assess their own health and fitness statuses. Thus, self-ratings concerning health and fitness parameters measured via questionnaires may give

supplemental, valuable information in addition to objective measurements via exercise tests. These findings, together with those from previous studies, underline the usefulness and the potential of self-estimations as a tool in occupational and public health contexts. For future research, it would be interesting to examine employees of smaller companies, as well as executives of middle management positions, since they are also prone to be physically and mentally stressed. Furthermore, female managers must be evaluated more in the future. A further strengthening of the health competency of managers and other employees is reasonable.

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