



**Quantitative Research
Methodology Report
Deliverable 3.1 (D3)**



UNIVERSIDAD
DE MURCIA



Co-funded by
the European Union



Co-funded by
the European Union

WMP - 101134048

First Edition, 2025

© 2025, Universidad de Murcia

Authors: Salvador Angosto & Guillermo Felipe López-Sánchez

Edition: Idi4Sport

Printing: Online handbook

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Co-funded by
the European Union

Disclaimer: Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

**Physical activity
and sport in the
working environment.**



workmoveandperf.com



Summary

1. INTRODUCTION	4
2. THEORETICAL BACKGROUND	6
2.1. Physical activity	6
2.2. Happiness	7
2.2.1. Engagement	8
2.2.2. Work satisfaction	9
2.2.3. Affective commitment	10
2.3. Wellbeing	11
2.4. Productivity	13
2.4.1. Absenteeism	14
2.4.2. Presenteeism	15
2. OBJECTIVES	17
3. METHODS	18
3.1. Sample	18
3.2. Instruments	18
3.3. Procedure	19
3.4. Statistical analyses	20
4. RESULTS	22
4.1. Descriptive analysis	22
4.1.1. Sociodemographic data	22
4.1.2. Physical activity	25
4.1.3. Happiness and wellbeing	29
4.1.4. Job information	30
4.2. Comparative analysis	32
4.2.1. Gender	32
4.2.2. Age	35
4.2.3. European region	42
4.2.4. Educational level	44
4.2.5. Civil status	46
4.2.6. Having children	48
4.2.7. Physical activity level	50
4.3. Regression analysis	53
5. CONCLUSIONS	54
6. IMPLICATIONS	57
REFERENCES	58

1. INTRODUCTION

Physical activity (PA) has been recognized by the World Health Organization (WHO) as a fundamental pillar for health promotion and the prevention of non-communicable chronic diseases. In recent decades, sedentary behavior has emerged as a critical risk factor, with its prevalence increasing significantly due to the automation of labor, the digitalization of production processes, and the growing trend of remote work (Kabore et al., 2024; Kechagias et al., 2024; Noviello et al., 2025). This pattern of prolonged sedentary behavior has been linked not only to physical health deterioration but also to impairments in mental health, motivation, and performance in work environments (Hallam et al., 2023).

Recent evidence indicates that a significant portion of the population fails to meet the minimum recommended levels of PA. In the European context, it is estimated that between 42% and 55% of adults do not comply with the guidelines established by health authorities (Baup et al., 2022). Furthermore, within the workplace, some employees may spend up to 10 hours per day in sedentary positions, posing a direct threat to musculoskeletal, cardiovascular, and cognitive health (Judice et al., 2023). Sedentary behavior is associated with depressive symptoms, chronic stress, and decreased productivity, especially in the absence of structured PA programs in the workplace (Dabkowski et al., 2023; Hervieux et al., 2023).

In this regard, the workplace represents a privileged setting for the implementation of strategies aimed at increasing PA levels. Employees spend approximately one-third of their daily time at work, allowing well-designed interventions to achieve a broad and sustained impact (Grimani et al., 2019; Jiménez Díaz-Benito et al., 2022; Nathan et al., 2020; Noviello et al., 2025). Workplace-based exercise programs have proven effective in improving physiological markers such as blood pressure and body mass index, as well as in reducing symptoms of anxiety, fatigue, and presenteeism (Casimiro-Andújar et al., 2022; Petrovcic et al., 2022).

From an economic perspective, several studies have documented the positive impact of PA on work productivity. The implementation of structured programs can reduce costs associated with absenteeism, increase talent retention, and enhance the organizational climate (Braun et al., 2022; Ojo et al., 2024). These improvements are mediated not only by physical health, but also by psychosocial variables such as perceived well-being, job satisfaction, and affective commitment to the organization (Bergefurt et al., 2024; Hasni & Bedhioufi, 2025; Imen et al., 2023; Inoue et al., 2022; Ryde et al., 2020; Shiri et al., 2023; Szabó & Kajos, 2024; Wallman-Sperlich et al., 2019).

More recent studies have explored the underlying psychological mechanisms involved. For example, Hussain et al. (2025) found that PA programs that progressively challenge employees' capabilities foster increased self-efficacy, engagement, and emotional resilience, particularly in high-demand work settings. Similarly, Kitano et al. (2025) demonstrated that incorporating short active breaks during the workday has positive effects on sustained attention, processing speed, and cognitive performance.

Complementarily, some studies integrating organizational and cultural perspectives suggest that developing a "health culture" within companies, based on shared values, active infrastructure, and committed leadership, is associated with higher levels of participation in PA and more positive perceptions of the work environment (Ammendolia et al., 2016; Engelen, 2020; Magnaita, 2017; Marenus et al., 2025; Tarro et al., 2020; Valentine et al., 2020; Welch et al., 2020). Therefore, the promotion of PA in the workplace constitutes not only a health prevention strategy but also a catalyst for well-being, motivation, and productivity. Its systematic integration into organizational policies aligns with the objectives of corporate sustainability, human development, and public health (Casimiro-Andújar et al., 2022; Genin et al., 2019; Hunter et al., 2016; Katz et al., 2019; Powell et al., 2025; Ryde et al., 2022; Safi et al., 2024; Stepanek et al., 2019).

2. THEORETICAL BACKGROUND

2.1. Physical activity

PA is defined by the WHO as “any bodily movement produced by skeletal muscles that requires energy expenditure” (World Health Organization, 2022). This definition encompasses not only structured exercise but also daily activities such as walking, climbing stairs, or performing household chores. In the workplace, PA has gained particular relevance due to the sustained rise in sedentary behavior, especially in administrative and digital occupations that involve prolonged screen time (Baup et al., 2022; Casimiro-Andújar et al., 2022; Engelen, 2020; Hallam et al., 2023; Judice et al., 2023; Kechagias et al., 2024; Ojo et al., 2018, 2022; Puig-Ribera et al., 2015; Santos & Miragaia, 2023; Wallmann-Sperlich et al., 2019).

Recent literature has emphasized that a significant portion of the workday is spent in a sedentary position (Hervieux et al., 2023; Ojo et al., 2022; Perterman et al., 2019). It is estimated that office workers remain seated between 70% and 85% of their working hours (Hallman et al., 2023; Puig-Ribera et al., 2019). This sedentary behavior increases the risk of developing cardiovascular diseases, metabolic syndrome, musculoskeletal pain, and symptoms of psychological stress (Judice et al., 2023; Petrovcic et al., 2022).

PA can be measured through direct or objective methods, such as accelerometers or pedometers, or through validated self-report questionnaires. The International Physical Activity Questionnaire (IPAQ) is one of the most widely used tools worldwide, as it allows for the estimation of the duration, frequency, and intensity of activity across different settings (Hunter et al., 2021). The Global Physical Activity Questionnaire (GPAQ), developed by WHO, classifies PA into three domains: occupational, active transport, and leisure time (Hallam et al., 2023). Additionally, the Godin Leisure-Time Exercise Questionnaire (GLTEQ) has proven useful for assessing the frequency and intensity of exercise during leisure time, particularly in clinical or personalized interventions (Casimiro-Andújar et al., 2022).

Several studies have shown that small modifications in workplace routines can have positive effects on employees' physical and mental health (Petrovcic et al., 2022; Ryde et al., 2022). Brief, structured active breaks during the workday are associated with improvements in sustained attention and the regulation of physiological stress (Kitano et al., 2025). The incorporation of adjustable workstations enables workers to alternate between positions and reduces total sedentary time (Judice et al., 2023). Moreover, improvements in metabolic parameters such as blood glucose and blood pressure have been observed among individuals who adopt these changes (Buman et al., 2017).

The Stand & Move at Work program is a notable example of an effective intervention in sedentary workplace settings (Ojo et al., 2018; Pertermann et al., 2019; Wallmann-Sperlich et al., 2019). This approach combines standing desks, scheduled active breaks, and educational components regarding the risks of sedentary behavior (Buman et al., 2017). Its 24-month implementation in office environments resulted in significant reductions in sitting time and sustained improvements in subjective well-being and physiological markers. These effects were more pronounced when institutional support and ongoing follow-up were present (Kitano et al., 2025).

Occupational type also influences PA levels. Workers in the agricultural or manufacturing sectors exhibit higher levels of occupational PA but are exposed to greater physical demands and ergonomic risks (Szabó & Kajos, 2024). In contrast, administrative employees report low PA levels, making them more vulnerable to the negative effects of sedentarism (Judice et al., 2023). In such contexts, multicomponent interventions, those that integrate individual, social, and organizational actions, have shown the most effective long-term results (Casimiro-Andújar et al., 2022; Ojo et al., 2022; Powell et al., 2025; Szabó & Kajos, 2024).

2.2. Happiness

The concept of happiness has evolved from an abstract philosophical idea into an operational and measurable psychological variable. Within the field of positive psychology, it is commonly understood as a combination of frequent positive emotions, overall life satisfaction, and the absence of persistent negative emotions (Diener et al., 1984). Happiness is approached from both affective and cognitive dimensions, which allows for its assessment through validated instruments such as the Satisfaction with Life Scale (SWLS) (Diener et al., 1985), the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988), the Oxford Happiness Questionnaire (Hills & Argyle, 2002), and more integrated tools like the Subjective Happiness Scale (SHS) (Lyubomirsky & Lepper, 1999).

Numerous studies have examined the relationship between PA and levels of happiness. Overall, empirical evidence suggests that regular PA is positively correlated with higher levels of positive affect, life satisfaction, and subjective well-being (Bergefurt et al., 2024; Coviello et al., 2022; Jiménez-Díaz-Benito et al., 2022; Hasni & Bedhioufi, 2025; Hervieux et al., 2023). For instance, Hervieux et al. (2023) found that physically active workers reported better emotional well-being and a lower prevalence of depressive disorders compared to those with sedentary lifestyles. Similarly, Hallam et al. (2023) documented improvements in perceived mental well-being among employees who participated in workplace yoga programs—a form of PA that also enhanced their subjective happiness.

The relationship between PA and happiness is not only cross-sectional but also longitudinal. Kitano et al. (2025) demonstrated that the incorporation of short active breaks during the workday is associated with sustained improvements in positive affective states and intrinsic motivation. Moreover, this effect appears to be maintained over time, provided that the activity is practiced regularly and adapted to the work context. These findings align with research showing how engagement in physical movement can modulate neurochemical processes associated with pleasure, such as the release of endorphins and serotonin, thereby directly influencing the subjective experience of happiness (Petrovcic et al., 2022).

Among older working populations, the impact of PA on happiness becomes particularly significant. Thøgersen-Ntoumani et al. (2017) observed that engagement in physical activities or volunteer work post-retirement predicts higher levels of subjective well-being, even years after retirement. This highlights the importance of promoting an active ageing culture that emphasizes social and physical participation as key drivers of long-term happiness. Beyond the individual context, promoting happiness in the workplace through PA also carries important organizational implications. Recent studies have shown that happier employees tend to exhibit higher engagement, lower turnover rates, and better interpersonal relationships at work (Bergefurt et al., 2024). Therefore, implementing strategies to promote PA contributes not only to individual well-being but also to sustainable organizational performance.

2.2.1. Engagement

Work engagement is defined as a positive, work-related psychological state characterized by vigor, dedication, and absorption (Schaufeli et al., 2002). Unlike other constructs such as job satisfaction or motivation, engagement involves a sustained emotional, cognitive, and behavioral connection with the work environment, making it a key predictor of performance, productivity, and talent retention (Bergefurt et al., 2024; Hasni & Bedhioufi, 2025; Hervieux et al., 2023). From an organizational perspective, high levels of engagement are associated with lower staff turnover, reduced absenteeism, and greater innovation (Baup et al., 2022).

In recent years, multiple studies have explored the relationship between PA and work engagement, identifying a significant connection between the two (Bergefurt et al., 2024; Casimiro-Andújar et al., 2022; Hasni & Bedhioufi, 2025; Hervieux et al., 2023). Regular participation in PA, particularly in workplace settings, may act as a positive modulator of engagement—not only due to its physiological benefits but also because of its impact on psychological variables such as mood, resilience, and perceived self-efficacy (Coviello et al., 2022; Jiménez Díaz-Benito et al., 2022; Hasni & Bedhioufi, 2025; Hervieux et al., 2023). According to Charisi et al. (2025), interventions focused on environmental redesign, such as the inclusion of green spaces or active breaks, lead to increased

engagement levels, particularly among employees exposed to high cognitive demands. Similarly, Ammendolia et al. (2016) found that employees participating in integrated health promotion programs, including structured PA, exhibited sustained improvements in engagement and reductions in emotional exhaustion.

These interventions also affect intermediary variables. PA promotes neurophysiological balance, enhances emotional regulation, and strengthens overall well-being, factors that directly influence a positive disposition toward work tasks. In organizational contexts that foster active participation, greater involvement, persistence in the face of challenges, and a stronger sense of belonging are commonly observed (Bergefurt et al., 2024). Additionally, some recent studies have employed designs focused on reducing sedentary behavior as a pathway to increasing engagement. For instance, the Stand & Move at Work approach promotes the integration of light movement during the workday, which has shown positive effects on energy levels, motivation, and attentional focus (Judice et al., 2023).

Finally, the evidence suggests that PA not only enhances employees' general health but also serves as a strategic tool to strengthen their emotional and cognitive connection with their work. Its implementation represents an investment with benefits for both individuals and organizations.

2.2.2. Work satisfaction

Work or job satisfaction refers to the degree to which employees positively evaluate their work, considering elements such as task content, working conditions, relationships with colleagues and supervisors, and opportunities for professional development (Coviello et al., 2022; Hasni & Bedhioufi, 2025; Hervieux et al., 2023). It is a multidimensional construct that has been linked to productivity, mental health, and talent retention (Howie et al., 2021). From the occupational health perspective, job satisfaction is also conceptualized as a component of subjective well-being (Nathan et al., 2020; Ryde et al., 2022; Shiri et al., 2023; Strijk et al., 2013; Ruhle et al., 2020; Tarro et al., 2020). When employees perceive that their work environment aligns with their personal expectations, there is a corresponding increase in motivation, resilience, and organizational commitment.

In this context, recent studies have shown that PA can serve as an indirect yet significant determinant of job satisfaction. Workplace interventions that promote PA have not only improved physical health but have also been associated with increases in subjective well-being and job satisfaction (Nathan et al., 2020; Strijk et al., 2013). For instance, programs such as step-count challenges have led to increases in engagement, motivation, and positive perceptions of the work environment (Ryde et al., 2022). These improvements are linked to psychological mechanisms such as stress reduction, mood enhancement, and a greater sense of achievement, all of which are indirect predictors of job satisfaction (Shiri et al., 2023; Strijk et al., 2013).

For example, Jiménez Díaz-Benito et al. (2022) observed that implementing exercise programs tailored to the office environment not only reduced sedentary behavior but also improved employees' overall well-being and their positive evaluation of their job roles. Similarly, Casimiro-Andújar et al. (2022) reported improvements in both physical and mental health indicators. These health benefits were accompanied by an increase in participants' satisfaction with their professional environment following a 16-week personalized PA intervention.

These benefits appear to be mediated by psychosocial mechanisms. Notable among these are increases in perceived self-efficacy, reductions in muscular tension, and the strengthening of social relationships in the workplace (Hergenroeder et al., 2022). Moreover, group-based interventions such as collective walks or brief exercise sessions during the workday have shown positive effects on organizational climate. These types of activities foster the perception of work as a source of personal fulfillment (Petrovcic et al., 2022).

Organizational models focused on well-being, such as those incorporating active workstations or guided movement breaks, have also been associated with higher levels of job satisfaction (Marenius et al., 2025; Ojo et al., 2022; Tarro et al., 2020). These effects are amplified when the social environment is perceived as supportive and inclusive health policies are in place (Braun et al., 2022). Finally, Shiri et al. (2023), in a review of multiple randomized controlled trials, concluded that workplace-based physical interventions, particularly in healthcare and social service sectors, significantly enhance employee well-being and job satisfaction by reducing stress and fostering positive attitudes. Physically active employees tend to experience lower levels of stress and higher energy, which contributes to a more favorable perception of the work environment (Bergefurt et al., 2024).

2.2.3. Affective commitment

Affective commitment refers to the emotional bond that connects an employee to their organization. This type of commitment entails a genuine desire to remain in the company, not out of obligation or convenience, but due to identification with organizational values and personal satisfaction within the work environment (Meyer & Allen, 1991). It differs from other forms of commitment, such as normative commitment (based on a sense of duty) and continuance commitment (based on the perceived costs of leaving the organization). This typology has been widely accepted and utilized to explain employee retention dynamics and organizational motivation (Meyer & Herscovitch, 2001).

In the workplace, affective commitment has been linked to a range of positive outcomes, including performance, loyalty, openness to change, and organizational citizenship behaviors (Bergefurt et al., 2024; Coviello et al., 2022; Ryde et al., 2022). It also serves as a protective factor against burnout and voluntary turnover, particularly in high-demand work environments (Hasni &

Bedhioufi, 2025; Shiri et al., 2023). However, sustaining this form of commitment requires favourable psychosocial conditions, such as a trust-based work environment, opportunities for personal development, and active participation in decision-making processes (Marenus et al., 2025; Baup et al., 2022).

In this context, PA emerges as an effective strategy for fostering affective commitment. Evidence suggests that participation in structured PA programs can strengthen employees' emotional connection to the workplace. Hasni and Bedhioufi (2025) demonstrated that interventions focused on physical well-being promote a positive organizational climate, thereby enhancing employees' identification with the organization's goals. This effect was particularly strong in high-demand settings, where PA acted as a buffer against stress.

Moreover, regular exercise is associated with more positive perceptions of leadership, increased group cohesion, and improved emotional regulation. These conditions foster the development of lasting emotional bonds between employees and their work environment (Bergefurt et al., 2024). In fact, variables such as engagement and subjective well-being, both closely linked to PA, have shown mediating effects in the consolidation of affective commitment (Charisi et al., 2025). Employees who feel energized, emotionally stable, and supported in their workplace are more likely to develop a strong and enduring relationship with their organization, thereby reinforcing their affective commitment. Such positive experiences in the workplace are associated with higher organizational loyalty, lower voluntary turnover, and increased proactive participation in collective tasks (Bergefurt et al., 2024; Hervieux et al., 2023; Marenus et al., 2025; Ryde et al., 2022). Therefore, beyond its physiological benefits, PA contributes to the consolidation of organizational relationships grounded in commitment, belonging, and shared well-being.

2.3. Wellbeing

The concept of well-being in the workplace encompasses physical, psychological, and social dimensions that shape the quality of life of employees both within and beyond the work environment. It goes beyond the mere absence of illness, involving a positive perception of energy, emotional balance, sense of purpose, and healthy relationships, consistent with both the eudaimonic and hedonic approaches to well-being (Dodge et al., 2012). From this perspective, well-being is a dynamic construct that arises from the balance between an individual's psychological and social resources and the challenges encountered in their environment. This integrative conception links well-being to other organizational variables such as resilience, positive affect, and self-actualization (Bergefurt et al., 2024; Hasni & Bedhioufi, 2025).

To evaluate well-being, various validated instruments are available to capture its multidimensional nature. The WHO-5 Wellbeing Index, developed by the World Health Organization, focuses on the frequency of positive experiences and healthy mood states over the past two weeks (Topp et al., 2015). The Subjective Vitality Scale (SVS), meanwhile, assesses individuals' sense of energy and personal vitality, key indicators of both physical and psychological well-being (Ryan & Frederick, 1997). Lastly, the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS) offers a broader perspective, integrating emotional, functional, and relational aspects of well-being in everyday life (Tennant et al., 2007).

In recent decades, well-being has gained importance as a strategic indicator for organizations. Employees who experience high levels of well-being demonstrate greater resilience, enhanced performance, and lower turnover intention (Hasni & Bedhioufi, 2025; Hervieux et al., 2023; Shiri et al., 2023). Conversely, low well-being has been associated with higher prevalence of stress, anxiety, absenteeism, and reduced organizational commitment (Baup et al., 2022).

PA plays a critical role in promoting employees' holistic well-being. Casimiro-Andújar et al. (2022) showed that personalized workplace exercise programs lead to significant improvements in subjective well-being indicators while reducing symptoms of anxiety and fatigue. These effects are especially pronounced when the intervention combines moderate exercise with behavioral motivation strategies.

Braun et al. (2022) emphasize that well-being improves not only through exercise itself, but also through its organizational impact: better workplace climate, increased perception of support, and a stronger sense of belonging. Thus, PA acts as a catalyst for a healthier and more cohesive environment. Well-being is also influenced by intermediary variables such as engagement, job satisfaction, and affective commitment. Kitano et al. (2025) found that short active breaks during the workday not only reduce stress but also enhance the sense of vitality and personal control, thereby strengthening overall well-being. Similarly, the Stand & Move at Work model has been recognized for its positive impact in reducing sedentary time, which directly improves perceived energy levels and mental health (Judice et al., 2023).

Furthermore, Marenus et al. (2025) highlight that organizations promoting a health-oriented culture, through active infrastructure, committed leadership, and voluntary participation, achieve higher levels of collective well-being and social cohesion. These practices not only enhance employees' daily experience but also reinforce the organization's social capital. Therefore, well-being should not be viewed as an isolated individual outcome but as a multidimensional organizational phenomenon, influenced by the psychosocial environment, corporate culture, and internal policies (Baup et al., 2022; Marenus et al., 2025). The integration of PA as a cross-cutting component of these

policies has been shown to foster healthier, more cohesive, and sustainable work environments, with positive impacts on organizational climate and employee satisfaction (Coviello et al., 2022; Ojo et al., 2024).

2.4. Productivity

Workplace productivity is defined as the worker's ability to transform time, skills, and resources into effective outcomes for the organization, encompassing both the quantitative and qualitative aspects of job performance (Braun et al., 2022; Ryde et al., 2022). In addition to being linked to individual performance, productivity is also a macroeconomic indicator reflecting operational efficiency and return on investment in human capital (Braun et al., 2022; Chandrakumar et al., 2024).

In today's context, marked by increasing automation, competitive pressure, and high cognitive demands, the maintenance of sustainable productivity has become a critical challenge. The goal is not merely to "produce more," but to do so consistently, healthily, and in alignment with both organizational and personal objectives. Factors such as psychological well-being, physical health, and perceptions of the work environment have a direct impact on performance (Bergefurt et al., 2024; Hallam et al., 2023). One of the most significant threats to productivity is the deterioration of employee health. Chronic non-communicable diseases, prolonged stress, and mental fatigue lead to substantial declines in effective output. These effects may manifest directly through absenteeism or more subtly, but persistently, through presenteeism (Chandrakumar et al., 2024; Petrovcic et al., 2022).

In response to this scenario, scientific evidence positions PA as a cost-effective tool for maintaining and enhancing productivity levels. Physically active workers have been shown to exhibit better cognitive function, greater stress resilience, lower susceptibility to burnout, and a more positive emotional disposition when facing complex tasks (Casimiro-Andújar et al., 2022; Kitano et al., 2025; Shiri et al., 2023). These improvements translate directly into key operational indicators, including greater task accuracy, faster execution speeds, fewer errors, and reduced need for direct supervision, factors that support sustained performance in demanding work environments (Jiménez Díaz-Benito et al., 2022; Halling Ullberg et al., 2023).

Furthermore, PA contributes indirectly to productivity by enhancing mediating variables such as engagement, job satisfaction, and team cohesion (Jiménez Díaz-Benito et al., 2022; Ojo et al., 2024). In this regard, organizational investment in physical health and well-being programs yields benefits not only at the individual level but also with positive organizational and economic implications.

Recent studies have begun to quantify these benefits. Hallam et al. (2023) estimated that corporate PA interventions could reduce productivity losses by up to 25% by lowering costs

associated with presenteeism, absenteeism, and work-related illnesses. Similarly, Braun et al. (2022) suggest that even low-cost measures, such as active breaks or adjustable desks, can yield positive returns on investment within six months, particularly in office-based sectors. In this framework, it becomes essential to analyze two critical phenomena associated with productivity: absenteeism (physical absence from the workplace) and presenteeism (being present with reduced performance). Both can be effectively mitigated through organizational strategies that incorporate PA as a cross-cutting component.

2.4.1. Absenteeism

Workplace absenteeism refers to an employee's absence from their position, whether due to physical, psychological, or social reasons. It has a significant negative impact on operational continuity, team workload, and overall organizational efficiency. Recent studies estimate that economic losses due to absenteeism range from 2% to 6% of a company's total labor costs (Hallam et al., 2023). Multiple investigations have identified low levels of PA, particularly among employees with predominantly sedentary lifestyles, as one of the strongest predictors of absenteeism (Kerner et al., 2017; Petrovcic et al., 2022; Shiri et al., 2023). Physically inactive workers are at greater risk of musculoskeletal disorders, chronic fatigue, and anxiety or depressive disorders, all common causes of workplace absences (Kerner et al., 2022). Halling Ullberg et al. (2023) concluded that corporate health programs incorporating regular exercise can reduce sick leave by up to 27%, whether due to physical or emotional reasons.

PA influences several mechanisms that explain its preventive effects. Regular PA improves immune function, which contributes to a reduction in respiratory infections and mild illnesses. It also lowers cortisol levels and increases serotonin production, leading to better emotional regulation and a more stable mood (Hasni & Bedhioufi, 2025; Hervieux et al., 2023; Petrovcic et al., 2022). Additionally, PA strengthens the musculoskeletal system, helping to prevent injuries caused by overload or prolonged poor posture (Jiménez Díaz-Benito et al., 2022). Ammendolia et al. (2016) observed sustained reductions in absenteeism among office workers after implementing interventions that included stretching, guided walks, and functional exercises. Casimiro-Andújar et al. (2022) reported similar benefits, particularly among employees performing sedentary tasks, when interventions were personalized and lasted at least eight weeks.

Ojo et al. (2024) emphasized that the effects are stronger when PA programs are continuous, inclusive, and complemented by additional measures such as nutritional counseling and active breaks. In companies that adopted this integrated approach, not only did the number of sick leaves decline, but team morale and willingness to return to work early also increased. Braun et al. (2022) also noted that absenteeism prevention cannot rely solely on medical treatment. They propose a

proactive health promotion strategy in which PA plays a central role, not only for its physiological benefits but also for its influence on employees' perceptions of the work environment.

Finally, findings by Marenus et al. (2025) indicate that organizations that foster an active and healthy culture, through committed leadership, dedicated movement spaces, and flexible scheduling, report lower prevalence of absences related to fatigue, stress, or musculoskeletal pain.

2.4.2. Presenteeism

Presenteeism is a more complex phenomenon to identify and measure. It refers to situations in which employees are physically present at the workplace but their performance is impaired due to physical discomfort, fatigue, stress, emotional difficulties, or lack of concentration (Chandrakumar et al., 2024; Petrovcic et al., 2022). Unlike absenteeism, whose effects are visible and quantifiable, presenteeism often goes unnoticed in conventional performance metrics, yet it can have longer-lasting consequences on operational efficiency.

This phenomenon is highly multifactorial. Physical inactivity, poor ergonomic conditions, sustained work-related stress, inadequate rest, and the absence of active breaks during the workday are all factors that, collectively, increase the risk of presenteeism by undermining employees' physical, cognitive, and emotional health (Jiménez Díaz-Benito et al., 2022; Judice et al., 2023; Ryde et al., 2022). Chandrakumar et al. (2024) found that over 60% of workers with low PA levels reported chronic fatigue and difficulty maintaining focus, both key contributors to presenteeism.

In this regard, PA acts as a protective factor. Kitano et al. (2025) demonstrated that workers who engaged in 5- to 10-minute active breaks during the workday experienced improvements in processing speed, alertness, and emotional regulation. These benefits are linked to neurophysiological mechanisms such as the release of endorphins and increased cerebral blood flow, both of which support enhanced cognitive performance.

Moreover, recent studies have begun to explore the broader organizational impact of presenteeism. Marenus et al. (2025) reported that workplaces with a high prevalence of presenteeism tend to exhibit lower job satisfaction, reduced team cohesion, and more negative perceptions of leadership. Conversely, promoting PA not only improves individual performance but also contributes to a more dynamic and resilient work environment.

Structured interventions that combine daily movement, flexible work schedules, and ergonomically sound environments—such as the Stand & Move at Work model—have been shown to reduce the frequency of presenteeism, particularly among office workers facing high cognitive demands (Judice et al., 2023; Halling Ullberg et al., 2023; Ojo et al., 2024; Rosenkranz et al., 2020).

Implementing such measures also reinforces the institutional message of caring for human capital, with positive effects on motivation and employee commitment.

In sum, presenteeism represents a silent form of productivity loss that demands a comprehensive approach, one that integrates ergonomic, psychosocial, and PA promotion strategies. Recent evidence strongly supports the notion that investing in movement during the workday not only improves worker health but also enhances overall performance and strengthens the operational sustainability of organizations (Braun et al., 2022; Marenus et al., 2024; Ojo et al., 2024; Ryde et al., 2022)

2. OBJECTIVES

The main objective is to analyse the benefits of PA for the improvement of productivity and well-being of employees in the workplace in Europe. The specific objectives are the following:

- a) To analyse the relationship between low levels of PA (<600 and <1200 MET-min/week) and the presence of functional limitations in both paid and unpaid work due to physical or psychological problems.
- b) To examine the impact of insufficient PA on work productivity, considering both absenteeism (missed workdays) and presenteeism (reduced performance while at work).
- c) To explore the association between PA levels and mental health outcomes, with a particular focus on depression risk as measured by the WHO-5 index.
- d) To assess the relationship between PA and work-related well-being indicators, including affective commitment, job satisfaction, and employee engagement.
- e) To determine the influence of PA on overall happiness and subjective well-being among employees.
- f) To compare the effects of two PA thresholds (<600 and <1200 MET-min/week) on the outcomes of productivity, well-being, and mental health, to identify potential minimum levels of activity for effective workplace interventions.

3. METHODS

3.1. Sample

The total sample for this study comprised 1,186 employees or volunteers working in companies or organisations located in European Union (EU) member states. Of these, 12 participants were excluded for not providing informed consent, and a further 10 participants were removed for reporting daily PA exceeding 960 minutes, which exceeds the threshold established by the World Health Organization (WHO) in accordance with the Global PA Questionnaire (GPAQ). Consequently, the final sample consisted of 1,164 participants from 20 different European countries. Descriptive results of the sample are presented in the results section.

3.2. Instruments

The survey instrument consisted of 44 items distributed across the following sections:

- a) **Physical Activity Level** (Herrmann et al., 2013): This variable was assessed using the GPAQ, comprising 16 items that capture PA at work (6 items), transport-related activity (3 items), recreational activity (6 items), and sedentary behaviour (1 item). MET-minutes/week is the specific unit utilized by the GPAQ to quantify PA. MET stands for Metabolic Equivalent of Task. This questionnaire uses a formula to calculate the total MET-minutes/week of PA, which consists of multiplying the assigned MET value (8.0 for vigorous, 4.0 for moderate, and 4.0 for transport) by the number of minutes per day and days per week for each activity domain, and then summing across all domains (work, transport, and recreation) (Bull et al., 2009; WHO, 2021). Based on the lower and upper limits of the WHO PA guidelines (WHO, 2024 2025), the following cutoffs were used: 600 MET-mins/week and 1200 MET-mins/week.
- b) **Happiness:** Happiness at work was assessed using the Shortened Happiness at Work Scale (SHAW; Feitor et al., 2022), consisting of nine items divided into three factors: (i) Engagement, characterised by enthusiasm, passion for work, and positive mental states such as vigour, dedication, and absorption (3 items); (ii) Job Satisfaction, referring to employees' perceptions of their working conditions (3 items); and (iii) Affective Commitment, which captures the emotional and relational connection between the employee and the organisation (3 items). Items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

- c) **WHO-5 Well-Being Index** (Topp et al., 2015): This five-item scale assesses both positive well-being and symptoms indicative of depression. Participants were asked to rate how frequently each item applied to them over the past 14 days, using a six-point scale ranging from 0 ("at no time") to 5 ("all of the time"). The raw scores (0–25) were multiplied by 4 to yield a final score ranging from 0 (worst imaginable well-being) to 100 (best imaginable well-being). Scores below 50 suggest risk of depression, while those below 28 indicate likely chronic depression. Scores above 50 indicate positive well-being, with an average of approximately 70 in the general population.
- d) **Employment data:** This section collected data regarding the occupational context of each participant, including: (i) job title, coded according to the International Standard Classification of Occupations (ISCO-08; International Labour Office, 2012); (ii) type of organisation (public sector, private company, or non-profit); (iii) country in which the company is based; (iv) company size, categorised by number of employees (from 1 to over 5,000); and (v) business sector, classified according to NACE Rev. 2 (Eurostat, 2008).
- e) **Productivity Cost Questionnaire** (Bouwman et al., 2015): The iMTA Productivity Cost Questionnaire (iPCQ), developed by the Institute for Medical Technology Assessment (Erasmus University, Rotterdam), was used to assess health-related productivity loss. The instrument includes 18 items across three modules: (i) Absenteeism, which records the number and duration of work absences; (ii) Presenteeism, which evaluates reduced productivity while working, using a 0–10 scale based on the Quantity and Quality (QQ) method; and (iii) Unpaid Work, which assesses limitations in performing household, caregiving, or voluntary tasks, along with an estimate of the time required for others to replace such activities. A four-week recall period was used. Productivity cost was calculated using the hourly labour costs by sector and country, as published by Eurostat (2023).
- f) **Sociodemographic variables:** Six sociodemographic items were included to characterise the sample: (i) gender; (ii) date of birth; (iii) highest educational qualification attained; (iv) current employment status; (v) current marital status; and (vi) parental status, recorded as a binary variable indicating whether the participant had dependent children.

3.3. Procedure

The study was carried out in five stages. First, a systematic review of the literature was conducted alongside a needs assessment using two focus groups (one with managers and one with employees). Findings from this phase are detailed in the report "D2. Nee Analysis Report". In the second phase, study variables and measurement tools were selected. The University of Murcia led the selection of

instruments, which were then reviewed by the wider consortium of the Work, Move and Perf Project (Project ID: 101134048), funded by the European Union.

After determining the appropriate instruments, the University of Murcia team prepared the questionnaire in English for review. To maximise reach, the questionnaire was translated into the 24 official languages of the EU (including German, French, Spanish, Italian, Polish, etc.) and five additional languages from EU-associated third countries (Bosnian, Serbian, Norwegian, Turkish, and Ukrainian). Translations were generated using generative AI and validated by native-speaking project partners.

A transnational meeting was held to determine dissemination strategies. The questionnaire was administered online via Microsoft Forms under the University of Murcia's Education 365 licence. Given the language diversity, four regional forms were created: (i) Northern region (Scandinavian and Baltic countries, Iceland); (ii) Central region (central European countries); (iii) Southern region (Romance language countries and Greece); and (iv) Eastern region (including Turkey and Ukraine). Translations were reviewed and validated by national partners.

In the third stage, data collection took place through three channels: (i) email distribution to institutions or employees; (ii) social media posts tailored to platform style; and (iii) printed posters with QR codes. Data collection spanned from November 2024 to June 2025, with periodic reminders issued to participants. In the fourth stage, a researcher from the University of Murcia cleaned, unified, and prepared the dataset for analysis. Generative AI was used to support the translation and standardisation of occupational and sectoral data. Finally, the data were analysed and the research report was drafted.

3.4. Statistical analyses

Data analysis was conducted using JAMOV software, version 2.7 (R Core Team, 2025; The Jamovi Project, 2025). Descriptive analyses were carried out for both qualitative variables (frequencies and percentages) and quantitative variables (means and standard deviations). The assumption of normality for quantitative variables was tested using the Kolmogorov–Smirnov test, which indicated significant deviations from normality; therefore, non-parametric statistical tests were applied.

Following the analytical framework proposed by Kerby (2014), the following inferential tests were employed: i) the Mann–Whitney U test was used to compare two independent groups on continuous variables, including comparisons based on gender, educational level, civil status, parental status, and PA level; ii) the Kruskal–Wallis test was applied when comparing more than two groups, such as analyses based on age categories or European region; and iii) chi-square tests were used to

explore associations between categorical variables, including those related to gender, age, and geographical region within Europe.

In addition, multinomial logistic regression analyses were conducted to assess the associations between PA levels (exposure) and outcome variables: productivity, happiness, and well-being. PA was examined based on WHO guidelines, using two thresholds: 600 MET-minutes/week and 1200 MET-minutes/week. Outcomes were operationalised as categorical variables according to the criteria described in the instruments section.

All models were adjusted for sociodemographic and occupational covariates. Sociodemographic and occupational covariates were included in the analyses. Age was treated as a continuous variable. Gender was categorized as woman or man, and educational level was classified as no postgraduate studies versus postgraduate studies. Civil status was coded as single or married/cohabiting, and parental status was recorded as having children (yes/no). Work-related variables included the type of organization (public, private, or non-profit), company size (1–10, 11–250, 251–1000, 1001–5000, or >5000 employees), employment status (paid job: yes/no), type of contract (full-time permanent or other), and occupation status (student, paid employment, self-employed, homemaker, unemployed, disabled for work, or retired/early retirement). Finally, country of residence was grouped as Northern or Southern.

Multinomial logistic regressions were performed using SPSS version 25, and odds ratios (OR) with 95% confidence intervals (CIs) were reported. Statistical significance was defined as $p < 0.05$. Effect sizes were estimated following the guidelines proposed by Domínguez-Lara et al. (2017), and the significance threshold was maintained at $p < 0.05$ throughout all analyses.

4. RESULTS

4.1. Descriptive analysis

4.1.1. Sociodemographic data

Table 1 presents the sociodemographic characteristics of the study sample, comprising a total of 1,164 participants. The table includes information on gender, age, European region of residence, educational level, occupational status, civil status, and parental status. This detailed profile allows for a comprehensive understanding of the population under study, particularly in relation to factors that may influence occupational PA and productivity outcomes.

In terms of gender distribution, the majority identified as male (61.2%, $n = 712$), followed by female participants (37.5%, $n = 436$). Only one participant identified as non-binary (0.1%), and 15 individuals (1.3%) preferred not to disclose their gender. This gender composition reveals a predominantly male sample, which may hold implications for interpreting outcomes related to occupational PA and productivity, given known gender-related differences in occupational roles and physical demands.

Regarding age, the sample was largely composed of middle-aged individuals. The most represented age group was 41–50 years (28.2%, $n = 328$), followed by 51–60 years (26.4%, $n = 307$) and 31–40 years (15.8%, $n = 184$). Young adults under 25 years constituted 4.8% of the sample ($n = 56$), while individuals aged 60 and above represented 11.5% ($n = 134$). Notably, age data were not provided by 5.0% of respondents ($n = 58$). This age profile reflects a workforce-dominant population, which is particularly pertinent given the focus on occupational contexts.

Geographically, the participants were predominantly from southern Europe (51.9%, $n = 604$), followed by individuals from the central/western region (27.2%, $n = 317$), eastern Europe (15.5%, $n = 180$), and northern Europe (5.4%, $n = 63$). This uneven regional distribution, skewed towards southern Europe, should be considered when interpreting findings that may be influenced by cultural or economic contexts across different European regions.

The educational background of the sample was notably high. Over half of the participants (54.1%, $n = 630$) reported having completed a master's degree or doctorate, while a further 33.5% ($n = 390$) held an undergraduate university degree. Lower levels of education were considerably less represented: vocational training (6.1%, $n = 71$), secondary education (5.7%, $n = 66$), primary education (0.3%, $n = 4$), and no formal education (0.3%, $n = 3$). This high level of educational attainment suggests a professionalised sample, which may relate to cognitive or sedentary occupational demands rather than physical labour.

In terms of employment status, the overwhelming majority were in paid employment (93.9%, $n = 1,093$). A small proportion reported being self-employed (2.2%, $n = 26$), students (1.9%, $n = 22$), retired or in early retirement (1.1%, $n = 13$), unemployed (0.7%, $n = 8$), full-time homemakers (0.1%, $n = 1$), or unable to work due to disability (0.1%, $n = 1$). The dominance of individuals in formal employment positions makes this sample especially relevant for investigations concerning work-related behaviours and productivity metrics.

With respect to marital status, 53.0% ($n = 617$) of participants were married, 22.3% ($n = 259$) were single, and 17.2% ($n = 200$) were cohabiting. The remainder included separated (4.9%, $n = 57$), divorced (1.4%, $n = 16$), and widowed individuals (1.3%, $n = 15$). This distribution indicates that most participants were in stable long-term relationships, which may play a role in household responsibilities and time availability. Finally, 64.8% of the sample ($n = 754$) reported having children, whereas 35.2% ($n = 410$) did not. Parenthood is a salient variable when examining behavioural outcomes such as PA engagement and perceived productivity, given its association with competing time demands and lifestyle constraints.

Table 1. Sociodemographic data of the sample.

Variables		N	%
Gender	Woman	436	37.5
	Man	712	61.2
	Non-binary	1	0.1
	Prefer not to say	15	1.3
Age	Not determined	58	5.0
	Less than 25 years	56	4.8
	26-30 years	97	8.3
	31-40 years	184	15.8
	41-50 years	328	28.2
	51-60 years	307	26.4
	60 years or more	134	11.5
European region	North	63	5.4
	Central/West	317	27.2
	East	180	15.5
	South	604	51.9
Educational level	I have not completed school or any education.	3	0.3
	Primary or elementary school.	4	0.3
	Middle or High school.	66	5.7
	Vocational training.	71	6.1
	Higher education/ University Degree	390	33.5
	Master's Degree or Doctorate	630	54.1
Occupation	I am at school, I study	22	1.9
	I am in paid employment	1093	93.9

Table 1. Sociodemographic data of the sample.

	I am self-employed	26	2.2
	I am a housewife/househusband	1	0.1
	I am unemployed	8	0.7
	I am disabled for working	1	0.1
	I am retired or have taken early retirement	13	1.1
Civil status	Single	259	22.3
	Married	617	53.0
	Cohabited	200	17.2
	Separated	57	4.9
	Divorced	16	1.4
	Widowed	15	1.3
Children	No	410	35.2
	Yes	754	64.8

Figure 1 displays the geographic distribution of the study sample across European countries, highlighting the number of participants recruited per country. Spain stands out as the country with the highest representation in the sample, contributing 569 participants, followed by France with 269 and Romania with 123. These three countries alone account for the vast majority of respondents. Additional notable contributions come from Italy (55) and Germany (18), although at significantly lower frequencies.

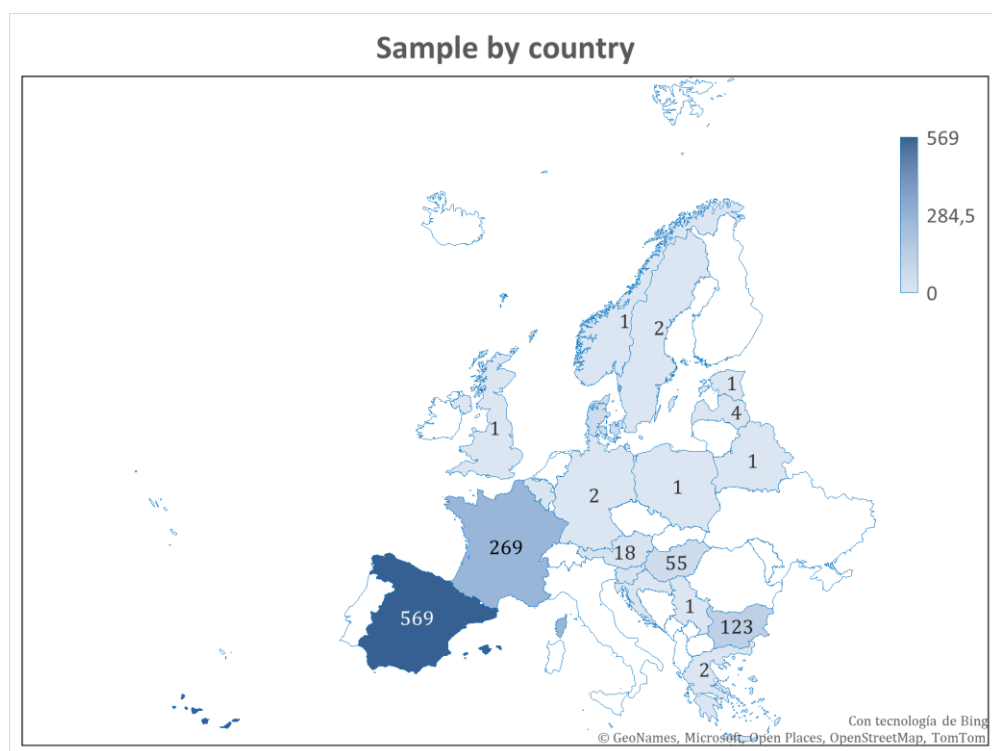


Figure 1. Geographic distribution of the study sample across European countries.

The rest of the countries represented in the sample exhibit minimal participation, generally ranging from 1 to 4 individuals, including nations such as Sweden, Finland, Ireland, Poland, and the Czech Republic. A few countries, such as the United Kingdom and Norway, also appear with only 1 respondent each, indicating a very limited geographic spread in those regions.

The map reveals a pronounced imbalance in country-level representation, with a heavy concentration of the sample drawn from southern and western Europe—especially the Iberian Peninsula. This overrepresentation of Spain and France aligns with the previously reported data by European region, where southern Europe comprised over half the total sample. Such geographic skewness should be carefully considered in interpreting findings that may be sensitive to national policies, labour contexts, or cultural norms related to occupational activity and productivity.

4.1.2. Physical activity

Table 2 presents the frequency of PA engagement among participants, disaggregated by activity type and context: work-related vigorous activity (Work VA), work-related moderate activity (Work MA), active commuting (walking or cycling), and recreational PA (both vigorous and moderate). The table includes both the proportion of individuals engaging in each activity type and the frequency of days per week on which the activity was reported.

Work-related vigorous activity (Work VA) was reported by a small minority of participants, with only 6.4% ($n = 75$) indicating engagement in this type of activity, while the vast majority (93.6%, $n = 1,089$) reported no such activity. Among those who did report Work VA, engagement was relatively evenly distributed across the week, with no distinct peak. Notably, 1.3% of the total sample reported performing vigorous PA at work five days per week, and fewer than 1% engaged in it daily. The low prevalence of vigorous work-related activity suggests that most participants are employed in occupations characterised by low physical demands.

In contrast, work-related moderate activity (Work MA) was more prevalent, with 19.8% ($n = 231$) of participants reporting engagement, compared to 80.2% ($n = 933$) who did not. The distribution of frequency was broader, with moderate work activity being reported across multiple days. The most common frequencies were 2 days (4.0%), 3 days (3.9%), and 5 days (4.6%), indicating that when moderate activity occurred, it tended to be somewhat regular. Nonetheless, the overall prevalence remained relatively modest, suggesting that even moderate-intensity physical demands at work are limited in this sample.

Active commuting, defined as walking or cycling to or from work, was reported by 65.8% ($n = 766$) of participants, reflecting a significantly higher engagement rate compared to work-based

activities. The most common frequency was 7 days per week (22.2%, $n = 258$), followed by 5 days (17.7%, $n = 206$), and 3–4 days (a combined 14.7%). These results suggest that active commuting constitutes a consistent and frequent source of PA for a substantial proportion of participants, potentially contributing meaningfully to their overall PA levels.

Engagement in recreational vigorous activity was reported by 64.0% ($n = 745$), while 36.0% ($n = 419$) reported no such activity. The most frequently reported frequencies were 2 days (18.6%) and 3 days (18.3%), with lower levels of engagement observed for daily or near-daily activity. These figures indicate that vigorous leisure-time PA is not only more prevalent than occupational VA but also occurs with greater regularity across the week for a substantial subgroup.

Recreational moderate activity showed the highest overall engagement, with 69.2% ($n = 805$) of participants reporting participation. Similar to recreational VA, the most common frequencies were 2 days (21.0%) and 3 days (15.8%), with a noteworthy portion also reporting activity on 5–7 days per week (12.6% combined). This pattern indicates that moderate-intensity leisure-time activity constitutes a regular behaviour for a majority of the sample, with potential implications for health and productivity outcomes.

Table 2. Sample physical activity frequency by type.

Variable		N	%
Work VA	No	1089	93.6
	Yes	75	6.4
Work VA days	Any day	1089	93.6
	1 day	4	0.3
	2 days	13	1.1
	3 days	17	1.5
	4 days	15	1.3
	5 days	15	1.3
	6 days	7	0.6
	7 days	4	0.3
Work MA	No	933	80.2
	Yes	231	19.8
Work MA days	Any day	934	80.2
	1 day	21	1.8
	2 days	47	4.0
	3 days	45	3.9
	4 days	31	2.7
	5 days	54	4.6
	6 days	13	1.1
	7 days	19	1.6

Table 2. Sample physical activity frequency by type.

Walk or bicycle	No	398	34.2
	Yes	766	65.8
Walk or bicycle days	Any day	400	34.4
	1 day	9	0.8
	2 days	44	3.8
	3 days	95	8.2
	4 days	76	6.5
	5 days	206	17.7
	6 days	76	6.5
	7 days	258	22.2
Recreational VA	No	419	36.0
	Yes	745	64.0
Recreational VA days	Any day	426	36.6
	1 day	74	6.4
	2 days	216	18.6
	3 days	213	18.3
	4 days	114	9.8
	5 days	78	6.7
	6 days	26	2.2
	7 days	17	1.5
Recreational MA	No	359	30.8
	Yes	805	69.2
Recreational MA days	Any day	369	31.7
	1 day	132	11.3
	2 days	244	21.0
	3 days	184	15.8
	4 days	89	7.6
	5 days	74	6.4
	6 days	20	1.7
	7 days	52	4.5

Note: VA: vigorous activity; MA: moderate activity.

Table 3 presents a summarised profile of the participants' PA engagement and energy expenditure, expressed in average frequency (days per week), duration (minutes per day), and metabolic equivalents (MET-minutes per week). The data reveal notable disparities across different contexts of PA (namely work, transportation, and recreation), and underscore the predominance of non-occupational activity among the sample.

Recreational PA emerged as the primary contributor to overall energy expenditure. Moderate recreational activity was reported an average of 2.05 days per week (SD = 2.0), with a daily duration of 42.7 minutes (SD = 49.5), while vigorous recreational activity occurred 1.95 days per week (SD =

1.9), lasting 44.0 minutes per day (SD = 49.8). These patterns translated into substantial weekly energy expenditure, 514.6 MET-minutes for moderate activity and 1,117.4 MET-minutes for vigorous activity. Collectively, recreational activities contributed 2,317.7 MET-minutes per week, accounting for the majority of total PA.

Active commuting (walking or cycling) was also a meaningful source of PA, reported 3.42 days per week (SD = 2.8) for an average of 31.4 minutes per day (SD = 42.0). This resulted in an average of 685.7 MET-minutes per week, indicating that a considerable portion of participants use active transportation regularly, likely integrated into daily routines such as travelling to work or running errands.

In stark contrast, work-related PA, both vigorous and moderate, was infrequent and low in volume. Vigorous activity at work occurred only 0.25 days per week (SD = 1.0) with an average of 5.5 minutes per day (SD = 29.6), while moderate activity averaged 0.73 days per week (SD = 1.7) and 15.9 minutes per day (SD = 47.0). The corresponding MET values were also low, 171 MET-minutes for vigorous and 272 MET-minutes for moderate activity, reflecting the limited physical demands of participants' occupational roles.

When aggregated, the participants engaged in 139.5 minutes of PA per day (SD = 118.5), equating to 529.2 minutes per week (SD = 552.8). Total weekly energy expenditure across all domains averaged 2,760.9 MET-minutes (SD = 2,908.9), although the high standard deviations indicate considerable inter-individual variability. Finally, sitting time was substantial, averaging 320 minutes per day (SD = 162.6), suggesting a highly sedentary lifestyle likely influenced by the sample's professional and educational characteristics. Given that sedentary behaviour is a known health risk even in physically active individuals, this result highlights the importance of addressing sitting time alongside PA promotion.

Table 3. Summary of physical activity and METs by sample.

Variable	M	SD
Work VA frequency (days/week)	0.25	1.0
Work VA time (min/day)	5.53	29.6
Work MA frequency (days/week)	0.73	1.7
Work MA time (min/day)	15.93	47.0
Walk or bicycle frequency (days/week)	3.42	2.8
Walk or bicycle time (min/day)	31.35	42.0
Recreational VA frequency (days/week)	1.95	1.9
Recreational VA time (min/day)	44.02	49.8
Recreational MA frequency (days/week)	2.05	2.0
Recreational MA time (min/day)	42.65	49.5
Sitting time (min/day)	320.00	162.6

Total minutes of PA per day	139.48	118.5
Total minutes PA per week	529.18	552.8
Work VA METS	170.96	932.0
Work MA METS	272.25	974.9
Walk or bicycle METS	685.65	1010.9
Recreational VA METS	1117.39	1522.7
Recreational MA METS	514.62	739.7
Total PA METS per week	2760.88	2908.9
Total work activity METS	443.21	1567.6
Total recreational activity METS	2317.66	2271.7

Note: VA: vigorous activity; MA: moderate activity.

4.1.3. Happiness and wellbeing.

Table 4 presents the descriptive statistics of psychological wellbeing and workplace happiness indicators across several validated scales, including total happiness, work engagement, job satisfaction, affective organisational commitment, and the WHO-5 Wellbeing Index. Mean values (M) and standard deviations (SD) are provided for each item and composite scale, offering insight into both the general affective state and the workplace experience of the sample.

Overall happiness was moderately high, with a mean of 3.57 (SD = 0.80) on a 5-point scale, suggesting a general sense of subjective wellbeing among participants. Similarly, work engagement showed a comparable mean of 3.58 (SD = 0.84), with individual engagement items reflecting slightly varied experiences: enthusiasm was highest (M = 3.72, SD = 1.03), followed by strength and vigour at work (M = 3.53, SD = 1.03), and absorption ("getting carried away") slightly lower (M = 3.50, SD = 1.12). These values indicate that, on average, respondents experience a moderate to high level of psychological engagement in their professional roles.

Work satisfaction presented a moderate global score (M = 3.49, SD = 0.87), though substantial variability was observed across specific aspects. Satisfaction with the nature of the work performed was relatively high (M = 3.92, SD = 0.96), while pay satisfaction was lower (M = 3.43, SD = 1.13), and opportunities for promotion rated lowest among the items (M = 3.11, SD = 1.19). These results suggest that while participants generally find their work meaningful and fulfilling, extrinsic rewards and career development opportunities are less satisfactory.

Affective commitment to the organisation showed a moderate overall score (M = 3.63, SD = 1.08), with all three component items displaying similar means: commitment to a long-term career with the organisation (M = 3.73), emotional attachment (M = 3.60), and sense of belonging (M = 3.58). These values suggest that employees experience a relatively strong emotional connection to their workplace, which could serve as a protective factor for both job satisfaction and retention.

The WHO-5 Wellbeing Index, which assesses general psychological wellbeing over the previous two weeks, yielded an average score of 59.23 (SD = 18.91) out of 100. This is slightly below the commonly accepted threshold of 60, often used to screen for potential depressive symptoms, indicating that while the sample is close to the normative wellbeing range, a non-negligible proportion may be at risk of reduced mental wellbeing.

Looking at individual WHO-5 items, the highest mean was observed for feeling cheerful and in good spirits ($M = 3.29$), followed by feeling active and vigorous ($M = 3.03$). In contrast, feeling calm and relaxed ($M = 2.91$) and waking up fresh and rested ($M = 2.46$) showed lower averages, suggesting that while participants maintain a generally positive emotional tone, they may be experiencing stress, fatigue, or sleep-related issues. Finally, participants reported moderate interest in daily life activities ($M = 3.12$), indicating that most found their routines somewhat stimulating, though not highly engaging.

Table 4. Descriptive statistics of happiness and wellbeing scales.

Variables	M	SD
Total Happiness	3.57	0.80
Engagement	3.58	0.84
At my job, I feel strong and vigorous.	3.53	1.03
I am enthusiastic about my job.	3.72	1.03
I get carried away when I am working.	3.50	1.12
Work satisfaction	3.49	0.87
Satisfaction with the nature of the work you perform.	3.92	0.96
Satisfaction with the pay you receive for your job.	3.43	1.13
Satisfaction with the opportunities that exist in this organization for advancement (promotion).	3.11	1.19
Affective commitment	3.63	1.08
I would be very happy to spend the rest of my career with this organization.	3.73	1.17
I feel emotionally attached to this organization.	3.60	1.18
I feel a strong sense of belonging to my organization.	3.58	1.19
Who-5 Wellbeing	59.23	18.91
I have felt cheerful and in good spirits.	3.29	1.05
I have felt calm and relaxed.	2.91	1.17
I have felt active and vigorous.	3.03	1.10
I woke up feeling fresh and rested All of the time.	2.46	1.26
My daily life has been filled with things that interest me.	3.12	1.14

4.1.4. Job information

Table 5 outlines participants' employment and organisational characteristics, revealing a workforce that is predominantly professional, public-sector, and full-time employed. Over half of the sample

(53.9%) held professional roles, with only a small proportion engaged in physically demanding occupations (e.g. trades, services, or manual labour).

Most participants (74.1%) worked in public organisations, particularly in large institutions: over 61% were employed in organisations with more than 1,000 employees. The education sector was by far the most represented field (45%), followed by health (10.7%) and the arts (11%), indicating that the sample largely comprises workers in socially oriented, knowledge-based industries. Contractual stability was high: 75.1% held permanent full-time contracts, with temporary and part-time roles being relatively uncommon. This employment structure aligns with the sample's high professional status and may influence reported levels of wellbeing, job satisfaction, and organisational commitment.

Geographically, the sample was concentrated in western (82.2%) and southern Europe (67.3%), which is consistent with earlier demographic distributions. Overall, the findings suggest that participants are situated in structured, stable work environments, typically sedentary and cognitively demanding—rather than in physically intensive or precarious jobs.

Table 5. Information about the company.

Variable		N	%
Professional occupation	Directors and managers	138	11.9
	Professionals	627	53.9
	Technicians and associate professionals	169	14.5
	Administrative support personnel	156	13.4
	Service workers and shop sales workers	18	1.5
	Craft and related trades workers	5	0.4
	Plant and machine operators and assemblers	4	0.3
	Elementary occupations	26	2.2
	Not determined	21	1.8
Type of organisation	Public organisation	862	74.1
	Private company	220	18.9
	Non-profit organisation	82	7.0
Size of your company	1-10 employees	75	6.4
	11-250 employees	181	15.5
	251-1000 employees	195	16.8
	1001-5000 employees	391	33.6
	More than 5000 employees	322	27.7
Company field	Agriculture, Forestry and Fishing	1	0.1
	Manufacturing	52	4.5
	Electricity, Gas, Steam and Air Conditioning Supply	7	0.6
	Water Supply; Sewerage, Waste Management and Remediation	2	0.2
	Construction	2	0.2
	Wholesale and Retail Trade; Repair of Motor Vehicles	11	0.9

Table 5. Information about the company.

	Transportation	6	0.5
	Accommodation and Food Service Activities	3	0.3
	Information and Communication	32	2.7
	Financial and Insurance Activities	103	8.8
	Real Estate Activities	5	0.4
	Professional, Scientific and Technical Activities	71	6.1
	Administrative and Support Service Activities	49	4.2
	Public Administration and Defence; Compulsory Social Security	38	3.3
	Education	524	45.0
	Human Health and Social Work Activities	125	10.7
	Arts, Entertainment and Recreation	128	11.0
	Other Service Activities	5	0.4
Type of contract	Non-paid job	27	2.3
	Full-time permanent (35 hours or more per week).	874	75.1
	Temporary full-time (35 hours or more per week)	126	10.8
	Part-time permanent (20-35 hours per week)	90	7.7
	Part-time permanent (10-20 hours per week)	17	1.5
	Part-time permanent (less than 10 hours per week)	3	0.3
	Temporary part-time (20-30 hours per week)	4	0.3
	Temporary part-time (10-20 hours per week)	15	1.3
	Temporary part-time (less than 10 hours per week)	8	0.7
Country by regions	Northern	381	32.7
	Southern	783	67.3
	Western	957	82.2
	Eastern	207	17.8

4.2. Comparative analysis

4.2.1. Gender

Table 6 presents the comparative analysis of study variables by gender, revealing statistically significant yet generally small differences across various dimensions of PA, wellbeing, and productivity. The results indicate that women consistently reported higher levels of PA than men, both in frequency and duration, particularly in the recreational and occupational domains. For instance, women engaged in vigorous recreational activity more frequently ($M = 2.31$ vs. 1.74 days/week) and for longer periods each day ($M = 52.3$ vs. 39.1 min/day), with effect sizes of -0.154 and -0.150 , respectively—among the largest observed in the dataset. This pattern was reflected in energy expenditure, where women accrued significantly higher METs from vigorous recreational activity ($M = 1,461.4$ vs. 917.6), with a moderate effect size of -0.163 .

Beyond the recreational context, women also reported significantly higher work-related PA, both in vigorous ($M = 0.37$ vs. 0.17 days/week) and moderate forms ($M = 0.93$ vs. 0.61 days/week), although the associated effect sizes were smaller (-0.049 and -0.085 , respectively). Women accumulated more total minutes of PA per day ($M = 159.4$ vs. 128.0) and per week ($M = 631.3$ vs. 471.3), as well as higher total METs per week ($M = 3,384.9$ vs. $2,403.3$), with corresponding effect sizes ranging from -0.139 to -0.185 , the latter representing the largest gender-based effect in the analysis. These results consistently suggest that women in the sample were more physically active than their male counterparts, particularly in non-work domains.

In terms of psychological wellbeing, measured by the WHO-5 index, women reported slightly higher wellbeing scores than men ($M = 61.1$ vs. 58.2), with a small but significant effect size (-0.090). However, no statistically significant gender differences were found in total happiness, work engagement, job satisfaction, or affective organisational commitment, with all corresponding effect sizes well below the threshold for practical relevance (≤ 0.053). This suggests that despite differences in PA levels and some wellbeing indicators, perceptions of work-related psychological experiences were largely equivalent across genders in this sample.

Significant gender differences were also observed in productivity-related outcomes, particularly in measures of presenteeism and associated costs. Women reported fewer days lost due to presenteeism ($M = 1.27$ vs. 1.95 days; $p = .006$), and incurred lower productivity costs as a result ($M = \text{€}71.8$ vs. $\text{€}108.6$; $p = .019$), with effect sizes of 0.073 and 0.059 , respectively. Furthermore, the total cost of lost productivity, aggregating both absenteeism and presenteeism, was significantly lower for women ($M = \text{€}108.5$ vs. $\text{€}250.4$), with a small but meaningful effect size (0.084). Although absenteeism-related differences (e.g., days lost, time absent, or costs) were also statistically significant, effect sizes in these cases were minimal (≤ 0.047), suggesting that gender-based differences in absenteeism may have limited practical implications.

Table 6. Comparison of study variables by gender.

Variable	Woman		Man		Statistic	p	Effect Size
	M	SD	M	SD			
Physical activity							
Work VA frequency (days/week)	0.37	1.2	0.17	0.8	147520	<.001	-0.049
Work VA time (min/day)	8.02	35.5	3.97	25.3	147529	<.001	-0.049
Work MA frequency (days/week)	0.93	1.8	0.61	1.6	141873	<.001	-0.085
Work MA time (min/day)	18.13	43.6	14.69	49.3	142702	<.001	-0.080
Walk or bicycle frequency (days/week)	3.42	2.8	3.41	2.8	155084	0.980	0.001
Walk or bicycle time (min/day)	35.68	54.2	28.86	32.4	150949	0.423	-0.027
Recreational VA frequency (days/week)	2.31	2.0	1.74	1.7	131288	<.001	-0.154

Recreational VA time (min/day)	52.34	54.2	39.14	46.0	131792	<.001	-0.150
Recreational MA frequency (days/week)	2.14	2.1	1.99	1.9	151561	0.492	-0.023
Recreational MA time (min/day)	45.28	56.5	41.37	45.0	154264	0.858	-0.006
Sitting time (min/day)	302.12	165.1	330.64	159.9	139874	0.003	0.098
Total minutes of PA per day	159.44	132.8	128.03	107.2	133548	<.001	-0.139
Total minutes PA per week	631.25	635.2	471.28	488.6	130366	<.001	-0.160
Work VA METS	258.44	1085.4	118.65	830.6	147483	<.001	-0.049
Work MA METS	303.58	830.5	256.32	1062.4	142474	<.001	-0.082
Walk or bicycle METS	774.17	1261.2	635.39	825.5	151478	0.483	-0.024
Recreational VA METS	1461.38	1860.4	917.64	1238.6	129811	<.001	-0.163
Recreational MA METS	587.34	820.3	475.25	689.6	150333	0.362	-0.031
Total PA METS per week	3384.91	3419.7	2403.26	2488.3	126468	<.001	-0.185
Total work activity METS	562.02	1596.4	374.97	1560.5	141179	<.001	-0.090
Total recreational activity METS	2822.89	2773.7	2028.29	1848.6	129586	<.001	-0.165
Total happiness score	3.61	0.8	3.55	0.8	148037	0.188	-0.046
Engagement	3.64	0.8	3.56	0.8	146982	0.128	-0.053
Work satisfaction	3.50	0.9	3.48	0.9	152947	0.675	-0.014
Affective commitment	3.69	1.1	3.60	1.1	148008	0.183	-0.046
Well-being level	61.14	18.5	58.20	19.1	141164	0.010	-0.090
Productivity							
Presenteeism (days lost)	1.27	3.7	1.95	4.6	143734	0.006	0.073
Costs of lost productivity due to short-term presenteeism	71.83	297.1	108.63	362.7	146010	0.019	0.059
Lost productivity	15.02	30.8	20.28	34.3	144044	0.007	0.071
Absenteeism. Absence from paid work	28.98	206.9	114.09	739.6	147993	0.003	0.046
Absenteeism (days lost)	0.05	0.2	0.10	0.3	147880	0.005	0.047
Costs of lost productivity due to short-term absenteeism	7.67	91.8	27.70	406.8	154678	0.590	0.003
Total lost productivity cost	108.48	376.1	250.42	931.2	142073	0.002	0.084

Note: Effect size: rank biserial correlation; 0.10: low effect, 0.30: medium effect, 0.50: large effect

Table 7 presents gender-based comparisons of categorical variables related to PA, psychological wellbeing, and work-related attitudes. Several statistically significant differences emerged, particularly in levels of PA and mental wellbeing, although all observed effect sizes were small (Cramér's $V < 0.10$), indicating limited practical magnitude despite statistical relevance.

Women were significantly more likely than men to meet the recommended threshold of ≥ 1200 MET-minutes per week for total PA, with only 24.5% of women classified as low-active compared to 35.0% of men ($\chi^2 = 11.3$, $p < .001$, Cramér's $V = 0.099$). A similar pattern was observed for recreational PA, where 28.9% of women were below the 1200 MET threshold, versus 38.5% of men ($\chi^2 = 10.9$, $p < .001$, $V = 0.097$), again suggesting greater engagement among women in leisure-time PA. Although work-related PA was generally low across both genders, the proportion of men below the threshold

(93.1%) was higher than that of women (87.6%), with the difference reaching statistical significance ($\chi^2 = 10.0$, $p = .002$, $V = 0.093$).

In contrast, gender differences in psychological and occupational wellbeing were minimal. For instance, the distribution of high vs. low happiness, work engagement, job satisfaction, and affective commitment did not differ significantly between men and women. All associated effect sizes were negligible (Cramér's V values ranging from 0.001 to 0.050) suggesting that both genders reported comparable levels of affective workplace experiences, regardless of PA disparities.

A notable exception was observed in WHO-5 wellbeing, where 31.7% of men were classified as at risk for depression, compared to 25.2% of women ($\chi^2 = 5.54$, $p = .019$, $V = 0.069$). Although still a small effect, this difference reinforces the previously reported trend of slightly better subjective wellbeing among women, potentially linked to higher engagement in health-promoting behaviours such as PA.

Table 7. Descriptive statistics of physical activity by gender.

Variables		Total		Woman		Man		χ^2	df	p	Effect size
		N	%	N	%	N	%				
Total PA MET	Less 1200 METs	204	17.5	107	24.5	249	35.0	11.3	1	<0.001	0.099
	More 1200 METs	960	82.5	329	75.5	463	65.0				
Work PA MET	Less 1200 METs	1007	86.5	382	87.6	663	93.1	10.0	1	0.002	0.093
	More 1200 METs	157	13.5	54	12.4	49	6.9				
Recreational PA MET	Less 1200 METs	226	19.4	126	28.9	274	38.5	10.9	1	<0.001	0.097
	More 1200 METs	938	80.6	310	71.1	438	61.5				
SHAW - Happiness	Low happiness	835	71.7	105	24.1	184	25.8	0.445	1	0.505	0.019
	High happiness	329	28.3	331	75.9	528	74.2				
SHAW - Engagement	Low engagement	365	31.4	120	27.5	230	32.3	2.92	1	0.088	0.050
	High engagement	799	68.6	316	72.5	482	67.7				
SHAW - Work satisfaction	Low satisfaction	1060	91.1	145	33.3	236	33.1	0.001	1	0.969	0.001
	High satisfaction	104	8.9	291	66.7	476	66.9				
SHAW - Affective commitment	Low commitment	410	35.2	138	31.7	234	32.9	0.182	1	0.670	0.012
	High commitment	754	64.8	298	68.3	478	67.1				
WHO-5 wellbeing	Depression (risk)	1062	91.2	110	25.2	226	31.7	5.54	1	0.019	0.069
	Wellbeing	102	8.8	326	74.8	486	68.3				

Note: Effect size: Cramer's V ; 0.10: low effect, 0.30: medium effect, 0.50: large effect

4.2.2. Age

Table 8 reports the comparative analysis of quantitative variables by age group, highlighting significant differences in PA, wellbeing, and productivity outcomes. Although many variables reached statistical significance, the effect sizes (ϵ^2) were generally small, indicating modest practical

relevance. Still, several consistent patterns emerged across the age spectrum, particularly in PA behaviours and workplace attitudes.

In the domain of PA, age differences were most pronounced in recreational vigorous activity. Participants aged 26–30 years reported the highest frequency ($M = 3.11$ days/week) and duration ($M = 60.31$ minutes/day), while those aged 60 or more reported the lowest frequency ($M = 1.43$ days/week). These differences were statistically significant ($p < .001$) with effect sizes of $\epsilon^2 = 0.067$ (frequency) and $\epsilon^2 = 0.041$ (duration), representing the largest effects observed in the dataset. Total recreational MET expenditure also differed significantly by age ($p < .001$, $\epsilon^2 = 0.054$), with younger participants, particularly those under 30, reporting greater energy expenditure.

Moderate occupational activity also showed age-related variation, with older adults (≥ 60) reporting more frequent engagement ($M = 1.18$ days/week) and longer durations ($M = 21.49$ min/day), compared to younger age groups. These findings were statistically significant ($p < .001$), although effect sizes remained small ($\epsilon^2 = 0.022$ for frequency; 0.020 for duration). Overall, the youngest and oldest participants appeared more active in certain domains, while middle-aged groups (31–50) were comparatively less active.

Regarding sitting time, a significant trend was observed across age groups ($p < .001$, $\epsilon^2 = 0.030$). Participants aged 31–40 spent the most time sitting ($M = 344.2$ min/day), whereas those over 60 reported substantially less sedentary time ($M = 282.7$ min/day), suggesting a possible shift in lifestyle or work patterns post-retirement or with reduced workload.

Age-related differences also emerged in psychological variables. Total happiness scores increased with age, ranging from $M = 3.22$ among 26–30-year-olds to $M = 3.71$ in those over 60, with a small-to-moderate effect size ($\epsilon^2 = 0.037$). Similarly, affective organisational commitment followed a clear positive trend with age: younger participants (under 30) reported lower levels ($M = 2.99$ – 3.17), whereas older groups (51–60 and 60+) reported significantly higher commitment ($M = 3.74$ and 3.95 , respectively), with $\epsilon^2 = 0.056$, the second-largest effect in the analysis. These patterns may reflect increased emotional investment and satisfaction with career stability in older adults.

Significant but small age-related differences were also found for total work satisfaction ($\epsilon^2 = 0.025$) and engagement ($\epsilon^2 = 0.012$), both increasing with age. Interestingly, the WHO-5 wellbeing index showed a slight upward trend ($p = 0.099$), with wellbeing scores peaking in the oldest group, though the effect size was minimal ($\epsilon^2 = 0.009$).

In the domain of productivity, notable differences were seen in costs of lost productivity due to presenteeism ($p = .001$, $\epsilon^2 = 0.019$) and total productivity loss ($p = .003$, $\epsilon^2 = 0.017$). Younger adults (26–30) reported the highest presenteeism-related costs ($M = €152.84$), while the lowest costs were

observed in the 60+ group ($M = €51.39$). This trend may reflect greater physical resilience in younger age groups offset by more workplace pressure or expectations, leading to higher presenteeism. On the other hand, total lost productivity costs followed a U-shaped curve, with middle-aged participants (41–60) showing higher costs compared to the youngest and oldest groups. Absenteeism variables, including days lost and associated costs, showed no significant variation across age, and all associated effect sizes were negligible ($\epsilon^2 < 0.005$), suggesting that absenteeism patterns remain stable across the lifespan in this sample.

Table 9 presents a comparative analysis of categorical variables by age group, focusing on PA levels, happiness, work engagement, satisfaction, affective commitment, and wellbeing. Several statistically significant differences were observed, particularly in relation to PA and organisational attitudes. Although most effect sizes were within the low range, some approached the threshold for practical significance, notably in recreational activity and affective commitment.

The proportion of participants meeting the recommended ≥ 1200 MET-minutes per week of total PA varied significantly across age groups ($\chi^2 = 24.4$, $p < .001$, Cramér's $V = 0.145$). Younger adults aged 26–30 years had the highest proportion of active individuals (89.7%), while the lowest rates were observed among those aged 31–60+, where approximately one-third of participants were categorised as low-active. A similar pattern was evident for recreational PA, where activity levels declined progressively with age ($\chi^2 = 25.2$, $p < .001$, $V = 0.147$). Notably, only 13.4% of participants aged 26–30 years were below the recreational MET threshold, compared to over 40% among those aged 60 and above.

Although differences in work-related PA were not statistically significant ($p = 0.063$), the data suggest a subtle increase in the proportion of participants meeting occupational MET guidelines with age—rising from 7.1% among those under 25 to 9.7% in the 60+ group. However, the effect size was small ($V = 0.101$) and the practical implications limited.

Significant age-related differences were also observed in work satisfaction ($\chi^2 = 16.6$, $p = .011$, $V = 0.120$) and especially in affective organisational commitment ($\chi^2 = 35.4$, $p < .001$, $V = 0.174$). The youngest participants (under 25 and 26–30 years) reported the lowest levels of commitment, with only 50% classified as highly committed, compared to over 70% in participants aged 41 and above. This suggests a meaningful shift in organisational attachment with age, potentially driven by greater career stability, tenure, or alignment with long-term organisational values among older workers.

Table 8. Comparative analysis of quantitative variables by age.

Variable	Less than 25 years		26-30 years		31-40 years		41-50 years		51-60 years		60 years or more		χ^2	df	p	ε^2
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD				
Physical activity																
Work VA frequency (days/week)	0.20	1.0	0.29	1.0	0.20	0.9	0.25	1.0	0.24	1.0	0.18	0.8	7.76	6	0.256	0.00668
Work VA time (min/day)	3.75	21.5	9.79	51.6	3.75	16.7	5.49	26.8	5.65	32.6	1.98	11.1	9.88	6	0.130	0.00849
Work MA frequency (days/week)	0.71	1.6	0.46	1.2	0.57	1.5	0.65	1.6	0.69	1.6	1.18	2.0	25.78	6	<.001	0.02217
Work MA time (min/day)	14.73	36.8	12.73	52.9	13.45	40.3	13.77	43.5	15.88	49.9	21.49	53.4	23.41	6	<.001	0.02013
Walk or bicycle frequency (days/week)	3.25	2.7	4.01	2.8	3.37	2.9	3.23	2.8	3.37	2.8	3.87	2.8	11.80	6	0.067	0.01014
Walk or bicycle time (min/day)	28.13	33.1	31.60	31.4	29.84	45.2	29.91	40.7	28.93	32.6	40.45	52.5	9.54	6	0.145	0.00821
Recreational VA frequency (days/week)	2.59	2.0	3.11	1.8	2.19	1.7	1.97	1.9	1.50	1.7	1.43	1.8	77.66	6	<.001	0.06678
Recreational VA time (min/day)	54.82	49.6	60.31	43.1	46.22	41.7	44.33	48.5	37.74	46.6	37.01	54.4	47.34	6	<.001	0.04071
Recreational MA frequency (days/week)	1.95	2.0	2.10	2.0	2.00	2.0	1.90	1.9	2.12	1.9	2.30	2.1	5.71	6	0.456	0.00491
Recreational MA time (min/day)	48.39	51.4	40.41	36.8	36.90	40.3	42.20	56.2	41.14	38.9	47.16	55.9	6.18	6	0.403	0.00532
Sitting time (min/day)	332.23	168.7	339.59	149.1	344.16	157.6	323.49	165.6	328.68	156.8	282.69	160.1	34.50	6	<.001	0.02966
Total minutes of PA per day	149.82	120.5	154.85	101.0	130.16	108.9	135.69	119.3	129.33	106.7	148.10	138.8	15.31	6	0.018	0.01316
Total minutes PA per week	171.43	1008.6	190.52	808.9	103.04	479.0	185.37	948.4	196.48	1224.4	59.40	333.1	19.84	6	0.003	0.01706
Work VA METS	256.07	745.9	194.23	1032.6	232.72	835.2	241.10	967.0	270.94	941.5	380.45	1282.5	9.75	6	0.135	0.00839
Work MA METS	609.29	792.0	753.40	839.9	666.52	1179.9	655.67	1030.3	620.59	811.5	875.82	1091.5	24.13	6	<.001	0.02075
Walk or bicycle METS	1747.86	2279.9	1807.01	1700.3	1111.30	1153.2	1103.66	1468.8	825.02	1129.2	963.88	1632.3	10.00	6	0.125	0.00859
Recreational VA METS	640.00	1104.4	498.97	595.2	435.43	554.1	489.27	851.5	481.17	530.8	633.58	767.0	62.97	6	<.001	0.05415
Recreational MA METS	3424.64	4143.2	3444.12	2534.7	2549.02	2548.8	2675.06	2985.0	2394.20	2539.3	2913.13	2962.6	7.24	6	0.299	0.00623
Total PA METS per week	427.50	1607.5	384.74	1625.0	335.76	1197.0	426.46	1547.8	467.43	1801.5	439.85	1348.4	25.19	6	<.001	0.02166
Total work activity METS	2997.14	3359.7	3059.38	2180.6	2213.26	2038.8	2248.60	2238.0	1926.78	1656.7	2473.28	2624.5	24.57	6	<.001	0.02112
Total recreational activity METS	616.25	712.9	611.34	467.9	485.46	525.4	507.64	570.1	470.86	474.7	600.37	598.4	27.21	6	<.001	0.02340

Table 8. Comparative analysis of quantitative variables by age.

Total happiness score	3.31	0.8	3.22	0.8	3.46	0.7	3.63	0.8	3.62	0.8	3.71	0.8	42.85	6	<.001	0.03684
Engagement	3.58	0.9	3.38	0.8	3.50	0.8	3.63	0.8	3.59	0.8	3.61	0.9	14.50	6	0.025	0.01247
Work satisfaction	3.35	0.8	3.10	0.9	3.43	0.8	3.56	0.9	3.53	0.9	3.58	0.9	28.95	6	<.001	0.02490
Affective commitment	2.99	1.1	3.17	1.1	3.46	1.0	3.71	1.0	3.74	1.0	3.95	1.1	64.60	6	<.001	0.05555
Well-being level	58.86	18.3	57.20	17.9	56.89	18.9	58.95	17.8	60.30	20.7	60.78	17.3	10.67	6	0.099	0.00917
Productivity																
Presenteeism (days lost)	1.02	2.9	1.91	4.2	1.86	4.7	1.72	4.1	1.90	4.9	1.24	3.4	11.20	6	0.082	0.00963
Costs of lost productivity due to short-term presenteeism	34.18	117.5	152.84	414.2	112.37	329.8	82.67	244.5	108.95	453.9	51.39	249.6	22.31	6	0.001	0.01918
Lost productivity	17.86	33.9	19.69	30.6	22.45	34.6	18.69	33.4	17.26	33.5	15.00	32.5	10.01	6	0.124	0.00861
Absenteeism. Absence from paid work	102.52	729.4	34.85	143.4	42.20	189.5	107.81	734.5	54.84	415.9	59.64	386.2	3.92	6	0.687	0.00337
Absenteeism (days lost)	8.14	60.9	5.77	56.9	47.17	639.9	25.80	341.1	10.58	141.4	8.96	103.7	5.47	6	0.485	0.00470
Costs of lost productivity due to short-term absenteeism	0.05	0.2	0.09	0.3	0.09	0.3	0.10	0.3	0.07	0.3	0.04	0.2	3.20	6	0.783	0.00275
Total lost productivity cost	144.84	776.5	193.46	480.5	201.74	734.9	216.28	846.4	174.37	667.2	119.98	516.0	19.90	6	0.003	0.01711

Note: Effect size: *H de Kruskal-Wallis*; 0.04: small effect, 0.25: medium effect, 0.64: large effect.

Table 9. Comparative analysis of qualitative variables by age.

Variables		-25 years		26-30 years		31-40 years		41-50 years		51-60 years		60+ years		χ ²	df	p	Effect size
		N	%	N	%	N	%	N	%	N	%	N	%				
Total PA	Less 1200 METs	15	26.8	10	10.3	58	31.5	117	35.7	100	32.6	47	35.1	24.4	6	<0.001	0.145
MET	More 1200 METs	41	73.2	87	89.7	126	68.5	211	64.3	207	67.4	87	64.9				
Work PA	Less 1200 METs	52	92.9	91	93.8	171	92.9	300	91.5	279	90.9	121	90.3	11,9	6	0.063	0.101
MET	More 1200 METs	4	7.1	6	6.2	13	7.1	28	8.5	28	9.1	13	9.7				
Recreational PA	Less 1200 METs	18	32.1	13	13.4	63	34.2	126	38.4	111	36.2	54	40.3	25.2	6	<0.001	0.147
MET	More 1200 METs	38	67.9	84	86.6	121	65.8	202	61.6	196	63.8	80	59.7				
SHAW - Happiness	Low happiness	17	30.4	35	36.1	52	28.3	80	24.4	67	21.8	28	20.9	11.1	6	0.086	0.097
	High happiness	39	69.6	62	63.9	132	71.7	248	75.6	240	78.2	106	79.1				
Engagement	Low engagement	15	26.8	33	34.0	68	37.0	93	28.4	96	31.3	39	29.1	6.51	6	0.368	0.074
	High engagement	41	73.2	64	66.0	116	63.0	235	71.6	211	68.7	95	70.9				
Work satisfaction	Low satisfaction	19	33.9	49	50.5	66	35.9	99	30.2	99	32.2	40	29.9	16.6	6	0.011	0.120
	High satisfaction	37	66.1	48	49.5	118	64.1	229	69.8	208	67.8	94	70.1				

Affective commitment	Low commitment	28	50.0	48	49.5	72	39.1	91	27.7	91	29.6	30	22.4	35.4	6	<0.001	0.174
	High commitment	28	50.0	49	50.5	112	60.9	237	72.3	216	70.4	104	77.6				
WHO-5 wellbeing	Depression (risk)	16	28.6	32	33.0	63	34.2	105	32.0	81	26.4	31	23.1	7.99	6	0.239	0.082
	Wellbeing	40	71.4	65	67.0	121	65.8	223	68.0	226	73.6	103	76.9				

Note: Effect size: Cramer's V; 0.10: low effect, 0.30: medium effect, 0.50: large effect

Table 10. Comparative analysis of quantitative variables by region.

Variables	North		South		Central/West		East		X ²	df	p	ε ²
	M	SD	M	SD	M	SD	M	SD				
Physical activity												
Work VA frequency (days/week)	0.05	0.4	0.12	0.7	0.15	0.8	0.89	1.9	73.46	3	<.001	0.06317
Work VA time (min/day)	1.67	13.2	3.40	26.5	3.20	18.8	18.11	49.3	65.48	3	<.001	0.05630
Work MA frequency (days/week)	0.57	1.6	0.60	1.5	0.46	1.4	1.73	2.3	68.80	3	<.001	0.05915
Work MA time (min/day)	11.35	36.6	12.88	41.5	8.86	36.5	40.22	70.9	67.74	3	<.001	0.05825
Walk or bicycle frequency (days/week)	2.76	2.9	3.50	2.8	2.99	2.8	4.14	2.6	22.75	3	<.001	0.01956
Walk or bicycle time (min/day)	24.37	28.0	29.86	38.7	29.29	47.8	42.44	43.9	23.67	3	<.001	0.02035
Recreational VA frequency (days/week)	2.60	1.8	1.92	1.9	1.90	1.6	1.88	1.9	10.13	3	0.018	0.00871
Recreational VA time (min/day)	46.03	47.0	40.01	45.7	54.43	60.0	38.42	41.4	18.19	3	<.001	0.01564
Recreational MA frequency (days/week)	3.33	2.2	2.03	2.0	1.85	1.8	2.00	2.0	26.04	3	<.001	0.02239
Recreational MA time (min/day)	52.54	59.9	40.89	49.1	47.68	52.5	36.19	39.2	8.48	3	0.037	0.00729
Sitting time (min/day)	361.43	133.0	300.13	167.3	384.57	132.2	258.42	165.6	85.89	3	<.001	0.07385
Total minutes of PA per day	135.95	100.1	127.04	108.1	143.47	115.1	175.39	152.1	15.28	3	0.002	0.01314
Total minutes PA per week	40.00	317.5	91.99	719.8	79.87	435.4	642.22	1806.7	19.71	3	<.001	0.01695
Work VA METS	200.32	736.1	210.93	882.0	128.20	625.2	756.89	1545.9	66.60	3	<.001	0.05727
Work MA METS	516.51	667.7	660.40	988.7	610.16	1006.9	962.56	1141.2	69.82	3	<.001	0.06003
Walk or bicycle METS	1267.94	1472.0	1071.39	1449.3	1246.31	1790.7	992.00	1231.7	25.94	3	<.001	0.02231
Recreational VA METS	866.67	1359.6	510.36	712.2	487.13	687.1	454.11	568.7	6.57	3	0.087	0.00565
Recreational MA METS	2891.43	2533.9	2545.07	2618.8	2551.67	2587.5	3807.78	4060.8	9.74	3	0.021	0.00837
Total PA METS per week	240.32	833.5	302.91	1264.4	208.08	912.0	1399.11	2788.1	13.78	3	0.003	0.01185
Total work activity METS	2651.11	2244.9	2242.15	2227.5	2343.60	2387.2	2408.67	2222.5	78.49	3	<.001	0.06749
Total recreational activity METS	559.37	503.3	490.84	500.0	472.15	476.7	747.67	771.7	3.67	3	0.300	0.00315
Total happiness score												
Engagement	3.67	0.7	3.59	0.8	3.30	0.8	3.93	0.7	72.61	3	<.001	0.06243
Work satisfaction	3.74	0.8	3.52	0.8	3.39	0.9	4.08	0.8	83.81	3	<.001	0.07206
Affective commitment	3.69	0.8	3.50	0.9	3.27	0.8	3.77	0.8	43.38	3	<.001	0.03730
Well-being level	3.59	1.0	3.75	1.1	3.26	1.1	3.94	0.9	59.87	3	<.001	0.05148
Well-being level												
Presenteeism (days lost)	61.40	15.9	58.21	19.4	58.42	17.8	63.29	19.5	10.74	3	0.013	0.00924
Productivity												
Presenteeism (days lost)	1.13	2.5	1.47	4.0	2.35	5.1	1.47	3.8	11.16	3	0.011	0.00960

Table 10. Comparative analysis of quantitative variables by region.

Costs of lost productivity due to short-term presenteeism	120.03	319.9	55.00	181.7	199.48	559.9	32.91	114.8	14.93	3	0.002	0.01284
Lost productivity	19.68	33.6	15.93	31.6	22.84	35.7	17.33	32.8	9.29	3	0.026	0.00799
Absenteeism. Absence from paid work	193.86	476.3	48.68	356.1	151.16	995.6	24.06	113.8	15.78	3	0.001	0.01357
Absenteeism (days lost)	0.00	0.0	5.59	96.9	61.20	603.2	1.60	21.5	11.29	3	0.010	0.00970
Costs of lost productivity due to short-term absenteeism	0.19	0.4	0.07	0.3	0.08	0.3	0.08	0.3	8.08	3	0.044	0.00695
Total lost productivity cost	313.89	673.0	109.27	426.6	411.84	1279.4	58.57	177.1	24.87	3	<.001	0.02139

Note: Effect size: *H* de Kruskal-Wallis; 0.04: small effect, 0.25: medium effect, 0.64: large effect.

Table 11. Comparative analysis of qualitative variables by region.

Variables		North		South		Central/West		East		X ²	df	p	Effect size
		N	%	N	%	N	%	N	%				
Total PA MET	Less than 1200 METs	16	25.4	195	32.3	108	34.1	46	25.6	27.6	3	<0.001	0.154
	More than 1200 METs	47	74.6	409	67.7	209	65.9	134	74.4				
Work PA MET	Less than 1200 METs	59	93.7	569	94.2	301	95.0	131	72.8	87.7	3	<0.001	0.275
	More than 1200 METs	4	6.3	35	5.8	16	5.0	49	27.2				
Recreational PA MET	Less than 1200 METs	17	27.0	217	35.9	115	36.3	61	33.9	2.30	3	0.512	0.044
	More than 1200 METs	46	73.0	387	64.1	202	63.7	119	66.1				
SHAW - Happiness	Low happiness	12	19.0	148	24.5	112	35.3	22	12.2	34.7	3	<0.001	0.173
	High happiness	51	81.0	456	75.5	205	64.7	158	87.8				
Engagement	Low engagement	16	25.4	195	32.3	121	38.2	26	14.4	32.2	3	<0.001	0.166
	High engagement	47	74.6	409	67.7	196	61.8	154	85.6				
Work satisfaction	Low work satisfaction	16	25.4	203	33.6	128	40.4	41	22.8	17.9	3	<0.001	0.124
	High work satisfaction	47	74.6	401	66.4	189	59.6	139	77.2				
Affective commitment	Low affective commitment	21	33.3	170	28.1	146	46.1	40	22.2	40.5	3	<0.001	0.187
	High affective commitment	42	66.7	434	71.9	171	53.9	140	77.8				
WHO-5 wellbeing level	Depression (risk)	15	23.8	188	31.1	97	30.6	43	23.9	4.66	3	0.198	0.063
	Wellbeing	48	76.2	416	68.9	220	69.4	137	76.1				

Note: Effect size: Cramer's V; 0.10: low effect, 0.30: medium effect, 0.50: large effect

While differences in happiness were not statistically significant ($p = .086$), a positive trend was observed: high happiness levels increased steadily with age, from 63.9% in the 26–30 group to 79.1% among participants aged 60+, though the effect size remained small ($V = 0.097$). Similarly, no significant differences were found in work engagement ($p = .368$) or WHO-5 wellbeing categories ($p = .239$), with all effect sizes falling below the 0.10 threshold. Nevertheless, wellbeing and engagement scores followed age-related trends consistent with prior analyses, with slightly more favourable distributions in older groups.

4.2.3. European region

Table 10 presents a regional comparative analysis of PA, wellbeing, and productivity-related quantitative variables, highlighting statistically significant differences across the North, South, Central/Western, and Eastern European regions. While all effect sizes (ϵ^2) fall within the small range, several patterns emerge with practical relevance, particularly in occupational PA, sitting time, psychological outcomes, and productivity costs.

The most pronounced regional differences were found in work-related PA, where participants from Eastern Europe reported substantially higher engagement than those from other regions. Specifically, Eastern Europeans showed the highest frequency and duration of both vigorous ($M = 0.89$ days/week; 18.1 min/day) and moderate activity ($M = 1.73$ days/week; 40.2 min/day), with all comparisons reaching strong statistical significance ($p < .001$) and effect sizes between $\epsilon^2 = 0.056$ – 0.063 —among the largest in this analysis. In contrast, respondents from Northern and Central/Western Europe reported the lowest levels of work-related PA, suggesting differing occupational demands across regions.

For walking or cycling, Eastern European participants again reported the highest frequency ($M = 4.14$ days/week) and duration ($M = 42.4$ min/day), whereas participants in the North and West were below the sample average. Although effect sizes were smaller ($\epsilon^2 \approx 0.02$), these findings reflect more active commuting behaviours in Eastern contexts. Interestingly, recreational moderate activity was highest in Northern Europe ($M = 3.33$ days/week), with corresponding METs also elevated ($M = 2,891.4$), whereas Southern and Eastern regions reported lower engagement. Differences in recreational vigorous activity were smaller in magnitude ($\epsilon^2 = 0.008$ – 0.015) but statistically significant ($p < .05$), with Western participants reporting the highest duration ($M = 54.4$ min/day), contrasting with lower values in the East.

Overall total PA was highest in Eastern Europe, with an average of 175.4 minutes per day and 642.2 minutes per week, and the highest total METs per week ($M = 1,399.1$), far exceeding the other

regions ($p < .001$, $\epsilon^2 = 0.012\text{--}0.022$). This again underscores the elevated activity patterns observed in Eastern countries, possibly due to more physically demanding work and transportation practices.

Sitting time differed substantially by region ($p < .001$, $\epsilon^2 = 0.074$), with Central/Western Europe reporting the highest levels ($M = 384.6$ min/day*) and Eastern Europe the lowest ($M = 258.4$ min/day*). This difference likely reflects both occupational roles and transport practices, further reinforcing the active profile of Eastern participants.

Psychological indicators also showed significant regional variation. Participants in Eastern Europe reported the highest total happiness ($M = 3.93$), engagement ($M = 4.08$), and work satisfaction ($M = 3.77$), with the strongest effects observed in engagement ($\epsilon^2 = 0.072$) and happiness ($\epsilon^2 = 0.062$). By contrast, Central/Western Europe consistently reported the lowest scores across all indicators, including affective commitment ($M = 3.26^*$) and wellbeing ($M = 58.4^*$). These results suggest that despite lower recreational activity, Eastern European respondents may derive greater psychological reward or fulfilment from their work contexts.

Significant regional differences also emerged in presenteeism, absenteeism, and total productivity loss. Central/Western Europe showed the highest costs of presenteeism ($M = \text{€}199.48$) and total productivity loss ($M = \text{€}411.84$), while Eastern Europe showed the lowest ($\text{€}32.91$ and $\text{€}58.57$, respectively), with all differences statistically significant ($p < .01$) and small but meaningful effects (ϵ^2 up to 0.021). Northern and Southern regions occupied intermediate positions. Interestingly, absenteeism was markedly higher in Central/Western Europe ($M = 61.2$ days lost*), compared to negligible values in the North ($M = 0.0$) and East ($M = 1.6$), suggesting regional discrepancies in leave-taking culture, job security, or health status.

Table 11 presents a comparative analysis of categorical variables related to PA levels, psychological wellbeing, and work engagement across four European regions (North, South, Central/West, and East). Statistically significant differences were found across several indicators, with effect sizes ranging from low to moderate. The most pronounced difference was observed in work-related PA. Participants from Eastern Europe demonstrated considerably higher levels of engagement in moderate-to-vigorous occupational activity, with 27.2% exceeding the 1,200 METs per week threshold. This contrasts with only 5–6% in the remaining regions. The difference was statistically significant ($p < .001$) and presented a moderate effect size (Cramer's $V = 0.275$), suggesting greater physical demands in the Eastern region's work environments.

Total weekly PA also revealed notable regional disparities ($p < .001$, $V = 0.154$). A higher proportion of participants from Southern and Central/Western Europe fell below the 1,200 METs threshold (32–34%), whereas the North and East showed more favourable distributions, with only 25–26% below this cut-off. Interestingly, recreational PA did not differ significantly by region ($p = 0.512$,

$V = 0.044$), suggesting that leisure-time exercise habits are more evenly distributed across Europe, regardless of work-related physical demands.

In terms of psychological wellbeing and engagement, regional disparities were evident. Perceived happiness differed significantly across regions ($p < .001$, $V = 0.173$). Central/Western Europe showed the highest proportion of individuals reporting low happiness (35.3%), whereas Eastern Europe displayed the most favourable outcome, with 87.8% of participants scoring in the high-happiness range. A similar pattern emerged in work engagement ($p < .001$, $V = 0.166$). Eastern Europe again reported the highest levels of highly engaged workers (85.6%), while Central/Western Europe had the lowest (61.8%). These findings align with previous quantitative results and point to stronger motivational and affective connections to work in the East.

Work satisfaction also varied significantly by region ($p < .001$, $V = 0.124$). Central/Western Europe reported the lowest satisfaction levels, with 40.4% of participants indicating low work satisfaction, while the East showed the highest levels, with 77.2% of participants expressing high satisfaction. Affective commitment followed a similar trend ($p < .001$, $V = 0.187$). The Central/West region once again had the lowest scores (46.1% low commitment), whereas Eastern Europe reported the highest levels (77.8% high commitment). These consistent trends suggest that workers in Eastern Europe not only engage more physically at work but also report higher affective ties, greater satisfaction, and stronger psychological engagement compared to other regions.

Although no statistically significant differences were found in the WHO-5 wellbeing scale ($p = 0.198$, $V = 0.063$), the data indicated a trend. Northern and Eastern regions showed better psychological wellbeing, with 76.1–76.2% of participants above the depression-risk threshold. In contrast, Southern and Central/Western regions had slightly higher proportions at risk of depression, suggesting a possible influence of contextual and occupational factors on mental health.

4.2.4. Educational level

Table 12 presents a comparative analysis of PA, wellbeing, and productivity indicators based on educational attainment, distinguishing between individuals with and without postgraduate studies. While most variables did not show statistically significant differences, several relevant distinctions emerged, particularly in relation to recreational PA and psychosocial outcomes, albeit with small effect sizes.

Participants with postgraduate studies reported significantly higher frequency of vigorous recreational PA ($p = .003$, $r = 0.098$) and greater energy expenditure in recreational vigorous METs ($p = .015$, $r = 0.080$), suggesting that higher educational attainment may be associated with more active leisure-time habits. Additionally, the total recreational activity METs were significantly higher among postgraduates ($p = .021$, $r = 0.078$), supporting this trend. These differences, although modest,

suggest that individuals with higher education levels may be more likely to engage in structured or intense recreational PA, possibly due to better health literacy or greater access to resources.

Regarding wellbeing indicators, individuals with postgraduate studies showed significantly higher happiness scores ($p = .004$, $r = 0.097$), greater engagement ($p = .006$, $r = 0.092$), and higher job satisfaction ($p = .003$, $r = 0.101$), all with small effect sizes. These results suggest a consistent pattern linking higher educational attainment with more favourable psychosocial work-related outcomes. Affective commitment to the organisation was also marginally higher among postgraduates ($p = .077$, $r = 0.059$), though this did not reach conventional statistical significance.

Interestingly, sitting time was slightly lower among the postgraduate group, and total PA METs per week were marginally higher, although these differences did not reach significance. Similarly, no relevant differences were observed in most productivity measures, including presenteeism, absenteeism, and their associated costs, indicating that education level may be more strongly linked to behavioural and attitudinal dimensions (e.g. engagement and wellbeing) than to concrete productivity outcomes.

Table 12. Comparison of quantitative variables by educational level.

Variable	No postgraduated studies		Postgraduated studies		Statistic	p	Effect Size
	M	SD	M	SD			
Physical activity							
Work VA frequency (days/week)	0.19	0.9	0.29	1.1	163900	0.076	0.025
Work VA time (min/day)	4.65	27.7	6.27	31.0	164160	0.090	0.024
Work MA frequency (days/week)	0.78	1.7	0.69	1.6	164745	0.383	-0.020
Work MA time (min/day)	16.69	51.1	15.29	43.3	165777	0.539	-0.014
Walk or bicycle frequency (days/week)	3.31	2.8	3.51	2.8	160714	0.177	0.044
Walk or bicycle time (min/day)	29.84	39.7	32.63	43.8	161195	0.208	0.041
Recreational VA frequency (days/week)	1.78	1.8	2.09	1.9	151593	0.003	0.098
Recreational VA time (min/day)	42.98	54.6	44.90	45.4	157537	0.054	0.063
Recreational MA frequency (days/week)	2.01	1.9	2.08	2.0	165331	0.606	0.017
Recreational MA time (min/day)	44.31	54.1	41.24	45.2	164995	0.565	-0.019
Sitting time (min/day)	327.75	163.8	313.42	161.4	159591	0.115	-0.051
Total minutes of PA per day	138.47	120.1	140.33	117.3	165774	0.670	0.014
Total minutes PA per week	518.31	557.5	538.38	549.1	159512	0.128	0.051
Work VA METS	154.16	1012.8	185.21	858.2	164148	0.089	0.024
Work MA METS	294.42	1123.6	253.46	828.8	165492	0.493	-0.016
Walk or bicycle METS	644.42	943.2	720.60	1064.3	160984	0.196	0.042
Recreational VA METS	1086.8	1676.5	1143.2	1379.8	154712	0.015	0.080
Recreational MA METS	513.90	731.3	515.24	747.3	167829	0.946	-0.002
Total PA METS per week	2693.7	2983.3	2817.7	2845.5	157696	0.066	0.062

Table 12. Comparison of quantitative variables by educational level.

Total work activity METS	448.58	1735.8	438.67	1410.9	166894	0.744	-0.007
Total recreational activity METS	2245.2	2351.7	2379.0	2201.6	155073	0.021	0.078
Total happiness score	3.50	0.8	3.63	0.8	151823	0.004	0.097
Engagement	3.51	0.8	3.65	0.8	152641	0.006	0.092
Work satisfaction	3.41	0.9	3.56	0.9	151197	0.003	0.101
Affective commitment	3.59	1.0	3.67	1.1	158175	0.077	0.059
Well-being level	58.70	19.3	59.68	18.5	165728	0.663	0.014
Productivity							
Presenteeism (days lost)	1.64	4.3	1.73	4.3	165604	0.553	0.015
Costs of lost productivity due to short-term presenteeism	85.68	312.0	101.89	358.6	164026	0.308	0.024
Lost productivity	18.46	34.0	18.03	32.3	166901	0.765	0.007
Absenteeism. Absence from paid work	112.29	794.1	53.81	339.5	168118	0.971	-0.001
Absenteeism (days lost)	0.09	0.3	0.08	0.3	166346	0.490	-0.011
Costs of lost productivity due to short-term absenteeism	37.56	471.3	4.77	66.0	166442	0.089	-0.010
Total lost productivity cost	235.52	975.5	160.47	528.1	168002	0.962	-0.001

Note: Effect size: rank biserial correlation; 0.10: low effect, 0.30: medium effect, 0.50: large effect

4.2.5. Civil status

The comparison of quantitative variables by civil status (Table 13) reveals minimal but noteworthy differences in PA, psychological wellbeing, and productivity indicators between individuals who are single and those who are married or cohabiting. Although most differences show low statistical significance and small effect sizes, certain trends are evident. In terms of recreational PA, single individuals exhibit a slightly higher frequency and duration of vigorous activity compared to those in a relationship. Specifically, singles report significantly longer recreational vigorous activity time per day ($p = .041$, $r = -0.073$) and higher recreational vigorous METs ($p = .037$, $r = -0.075$), along with greater total recreational MET expenditure ($p = .040$, $r = -0.075$). While the overall differences are small, these findings suggest a modest association between being single and greater engagement in vigorous leisure activities.

Psychological indicators also show significant differences, particularly in happiness ($p = .032$, $r = 0.079$), affective commitment ($p = .006$, $r = 0.100$), and wellbeing level ($p = .044$, $r = 0.074$). Married or cohabiting individuals reported higher levels in all three measures, indicating that relationship status may have a modest positive impact on emotional attachment to work and overall psychological wellbeing. Although work satisfaction approached significance ($p = .096$, $r = 0.061$), and engagement did not differ significantly, the trend suggests a slightly more favourable psychosocial profile for partnered individuals.

Regarding productivity, no significant differences were found between groups in terms of presenteeism, absenteeism, or associated productivity losses. All productivity metrics, including total

lost productivity cost, showed minimal variation and negligible effect sizes, indicating that civil status is not a relevant factor in work productivity outcomes in this sample.

Table 13. Comparison of quantitative variables by civil status.

Variables	Single		Married/Cohabited		Statistic	p	Effect Size
	M	SD	M	SD			
Physical activity							
Work VA frequency (days/week)	0,26	1,0	0,24	1,0	139216	0.256	-0.017
Work VA time (min/day)	6,24	32,6	5,23	28,2	139153	0.236	-0.018
Work MA frequency (days/week)	0,64	1,6	0,77	1,7	136732	0.169	0.035
Work MA time (min/day)	14,21	45,0	16,66	47,9	136684	0.163	0.035
Walk or bicycle frequency (days/week)	3,62	2,7	3,33	2,8	134488	0.154	-0.051
Walk or bicycle time (min/day)	33,18	48,7	30,58	38,8	138420	0.516	-0.023
Recreational VA frequency (days/week)	2,10	1,9	1,88	1,8	133872	0.121	-0.055
Recreational VA time (min/day)	48,46	50,9	42,13	49,3	131368	0.041	-0.073
Recreational MA frequency (days/week)	2,09	2,0	2,03	1,9	141242	0.921	-0.003
Recreational MA time (min/day)	44,42	51,5	41,89	48,6	139856	0.712	-0.013
Sitting time (min/day)	322,75	165,0	318,82	161,7	139405	0.641	-0.016
Total minutes of PA per day	146,51	124,6	136,49	115,7	136198	0.290	-0.039
Total minutes PA per week	155,16	724,5	177,67	1007,7	133266	0.106	-0.059
Work VA METS	253,95	944,7	280,02	988,0	139224	0.249	-0.017
Work MA METS	722,19	1144,4	670,13	948,8	136611	0.157	0.036
Walk or bicycle METS	1283,80	1662,1	1046,71	1454,8	137715	0.431	-0.028
Recreational VA METS	548,30	737,7	500,32	740,5	131085	0.037	-0.075
Recreational MA METS	2963,40	3048,0	2674,86	2845,4	138403	0.516	-0.023
Total PA METS per week	409,11	1434,0	457,70	1621,7	132649	0.083	-0.064
Total work activity METS	2554,29	2545,4	2217,16	2138,7	137327	0.232	0.031
Total recreational activity METS	560,98	577,9	515,67	541,6	130979	0.040	-0.075
Total happiness score							
Engagement	3,49	0,8	3,60	0,8	130535	0.032	0.079
Work satisfaction	3,54	0,9	3,60	0,8	137320	0.395	0.031
Affective commitment	3,43	0,8	3,51	0,9	133083	0.096	0.061
	3,49	1,1	3,70	1,0	127558	0.006	0.100
Well-being level							
	57,61	18,5	59,91	19,1	131225	0.044	0.074
Productivity							
Presenteeism (days lost)	1,71	4,1	1,68	4,4	140436	0.744	-0.0092
Costs of lost productivity due to short-term presenteeism	110,43	413,5	87,66	300,2	140193	0.680	-0.01098
Lost productivity	18,56	33,2	18,09	33,1	140805	0.814	-0.0066
Absenteeism. Absence from paid work	63,69	426,1	87,84	651,8	140757	0.672	0.00700
Absenteeism (days lost)	4,77	68,8	26,20	383,0	139965	0.472	0.01259

Table 13. Comparison of quantitative variables by civil status.

Costs of lost productivity due to short-term absenteeism	0,07	0,3	0,08	0,3	140659	0.253	0.00770
Total lost productivity cost	178,89	617,8	201,70	822,6	140759	0.806	0.00699

Note: Effect size: rank biserial correlation; 0.10: low effect, 0.30: medium effect, 0.50: large effect

4.2.6. Having children

The comparison of quantitative variables by parental status (Table 14) reveals statistically significant differences across multiple domains of PA, psychological wellbeing, and productivity, with small-to-moderate effect sizes indicating meaningful patterns in the data.

Individuals without children consistently demonstrate higher levels of PA, especially in the recreational domain. Those without children report significantly greater frequency and duration of recreational vigorous activity ($p < .001$, $r = -0.166$ and -0.117 , respectively) and recreational MET expenditure ($p < .001$, $r = -0.153$), along with higher total recreational activity METs ($p < .001$, $r = -0.134$). These participants also sit longer on average ($p = .021$, $r = -0.078$), accumulate more total minutes of PA per day and per week (both $p = .006$, $r \approx -0.096$ to -0.098), and reach higher overall total PA METs per week ($p < .001$, $r = -0.121$). These results suggest that not having children may afford individuals more time and energy for engaging in structured or leisure PA, particularly of vigorous intensity.

In contrast, individuals with children report better psychological wellbeing across all measured indicators. Significant differences are observed in happiness ($p < .001$, $r = 0.212$), engagement ($p < .001$, $r = 0.123$), work satisfaction ($p < .001$, $r = 0.163$), affective commitment ($p < .001$, $r = 0.230$), and overall wellbeing level ($p = .001$, $r = 0.113$). These moderate effect sizes highlight a potential emotional benefit associated with having children, possibly due to increased life meaning, stability, or support, which may buffer work-related stress or enhance affective ties to work.

Regarding productivity outcomes, individuals without children show slightly higher presenteeism (days lost, $p = .002$, $r = -0.082$), greater productivity loss ($p = .002$, $r = -0.082$), and higher short-term presenteeism costs ($p = .003$, $r = -0.076$), suggesting a modestly greater impact of reduced performance while at work. However, no significant differences are found in absenteeism indicators or short-term absenteeism costs, except for total lost productivity cost, which is higher for individuals without children ($p = .037$, $r = -0.057$), albeit with a small effect size.

Table 14. Comparison of quantitative variables by having children.

Variables	No		Yes		Statistic	p	Effect Size
	M	SD	M	SD			
Physical activity							
Work VA frequency (days/week)	0,24	1,0	0,25	1,0	153774	0.733	-0.005
Work VA time (min/day)	6,05	31,7	5,25	28,3	153006	0.494	-0.010
Work MA frequency (days/week)	0,68	1,6	0,76	1,7	152869	0.655	0.011
Work MA time (min/day)	16,29	47,3	15,74	46,9	153658	0.810	0.005
Walk or bicycle frequency (days/week)	3,58	2,8	3,33	2,8	147170	0.164	-0.047
Walk or bicycle time (min/day)	32,87	44,1	30,53	40,8	150582	0.456	-0.025
Recreational VA frequency (days/week)	2,30	1,9	1,75	1,8	128902	<.001	-0.166
Recreational VA time (min/day)	48,99	50,7	41,31	49,2	136427	<.001	-0.117
Recreational MA frequency (days/week)	2,11	2,0	2,01	1,9	150248	0.419	-0.027
Recreational MA time (min/day)	46,00	50,7	40,82	48,7	143999	0.049	-0.068
Sitting time (min/day)	334,57	159,4	312,07	163,9	142484	0.021	-0.078
Total minutes of PA per day	150,20	122,5	133,65	115,9	139581	0.006	-0.096
Total minutes PA per week	585,80	602,7	498,38	521,6	139410	0.006	-0.098
Work VA METS	169,27	831,8	171,88	982,8	153078	0.514	-0.009
Work MA METS	272,59	921,2	272,07	1003,6	153253	0.729	0.008
Walk or bicycle METS	732,15	1133,5	660,37	937,3	149742	0.367	-0.031
Recreational VA METS	1367,90	1739,8	981,17	1372,7	130864	<.001	-0.153
Recreational MA METS	569,90	769,4	484,56	721,7	145453	0.090	-0.058
Total PA METS per week	3111,80	3214,0	2570,05	2712,0	135822	<.001	-0.121
Total work activity METS	441,85	1526,5	443,95	1590,5	152934	0.672	0.010
Total recreational activity METS	2669,95	2596,3	2126,10	2050,5	133775	<.001	-0.134
Total happiness score							
Engagement	3,37	0,8	3,67	0,8	121846	<.001	0.21171
Work satisfaction	3,45	0,9	3,66	0,8	135529	<.001	0.123
Affective commitment	3,32	0,8	3,58	0,9	129251	<.001	0.163
	3,35	1,1	3,79	1,0	118994	<.001	0.230
Well-being level							
	57,00	18,8	60,44	18,8	136970	0.001	0.113
Productivity							
Presenteeism (days lost)	1,93	4,5	1,56	4,2	141836	0.002	-0.082
Costs of lost productivity due to short-term presenteeism	113,82	374,8	83,92	315,9	142730	0.003	-0.076
Lost productivity	21,61	34,6	16,39	32,2	141882	0.002	-0.082
Absenteeism. Absence from paid work	104,80	782,7	67,50	459,0	153643	0.705	-0.006
Absenteeism (days lost)	0,08	0,3	0,08	0,3	154301	0.917	0.001
Costs of lost productivity due to short-term absenteeism	2,48	35,6	29,24	400,5	153068	0.132	0.009
Total lost productivity cost	221,10	880,7	180,66	697,8	145745	0.037	-0.057

Note: Effect size: rank biserial correlation; 0.10: low effect, 0.30: medium effect, 0.50: large effect

4.2.7. Physical activity level

The comparison of quantitative variables by PA level, categorized by a cutoff of 1200 METs per week, reveals highly significant differences across virtually all domains analyzed, with large effect sizes in key areas such as PA behavior, energy expenditure, psychological well-being, and moderate impacts on productivity.

Participants who accumulate more than 1200 METs per week demonstrate substantially higher PA engagement across all modalities. The differences in frequency and duration are striking. For example, vigorous recreational activity shows the largest effect sizes in both frequency ($r = 0.646$) and time ($r = 0.658$), as well as corresponding recreational VA METs ($r = 0.698$). Similarly, moderate recreational activity (both frequency and time) also reflects very strong effects ($r > 0.4$), and walking or bicycling time exhibits the highest magnitude ($r = 0.454$). Even in domains typically less modifiable, such as work activity, those with higher PA levels report significantly greater moderate and vigorous work-related PA (e.g., $r = 0.216$ – 0.219), illustrating a pattern of globally higher movement levels in more active individuals.

These patterns are further supported by very large differences in energy expenditure, especially in total PA METs per week, where the effect size reaches the maximum scale ($r = 1.00$), indicating complete separation between the groups by design. Substantial differences are also seen in total recreational activity METs ($r = 0.951$), walking/bicycling METs ($r = 0.477$), and total work activity METs ($r = 0.229$).

Beyond behavior and energy output, higher PA levels are also linked to better psychological well-being. Participants above the 1200 MET threshold report significantly higher happiness ($r = 0.102$), engagement ($r = 0.151$), work satisfaction ($r = 0.071$), and well-being level ($r = 0.212$), all reaching small to moderate effect sizes. While affective commitment was not significantly different, the trend was still favorable.

From a productivity standpoint, those with higher PA levels tend to report lower presenteeism (non-significant but directionally consistent, $r = -0.043$), lower productivity costs due to presenteeism and total productivity cost. Notably, the only statistically significant difference in productivity costs is in short-term absenteeism costs, which are lower among the more active group ($p = .019$). Overall, although productivity differences are less marked than in psychological or behavioral domains, they suggest potential economic benefits associated with higher PA.

Table 15. Comparison of quantitative variables by physical activity level.

Variable	<1200 METS		>1200 METS		Statistic	p	Effect Size
	M	SD	M	SD			
Physical activity							
Work VA frequency (days/week)	0.01	0.1	0.36	1.2	132685	<.001	0.090
Work VA time (min/day)	0.01	0.1	8.03	35.0	133228	<.001	0.086
Work MA frequency (days/week)	0.12	0.6	1.02	1.9	114279	<.001	0.216
Work MA time (min/day)	1.81	10.2	22.38	55.2	114133	<.001	0.217
Walk or bicycle frequency (days/week)	2.04	2.4	4.05	2.8	86883	<.001	0.4041
Walk or bicycle time (min/day)	12.78	17.3	39.84	46.9	79521	<.001	0.454
Recreational VA frequency (days/week)	0.54	1.0	2.59	1.8	51569	<.001	0.646
Recreational VA time (min/day)	10.18	20.1	59.47	51.7	49743	<.001	0.658
Recreational MA frequency (days/week)	1.06	1.4	2.50	2.0	83322	<.001	0.428
Recreational MA time (min/day)	18.07	25.2	53.87	53.7	74649	<.001	0.488
Sitting time (min/day)	363.88	153.5	299.95	162.8	113478	<.001	-0.221
Total minutes of PA per day	42.89	33.8	183.60	117.2	11834	<.001	0.918
Total minutes PA per week	116.56	87.8	717.67	573.1	4228	<.001	0.971
Work VA METS	0.88	16.8	248.66	1116.5	133228	<.001	0.086
Work MA METS	14.79	89.5	389.86	1156.5	113855	<.001	0.219
Walk or bicycle METS	216.22	300.6	900.10	1140.7	76208	<.001	0.477
Recreational VA METS	146.96	294.9	1560.70	1646.8	43931	<.001	0.698
Recreational MA METS	161.32	245.0	676.02	808.7	70121	<.001	0.519
Total work activity METS	15.67	90.9	638.52	1859.0	112352	<.001	0.229
Total recreational activity METS	524.49	396.9	3136.82	2303.6	7136	<.001	0.951
Total happiness score							
Engagement	3.48	0.8	3.61	0.8	130915	0.005	0.102
Work satisfaction	3.44	0.8	3.65	0.8	123768	<.001	0.151
Affective commitment	3.42	0.9	3.52	0.9	135357	0.048	0.071
	3.58	1.1	3.66	1.1	139200	0.210	0.045
Well-being level							
	54.20	20.0	61.52	17.9	114821	<.001	0.212
Productivity							
Presenteeism (days lost)	1.94	4.3	1.57	4.2	139506	0.122	-0.043
Costs of lost productivity due to short-term presenteeism	119.34	414.9	83.08	295.8	140622	0.174	-0.035
Lost productivity	19.80	34.0	17.51	32.7	140283	0.174	-0.037
Absenteeism. Absence from paid work	51.46	342.5	93.97	677.7	142918	0.222	0.019
Absenteeism (days lost)	0.45	2.5	0.44	2.7	145628	0.940	0.001
Costs of lost productivity due to short-term absenteeism	48.68	557.3	6.63	99.9	143537	0.019	-0.015
Total lost productivity cost	249.48	771.2	183.68	765.4	139387	0.117	-0.044

Note: Effect size: rank biserial correlation; 0.10: low effect, 0.30: medium effect, 0.50: large effect

Table 16 presents the comparison of qualitative variables according to PA levels, distinguishing between individuals who accumulate less than 1200 METs per week and those who exceed this threshold. Overall, the findings indicate statistically significant associations between PA level and various indicators of behaviour, well-being, and mental health, with effect sizes ranging from small to large, depending on the variable.

There is a strong association between overall PA level and meeting the specific thresholds of work-related and recreational PA. All participants in the low activity group fall below 1200 METs in both domains, whereas within the more active group, 13% exceed 1200 METs solely through work activity, and 94.4% through recreational activity. These associations show large and moderate effect sizes (Cramer's $V = 0.467$ and 0.197 , respectively), highlighting the central role of recreational activity in distinguishing between levels of PA adherence.

In terms of subjective well-being, higher levels of PA are associated with a greater proportion of individuals reporting high happiness, although this difference does not reach statistical significance ($p = 0.064$), it suggests a positive trend. Similarly, higher levels of engagement, job satisfaction, and affective commitment are observed among the more physically active, although only affective commitment shows a statistically significant difference ($p = 0.045$; $V = 0.058$), albeit with a small effect size.

The most substantial difference is observed in relation to psychological well-being (WHO-5). The risk of depression is markedly higher among those with lower levels of PA (41.1%) compared to their more active counterparts (24.2%), a statistically significant difference ($p = 0.006$) with a small-to-moderate effect size ($V = 0.080$). This finding reinforces the protective role of PA against psychological distress.

Table 16. Comparison of qualitative variables by physical activity level.

Variable		< 1200 METs		> 1200 METs		χ^2	df	p	Effect size
		N	%	N	%				
Work PA MET	Less than 1200 METs	365	100.0	695	87.0	254.0	1	<0.001	0.467
	More than 1200 METs	-	-	104	13.0				
Recreational PA MET	Less than 1200 METs	365	100.0	45	5.6	45.0	1	<0.001	0.197
	More than 1200 METs	-	-	754	94.4				
SHAW - Happiness	Low happiness	105	28.8	189	23.7	3.43	1	0.064	0.054
	High happiness	260	71.2	610	76.3				
SHAW - Engagement	Low engagement	136	37.3	222	27.8	2.74	1	0.098	0.048
	High engagement	229	62.7	577	72.2				
SHAW - Work satisfaction	Low work satisfaction	138	37.8	250	31.3	1.74	1	0.187	0.038
	High work satisfaction	227	62.2	549	68.7				

Table 16. Comparison of qualitative variables by physical activity level.

SHAW - Affective commitment	Low affective commitment	127	34.8	250	31.3	4.01	1	0.045	0.058
	High affective commitment	238	65.2	549	68.7				
WHO-5 wellbeing level	Depression (risk)	150	41.1	193	24.2	7.52	1	0.006	0.080
	Wellbeing	215	58.9	606	75.8				

Note: Effect size: Cramer's V; 0.10: low effect, 0.30: medium effect, 0.50: large effect

4.3. Regression analysis

Table 17 presents the associations between PA levels and the outcomes of productivity, happiness, and well-being. Individuals engaging in less than 600 MET-minutes per week showed significant associations with several adverse outcomes. Specifically, lower PA was associated with a higher likelihood of reporting days in the past four weeks in which they were able to do less unpaid work due to physical or psychological problems, as well as with low engagement, low happiness, and increased risk of depression.

For participants engaging in less than 1200 MET-minutes per week, significant associations were observed with low affective commitment and increased risk of depression. These findings suggest that lower levels of PA are linked to reduced well-being and work-related outcomes, with some effects observable even at moderate activity thresholds.

Table 17. Association between low levels of physical activity (exposure) and outcomes, estimated by multivariable logistic regression.

Outcomes	< 600 MET-min/week	< 1200 MET-min/week
Absent from your work in the past 4 weeks because you were ill	0.642 (0.398-1.036)	1.202 (0.526-2.749)
Absent from your work because of being ill for longer than the entire period of 4 weeks	0.729 (0.134-3.955)	0.000 (0.000-0.000)
Days over the past 4 weeks when you worked but suffered from physical or psychological problems during your work	0.961 (0.703-1.314)	1.062 (0.628-1.795)
Days over the past 4 weeks on which you were able to do less unpaid work because of your physical or psychological problems	1.711 (1.107-2.645)*	2.120 (0.896-5.017)
Low engagement	1.795 (1.301-2.475)*	1.297 (0.775-2.171)
Low job satisfaction	1.244 (0.922-1.679)	1.193 (0.728-1.956)
Low affective commitment	1.250 (0.917-1.704)	1.839 (1.056-3.203)*
Low happiness	1.503 (1.070-2.111)*	1.669 (0.924-3.013)
Depression risk	1.502 (1.096-2.058)*	1.815 (1.037-3.177)*

Note: Results presented as Odds Ratio (95% Confidence Interval). * $P < 0.05$.

Models adjusted for age, gender, educational level, civil status, parental status, type of organization, company size, employment status, type of contract, occupation status, and country of residence.

5. CONCLUSIONS

The main conclusions of this quantitative study are the following:

- 1) The data reveal clear distinctions between contexts of PA. Recreational and active transport-related activities were markedly more common than those occurring in the occupational domain. Vigorous activity, whether recreational or work-related, was less prevalent and less frequent than moderate activity. The relatively low engagement in occupational PA, particularly vigorous forms, suggests that for this sample, non-work domains are the primary avenues for meeting PA guidelines. These findings may be interpreted within the context of predominantly sedentary or cognitively demanding job roles, as suggested by the sample's high educational and employment profiles.
- 2) The most notable gender differences emerged in recreational and occupational PA, where women consistently reported higher engagement and energy expenditure. These behavioural differences translated into modest but significant differences in overall PA volume and METs, and were accompanied by slightly better wellbeing scores and lower productivity loss among women. While the statistical significance of these findings is robust, the effect sizes suggest that, in most cases, gender differences are relatively modest in magnitude. Nevertheless, they may warrant consideration in the design of workplace health promotion strategies, especially in tailoring PA and wellbeing interventions by gender.

While the differences between men and women in psychological outcomes were largely negligible, gender-related differences in PA engagement were consistent and statistically significant, particularly in recreational and total activity. Women were more likely to meet recommended MET thresholds and reported slightly better mental wellbeing, although all effect sizes remained within the low range, suggesting the importance of nuanced interpretation rather than categorical conclusions.
- 3) The most meaningful age-related differences were observed in recreational PA, organisational commitment, and happiness, with older participants generally reporting higher wellbeing and workplace satisfaction, despite lower engagement in vigorous activity. The effect sizes remained small, indicating that while age influences several behavioural and psychological outcomes, the practical differences between age groups are modest. These findings suggest that age-sensitive health promotion and workplace engagement strategies may be beneficial, especially when targeting middle-aged groups who appear to report lower activity and affective commitment levels.
- 4) The most notable age-related differences emerged in PA engagement, particularly recreational activity, and organisational commitment, both of which demonstrated statistically

significant and approaching-moderate effect sizes. Younger adults (particularly those aged 26–30) were more likely to meet PA guidelines, while older participants (41+) reported higher affective commitment and satisfaction in the workplace. These patterns support a developmental trajectory wherein younger workers prioritise active lifestyles and exploration, while older workers demonstrate stronger organisational bonds and psychological investment. Interventions may therefore benefit from being tailored to different life stages, focusing on engagement and purpose for younger employees, and health maintenance for older ones.

- 5) Participants from Eastern Europe consistently reported higher occupational and active transport PA, lower sitting time, greater psychological wellbeing, and lower productivity losses. Despite these advantages, they reported less recreational activity than their Northern counterparts. Western and Central European participants, in contrast, showed higher sedentary behaviour, lower wellbeing, and greater productivity losses, particularly due to presenteeism and absenteeism.

While all effect sizes remained within the small range, several variables approached or exceeded small effect, indicating notable practical differences. These findings underscore the importance of contextualising workplace and health interventions regionally, taking into account cultural, occupational, and infrastructural factors that influence wellbeing, activity, and productivity.

- 6) The results indicate that regional context plays a substantial role in shaping both PA patterns and psychosocial outcomes in the workplace. Eastern Europe consistently emerged as the region with the highest levels of work-based PA, greater psychological wellbeing, and stronger organisational engagement. In contrast, Central/Western Europe showed the least favourable psychosocial indicators, despite moderate PA levels. The most notable effect sizes were found for work-related MET levels, affective commitment, and happiness, highlighting meaningful differences with practical implications for occupational health policies and organisational strategies across European regions.

While the observed differences are modest, the data suggest that postgraduate education is associated with higher levels of recreational PA and improved subjective wellbeing, including greater happiness, engagement, and satisfaction at work. These findings may reflect broader patterns of social and occupational advantage associated with higher education, highlighting the role of educational attainment in shaping both health behaviours and workplace experiences.

- 7) The results by civil status show that being single is modestly associated with higher levels of vigorous recreational PA, whereas being married or cohabiting is associated with higher happiness, affective commitment, and psychological wellbeing. Despite small effect sizes,

these differences contribute to a nuanced understanding of how relationship status may influence lifestyle behaviours and workplace experiences.

- 8) The presence of children appears to be associated with greater psychological wellbeing and stronger work-related attitudes, while the absence of children is associated with higher PA, particularly in vigorous recreational forms. Although productivity losses are slightly higher among individuals without children, the differences are modest. These findings reflect the complex trade-offs between time availability, lifestyle priorities, and psychosocial factors that differ between individuals with and without children.
- 9) Accumulating more than 1200 METs per week is strongly and positively associated with greater frequency and intensity of PA, enhanced energy expenditure, improved psychological outcomes, and a potential reduction in productivity-related costs. The large effect sizes across key PA and well-being measures emphasize the public health relevance of promoting PA to reach or exceed this threshold.
- 10) The results demonstrate that meeting the recommended levels of PA is not only associated with higher engagement in recreational and occupational domains, but also with better emotional well-being, mental health, and work-related experiences, supporting its promotion as a key strategy in public health and occupational wellness programmes.

6. IMPLICATIONS

The findings of this study underscore the significant role of PA in shaping both psychological well-being and work-related outcomes among employees across Europe. Multivariable logistic regression analyses revealed that individuals engaging in low levels of PA, specifically those below 600 MET-minutes per week, were more likely to experience adverse outcomes such as increased risk of depression, lower engagement, and reduced happiness at work. These associations remained statistically significant even after controlling for key sociodemographic and occupational variables, reinforcing the independent and protective effect of PA on mental health in occupational settings.

Moreover, even when the threshold was raised to 1200 MET-minutes per week, participants with lower PA levels continued to show heightened risks for depression and reported lower affective commitment towards their organisations. These results suggest that the benefits of PA extend beyond mental well-being, influencing employees' emotional attachment to their workplace and potentially affecting retention and motivation.

The comparative analysis further highlights the tangible impact of PA on productivity outcomes. Workers with higher levels of PA reported fewer days affected by physical or psychological problems, less time lost in unpaid labour due to health-related limitations, and reduced levels of presenteeism. In contrast, physically inactive individuals not only reported lower physical performance but also incurred higher productivity costs, albeit not always reaching statistical significance. Importantly, the most pronounced differences emerged in measures of total daily and weekly activity, with very large effect sizes, confirming the behavioural gap between active and inactive workers.

Taken together, these findings support the notion that PA serves as a critical determinant of both individual well-being and organisational productivity. Interventions aimed at promoting PA in the workplace may offer a dual advantage: improving employees' mental health and enhancing their functional capacity and performance. Future policies and programmes at the organisational or national level should therefore consider PA as a strategic component for sustainable workforce development and employee health promotion.

REFERENCES

- Ammendolia, C., Cote, P., Cancelliere, C., Cassidy, J. D., Hartvigsen, J., Boyle, E., Soklaridis, S., Stern, P., & Amick, B., III. (2016). Healthy and productive workers: Using intervention mapping to design a workplace health promotion and wellness program to improve presenteeism. *BMC Public Health*, 16. <https://doi.org/10.1186/s12889-016-3843-x>
- Baup, Y., Vignal, B., & Bodet, G. (2022). Sport and physical activity participation in the workplace: The role of employees' self-perception. *International Journal of Workplace Health Management*, 15(1), 54–69. <https://doi.org/10.1108/IJWHM-03-2021-0055>
- Bergefurt, L., van den Boogert, P. F., Appel-Meulenbroek, R., & Kemperman, A. (2024). The interplay of workplace satisfaction, activity support, and productivity support in the hybrid work context. *Building and Environment*, 261. <https://doi.org/10.1016/j.buildenv.2024.111729>
- Bouwmans, C., Krol, M., Severens, H., Koopmanschap, M., Brouwer, W., & Hakkaart-van Roijen, L. (2015). The iMTA productivity cost questionnaire: a standardized instrument for measuring and valuing health-related productivity losses. *Value in health*, 18(6), 753–758. <https://doi.org/10.1016/j.jval.2015.05.009>
- Braun, A., Franczukowska, A. A., Teufl, I., & Krczal, E. (2022). The economic impact of workplace physical activity interventions in Europe: A systematic review of available evidence. *International Journal of Workplace Health Management*, 15(4), 445–466. <https://doi.org/10.1108/IJWHM-04-2021-0105>
- Bull, F. C., Maslin, T. S., & Armstrong, T. (2009). Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *Journal of Physical Activity and health*, 6(6), 790–804. <https://doi.org/10.1123/jpah.6.6.790>
- Buman, M. P., Mullane, S. L., Toledo, M. J., Rydell, S. A., Gaesser, G. A., Crespo, N. C., Hannan, P., Feltes, L., Brenna Vuong, & Pereira, M. A. (2017). An intervention to reduce sitting and increase light-intensity physical activity at work: Design and rationale of the 'Stand & Move at Work' group randomized trial. *Contemporary Clinical Trials*, 53, 11–19. <https://doi.org/10.1016/j.cct.2016.12.008>
- Casimiro-Andujar, A. J., Martin-Moya, R., Marave-Vivas, M., & Ruiz-Montero, P. J. (2022). Effects of a Personalised Physical Exercise Program on University Workers Overall Well-Being: 'UAL-Activa' Program. *International Journal of Environmental Research and Public Health*, 19(18). <https://doi.org/10.3390/ijerph191811331>
- Chandrakumar, D., Arumugam, V., & Vasudevan, A. (2024). Exploring presenteeism trends: A comprehensive bibliometric and content analysis. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1352602>
- Charisi, V., Zafeiroudi, A., Trigonis, I., Tsartsapakis, I., & Kouthouris, C. (2025). The Impact of Green Spaces on Workplace Creativity: A Systematic Review of Nature-Based Activities and Employee Well-Being. *Sustainability*, 17(2). <https://doi.org/10.3390/su17020390>
- Coviello, D., Deserranno, E., Persico, N., & Sapienza, P. (2022). Effect of mood and worker incentives on workplace productivity†. *Journal of Law Economics & Organization*, 40(2), 362–393. <https://doi.org/10.1093/jleo/ewac017>
- Dabkowski, E., Porter, J. E., Barbagallo, M., Prokopiv, V., Snell, C., & Missen, K. (2023). A systematic literature review of workplace physical activity programs: An exploration of barriers and enabling factors. *Cogent Psychology*, 10(1). <https://doi.org/10.1080/23311908.2023.2186327>

- Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, 95(3), 542–575. <https://doi.org/10.1037/0033-2909.95.3.542>
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment*, 49(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13
- Dodge, R., Daly, A. P., Huyton, J., & Sanders, L. D. (2012). The challenge of defining wellbeing. *International Journal of Wellbeing*, 2(3), 222–235. <https://doi.org/10.5502/ijw.v2i3.4>
- Domínguez-Lara, S. (2018). Effect size, a quick guide. *Educación Médica*, 19(4), 251–254. <https://doi.org/10.1016/j.edumed.2017.07.002>
- Engelen, L. (2020). Does Active Design Influence Activity, Sitting, Wellbeing and Productivity in the Workplace? A Systematic Review. *International Journal of Environmental Research and Public Health*, 17(24). <https://doi.org/10.3390/ijerph17249228>
- Eurostat. (2008). *NACE Rev. 2: Statistical classification of economic activities in the European Community*. Office for Official Publications of the European Communities. <https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>
- Eurostat. (2023). *Labour cost levels by NACE Rev. 2 activity - hourly data*. Eurostat. https://ec.europa.eu/eurostat/databrowser/view/LC_LCI_LEV_custom_1536460
- Feitor, S., Martins, T., & Borges, E. (2022). Shorted happiness at work scale: Psychometric proprieties of the Portuguese version in a sample of nurses. *International Journal of Environmental Research and Public Health*, 20(1), 658. <https://doi.org/10.3390/ijerph20010658>
- Genin, P., Beaujouan, J., Thivel, D., & Duclos, M. (2019). Is workplace an appropriate setting for the promotion of physical activity? A new framework for worksite interventions among employees. *Work-a Journal of Prevention Assessment & Rehabilitation*, 62(3), 421–426. <https://doi.org/10.3233/WOR-192873>
- Grimani, A., Aboagye, E., & Kwak, L. (2019). The effectiveness of workplace nutrition and physical activity interventions in improving productivity, work performance and workability: A systematic review. *BMC Public Health*, 19(1). <https://doi.org/10.1186/s12889-019-8033-1>
- Hallam, K. T., Peeters, A., Gupta, A., & Bilsborough, S. (2023). Moving minds: Mental health and wellbeing benefits of a 50-day workplace physical activity program. *Current Psychology*, 42(15), 13038–13049. <https://doi.org/10.1007/s12144-021-02525-6>
- Halling Ullberg, O., Toivanen, S., Tillander, A., & Balter, K. (2023). Workplace health promotion to facilitate physical activity among office workers in Sweden. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1175977>
- Hasni, A., & Bedhioufi, H. (2025). The impact of physical activity on the psychosocial well-being of young employees. *Cogent Business & Management*, 12(1). <https://doi.org/10.1080/23311975.2025.2511280>
- Hergenroeder, A., Quinn, T. D., Perdomo, S. J., Kline, C. E., & Gibbs, B. B. (2022). Effect of a 6-month sedentary behavior reduction intervention on well-being and workplace health in desk workers with low back pain. *Work-a Journal of Prevention Assessment & Rehabilitation*, 71(4), 1145–1155. <https://doi.org/10.3233/WOR-205178>
- Herrmann, S. D., Heumann, K. J., Der Ananian, C. A., & Ainsworth, B. E. (2013). Validity and reliability of the global physical activity questionnaire (GPAQ). *Measurement in Physical Education and Exercise Science*, 17(3), 221–235. <https://doi.org/10.1080/1091367X.2013.805139>
- Hervieux, V., Biron, C., & Dima, J. (2023). Investigating Associations Between Physical Activity and Presenteeism—A Scoping Review. *American Journal of Health Promotion*, 37(8), 1147–1161. <https://doi.org/10.1177/08901171231193781>

- Hills, P., & Argyle, M. (2002). *The Oxford Happiness Questionnaire: A compact scale for the measurement of psychological well-being*. *Personality and Individual Differences*, 33(7), 1073–1082. [https://doi.org/10.1016/S0191-8869\(01\)00213-6](https://doi.org/10.1016/S0191-8869(01)00213-6)
- Howie, E. K., Daniels, B. T., Human, A., Gray, M., & Baum, J. I. (2021). Effectiveness and implementation of a virtual versus in-person walking program among employees on physical activity, fitness, and cognition. *Health and Technology*, 11(4), 909–917. <https://doi.org/10.1007/s12553-021-00546-6>
- Hunter, J. R., Meiring, R. M., Cripps, A., Suppiah, H. T., Vicendese, D., Kingsley, M. I., & Gordon, B. A. (2021). Relationships between Physical Activity, Work Ability, Absenteeism and Presenteeism in Australian and New Zealand Adults during COVID-19. *International Journal of Environmental Research and Public Health*, 18(23). <https://doi.org/10.3390/ijerph182312563>
- Hunter, R. F., Brennan, S. F., Tang, J., Smith, O. J., Murray, J., Tully, M. A., Patterson, C., Longo, A., Hutchinson, G., Prior, L., French, D. P., Adams, J., McIntosh, E., & Kee, F. (2016). Effectiveness and cost-effectiveness of a physical activity loyalty scheme for behaviour change maintenance: A cluster randomised controlled trial. *BMC Public Health*, 16. <https://doi.org/10.1186/s12889-016-3244-1>
- Hussain, M. A., Humayun, S., Ghouri, M. W. A., Emam, W., & Tashkandy, Y. (2025). Unrestricted challenging ability turn out to high sports performance through presenteeism: The moderating role of physical activity. *Acta Psychologica*, 255. <https://doi.org/10.1016/j.actpsy.2025.104940>
- Imen, A., Nehla, R., Imen, S., Nada, K., Mounira, H., & Ahmed, R. (2023). Determinants of Workplace Productivity Decline in the Tunisian Onshore Oil and Gas Industry. *Indian Journal of Occupational and Environmental Medicine*, 27(2), 132–137. https://doi.org/10.4103/ijoom.ijoom_56_22
- Inoue, S., Nagata, T., Nagata, M., Tateishi, S., Fujino, Y., & Mori, K. (2022). Relationship Between Psychosocial Work Environment Factors and Presenteeism Among Workers With Diarrhea/Constipation Symptoms A Cross-Sectional Study. *Journal of Occupational and Environmental Medicine*, 64(4), E197–E201. <https://doi.org/10.1097/JOM.0000000000002476>
- International Labour Office. (2012). *International Standard Classification of Occupations: ISCO-08. Volume 1: Structure, group definitions and correspondence tables*. International Labour Office. <https://www.ilo.org/public/english/bureau/stat/isco/isco08/>
- Jimenez Diaz-Benito, V., Barriopedro Moro, M. I., Clemente Remon, A. L., Santacruz Lozano, J. A., Hervas Perez, J. P., & Vanderhaegen, F. (2022). Effects of worksite exercise intervention (PRODET®) on well-being at work and capability in performing work-related sedentary tasks: A pilot study. *Work-a Journal of Prevention Assessment & Rehabilitation*, 72(3), 909–920. <https://doi.org/10.3233/WOR-205340>
- Jimenez Diaz-Benito, V., Barriopedro Moro, M. I., Vanderhaegen, F., Clemente Remon, A. L., Santacruz Lozano, J. A., Cimadevilla Fernandez-Pola, E., & Hervas Perez, J. P. (2022). Intervention of physical exercise in the workplace on work ability, depression, anxiety and job satisfaction in workers with sedentary tasks. *Work-a Journal of Prevention Assessment & Rehabilitation*, 72(3), 921–931. <https://doi.org/10.3233/WOR-210300>
- Judice, P. B., Silva, H., Teno, S. C., Monteiro, P., Silva, M. N., Carraca, E. V., Santos, I., Pereira, S., Luz, F., Viegas, P. C., Oliveira, J., Santos, I. F., & Palmeira, A. L. (2023). Providing office workers with height-adjustable workstation to reduce and interrupt workplace sitting time:

- Protocol for the Stand Up for Healthy Aging (SUFHA) cluster randomized controlled trial. *Trials*, 24(1). <https://doi.org/10.1186/s13063-023-07407-9>
- Kabore, P., Combarry, O. S., & Sempore, W. Y. (2024). Effects of the practice of physical and sports activities (PSA) on the well-being and performance of public and private sector workers in Burkina Faso. *Journal of Public Health-Heidelberg*. <https://doi.org/10.1007/s10389-024-02261-8>
- Katz, A. S., Pronk, N. P., McLellan, D., Dennerlein, J., & Katz, J. N. (2019). Perceived Workplace Health and Safety Climates: Associations With Worker Outcomes and Productivity. *American Journal of Preventive Medicine*, 57(4), 487–494. <https://doi.org/10.1016/j.amepre.2019.05.013>
- Kechagias, E. P., Papadopoulos, G. A., & Rokai, I. (2024). Evaluating the Impact of Digital Health Interventions on Workplace Health Outcomes: A Systematic Review. *Administrative Sciences*, 14(6). <https://doi.org/10.3390/admsci14060131>
- Kerby, D. S. (2014). The simple difference formula: An approach to teaching nonparametric correlation. *Comprehensive Psychology*, 3, 2165–2228. <https://doi.org/10.2466/11.IT.3.1>
- Kerner, I., Rakovac, M., & Lazinica, B. (2017). Leisure-time physical activity and absenteeism. *Archives of Industrial Hygiene and Toxicology*, 68(3), 159–170. <https://doi.org/10.1515/aiht-2017-68-2963>
- Kitano, N., Jindo, T., Yoshiba, K., Yamaguchi, D., Fujii, Y., Wakaba, K., Maruo, K., Kai, Y., & Arao, T. (2025). Effectiveness of short active breaks for reducing sedentary behavior and increasing physical activity among Japanese office workers: One-year quasi-experimental study. *Scandinavian Journal of Work Environment & Health*. <https://doi.org/10.5271/sjweh.4224>
- Lyubomirsky, S., & Lepper, H. S. (1999). A measure of subjective happiness: Preliminary reliability and construct validation. *Social Indicators Research*, 46(2), 137–155. <https://doi.org/10.1023/A:1006824100041>
- Magnavita, N. (2017). Productive aging, work engagement and participation of older workers. A triadic approach to health and safety in the workplace. *Epidemiology Biostatistics and Public Health*, 14(2). <https://doi.org/10.2427/12436>
- Marens, M. W., Marzec, M., Kilbourne, A., Colabianchi, N., & Chen, W. (2025). Workplace Culture of Health, Remote Work, and Employee Wellbeing: A Mixed Methods Study. *Journal of Occupational and Environmental Medicine*. <https://doi.org/10.1097/JOM.0000000000003473>
- Meyer, J. P., & Allen, N. J. (1991). A three-component conceptualization of organizational commitment. *Human Resource Management Review*, 1(1), 61–89. [https://doi.org/10.1016/1053-4822\(91\)90011-Z](https://doi.org/10.1016/1053-4822(91)90011-Z)
- Meyer, J. P., & Herscovitch, L. (2001). Commitment in the workplace: Toward a general model. *Human Resource Management Review*, 11(3), 299–326. [https://doi.org/10.1016/S1053-4822\(00\)00053-X](https://doi.org/10.1016/S1053-4822(00)00053-X)
- Nathan, N., Murawski, B., Hope, K., Young, S., Sutherland, R., Hodder, R., Booth, D., Toomey, E., Yoong, S. L., Reilly, K., Tzelepis, F., Taylor, N., & Wolfenden, L. (2020). The Efficacy of Workplace Interventions on Improving the Dietary, Physical Activity and Sleep Behaviours of School and Childcare Staff: A Systematic Review. *International Journal of Environmental Research and Public Health*, 17(14). <https://doi.org/10.3390/ijerph17144998>
- Noviello, C., Riformato, G., Palattella, M. M., Lattanzio, S., Cuscianna, E., & Tafuri, S. (2025). Enhancing workplace wellness: The impact of multidisciplinary interventions on employee health and productivity. *Journal of Sports Medicine and Physical Fitness*, 65(5), 673–680. <https://doi.org/10.23736/S0022-4707.25.16125-2>

- Ojo, S. O., Bailey, D. P., Chater, A. M., & Hewson, D. J. (2018). The Impact of Active Workstations on Workplace Productivity and Performance: A Systematic Review. *International Journal of Environmental Research and Public Health*, 15(3). <https://doi.org/10.3390/ijerph15030417>
- Ojo, S. O., Bailey, D. P., Chater, A. M., & Hewson, D. J. (2022). Workplace Intervention for Reducing Sitting Time in Sedentary Workers: Protocol for a Pilot Study Using the Behavior Change Wheel. *Frontiers in Public Health*, 10. <https://doi.org/10.3389/fpubh.2022.832374>
- Ojo, S. O., Chater, A. M., Hewson, D. J., & Bailey, D. P. (2024). Workplace Productivity, Health and Wellbeing Findings From a Cluster Randomised Controlled Trial of a Workplace Intervention to Reduce Sitting in Office Workers. *Journal of Occupational And Environmental Medicine*, 66(6), 487–494. <https://doi.org/10.1097/JOM.0000000000003091>
- Peterman, J. E., Healy, G. N., Winkler, E. A. H., Moodie, M., Eakin, E. G., Lawler, S. P., Owen, N., Dunstan, D. W., & LaMontagne, A. D. (2019). A cluster randomized controlled trial to reduce office workers' sitting time: Effect on productivity outcomes. *Scandinavian Journal of Work Environment & Health*, 45(5), 483–492. <https://doi.org/10.5271/sjweh.3820>
- Petrovic, A., Erculj, V., & Bostjancic, E. (2022). Can we reduce psychosomatic symptoms and work presenteeism with physical activity? *Human Systems Management*, 41(1), 143–153. <https://doi.org/10.3233/HSM-211213>
- Powell, J., Conlon, J. A., Chivers, P., & Cripps, A. J. (2025). Exercising Smart; Exploring the Impact of a University Staff Fitness Program on Employee Productivity and Cognition. *Journal of Occupational and Environmental Medicine*. <https://doi.org/10.1097/JOM.0000000000003507>
- Puig-Ribera, A., Martinez-Lemos, I., Gine-Garriga, M., Manuel Gonzalez-Suarez, A., Bort-Roig, J., Fortuno, J., Munoz-Ortiz, L., McKenna, J., & Gilson, N. D. (2015). Self-reported sitting time and physical activity: Interactive associations with mental well-being and productivity in office employees. *BMC Public Health*, 15. <https://doi.org/10.1186/s12889-015-1447-5>
- R Core Team (2025). *R: A Language and environment for statistical computing*. (Version 4.5) [Computer software]. Retrieved from <https://cran.r-project.org>. (R packages retrieved from CRAN snapshot 2025-05-25).
- Ruhle, S. A., Breitsohl, H., Aboagye, E., Baba, V., Biron, C., Leal, C. C., Dietz, C., Ferreira, A., I., Gerichh, J., Johns, G., Karanika-Murray, M., Lohaus, D., Lokke, A., Lopes, S. L., Martinez, L. F., Miraglia, M., Muschalla, B., Poethke, U., Sarwat, N., ... Yang, T. (2020). 'To work, or not to work, that is the question'—Recent trends and avenues for research on presenteeism. *European Journal of Work and Organizational Psychology*, 29(3), 344–363. <https://doi.org/10.1080/1359432X.2019.1704734>
- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, 65(3), 529–565. <https://doi.org/10.1111/j.1467-6494.1997.tb00326.x>
- Ryde, G. C., Tomaz, S. A., Sandison, K., Greenwood, C., & Kelly, P. (2022). Measuring Productivity, Perceived Stress and Work Engagement of a Nationally Delivered Workplace Step Count Challenge. *International Journal of Environmental Research and Public Health*, 19(3). <https://doi.org/10.3390/ijerph19031843>
- Safi, A., Deb, S., Kelly, A., Cole, M., Walker, N., & Zariwala, M. G. (2024). Incentivised physical activity intervention promoting daily steps among university employees in the workplace through a team-based competition. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1121936>

- Schaufeli, W. B., Salanova, M., González-Romá, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies*, 3(1), 71–92. <https://doi.org/10.1023/A:1015630930326>
- Shiri, R., Nikunlaakso, R., & Laitinen, J. (2023). Effectiveness of Workplace Interventions to Improve Health and Well-Being of Health and Social Service Workers: A Narrative Review of Randomised Controlled Trials. *Healthcare*, 11(12). <https://doi.org/10.3390/healthcare11121792>
- Stepanek, M., Jahanshahi, K., & Millard, F. (2019). Individual, Workplace, and Combined Effects Modeling of Employee Productivity Loss. *Journal of Occupational And Environmental Medicine*, 61(6), 469–478. <https://doi.org/10.1097/JOM.0000000000001573>
- Strijk, J. E., Proper, K. I., van Mechelen, W., & van der Beek, A. J. (2013). Effectiveness of a worksite lifestyle intervention on vitality, work engagement, productivity, and sick leave: Results of a randomized controlled trial. *Scandinavian Journal of Work Environment & Health*, 39(1), 66–75. <https://doi.org/10.5271/sjweh.3311>
- Szabo, A., & Kajos, A. (2024). Which factors can be used to persuade managers to start workplace physical activity programmes and what motivates employees to participate? A Hungarian study on goals, effects and motivations. *Sport Business and Management - An International Journal*, 14(2), 287–308. <https://doi.org/10.1108/SBM-05-2023-0061>
- Tarro, L., Llauro, E., Ulldemolins, G., Hermoso, P., & Sola, R. (2020). Effectiveness of Workplace Interventions for Improving Absenteeism, Productivity, and Work Ability of Employees: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *International Journal of Environmental Research and Public Health*, 17(6). <https://doi.org/10.3390/ijerph17061901>
- Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., ... & Stewart-Brown, S. (2007). The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): Development and UK validation. *Health and Quality of Life Outcomes*, 5(1), 63. <https://doi.org/10.1186/1477-7525-5-63>
- The jamovi project (2025). *jamovi*. (Version 2.7) [Computer Software]. Retrieved from <https://www.jamovi.org>.
- Thogersen-Ntoumani, C., Black, J., Lindwall, M., Whittaker, A., & Balanos, G. M. (2017). Presenteeism, stress resilience, and physical activity in older manual workers: A person-centred analysis. *European Journal of Ageing*, 14(4), 385–396. <https://doi.org/10.1007/s10433-017-0418-3>
- Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A systematic review of the literature. *Psychotherapy and Psychosomatics*, 84(3), 167–176. <https://doi.org/10.1159/000376585>
- Valentine, D. S., Ferebee, S., & Heitner, K. L. (2019). The Effect of Wellness Programs on Long-Term Contract Employees' Workplace Stress, Absenteeism, and Presenteeism. *International Journal of Adult Vocational Education and Technology*, 10(4), 30–40. <https://doi.org/10.4018/IJAVET.2019100103>
- Wallmann-Sperlich, B., Hoffmann, S., Salditt, A., Bipp, T., & Froboese, I. (2019). Moving to an 'Active' Biophilic Designed Office Workplace: A Pilot Study about the Effects on Sitting Time and Sitting Habits of Office-Based Workers. *International Journal of Environmental Research and Public Health*, 16(9). <https://doi.org/10.3390/ijerph16091559>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>

- Welch, A., Healy, G., Straker, L., Comans, T., O'Leary, S., Melloh, M., Sjogaard, G., Pereira, M., Chen, X., & Johnston, V. (2020). Process evaluation of a workplace-based health promotion and exercise cluster-randomised trial to increase productivity and reduce neck pain in office workers: A RE-AIM approach. *BMC Public Health*, 20(1). <https://doi.org/10.1186/s12889-020-8208-9>
- World Health Organization (2021) Global Physical Activity Questionnaire (GPAQ) Analysis Guide. https://www.who.int/ncds/surveillance/steps/resources/GPAQ_Analysis_Guide.pdf
- World Health Organization (2024) *Physical activity*. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
- World Health Organization (2025) *Physical activity*. <https://www.who.int/initiatives/behealthy/physical-activity>
- World Health Organization. (2022). *Physical activity*. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>