Presenteeism, stress resilience, and physical activity in older manual workers: A person-centred analysis

Cecilie Thogersen-Ntoumani, Curtin University. Bentley, Australia

Julie Black, University of Birmingham, Birmingham, UK

Magnus Lindwall, University of Gothenburg, Gothenburg, Sweden

Anna Whittaker, University of Birmingham, Birmingham, UK

George M. Balanos, University of Birmingham, Birmingham, UK

Word count: 5,997

Abstract

This study used a person-centred approach to explore typologies of older manual workers based on presenteeism, stress resilience, and physical activity. Older manual workers (*n*=217; 69.1% male; age range: 50 – 77; *M* age = 57.11 years; *SD*= 5.62) from a range of UK-based organisations, representing different manual job roles, took part in the study. A cross-sectional survey design was used. Based on the three input variables: presenteeism, stress resilience and physical activity, four distinct profiles were identified on using Latent Profile Analysis. One group ('High sport/exercise and well-functioning'; 5.50%) engaged in high levels of sport/exercise and exhibited low levels of stress resilience and all types of presenteeism. Another profile ('Physically burdened'; 9.70%) reported high levels of work and leisure-time physical activity, low stress resilience, as well as high levels of presenteeism due to physical and time demands. A 'Moderately active and functioning' group (46.50%) exhibited moderate levels on all variables. Finally, the fourth profile ('Moderately active with high presenteeism'; 38.20%) reported engaging in moderate levels of physical activity and had relatively high levels of stress resilience, yet also high levels of presenteeism. The profiles differed on work affect and health perceptions largely in the expected directions. There were no differences between the profiles in socio-demographics. These results highlight complex within-person interactions between presenteeism, stress resilience, and physical activity in older manual workers. The identification of profiles of older manual workers who are at risk of poor health and functioning may inform targeted interventions to help retain them in the workforce for longer.

Keywords: ageing workers; well-being; occupational activity; exercise; leisure-time activity; Latent Profile Analysis

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The global workforce population is ageing and a reduction in birth rate means that the current median age of workforces is increasing (Billett et al. 2011). Research indicates that the ratio of active workers to pensioners in the UK is currently 1:1, however, as life expectancy increases, it is predicted that by 2032 this ratio will shift to 2:9 respectively (Crawford et al. 2010). This evidence suggests that there is likely to be a shortage of workers within the UK workforce if sufficient numbers of older workers (defined as workers aged 50 or above; Department for Work and Pensions, 2011) are not retained. This could have a detrimental impact on the British labour economy.

Manual workers may be susceptible to early exit from the labour market because they tend to suffer more with musculoskeletal disorders and cardiovascular disease than non-manual workers (Allesoe et al. 2015). Not surprisingly, older manual workers also experience more age related problems, such as fatigue and muscle function decline, than their younger counterparts (Fragar and Depczynski 2011; Jones et al. 2013; Koolhaas et al. 2012). Indeed, physically demanding jobs carried out over long periods of time contribute to health problems in this population (Peeters et al. 2008). Thus, older manual workers may be at particular risk of ill being, which may lead to individuals having to retire earlier than planned and/or reduced health and morbidity into older age. At a societal level, this could have implications for public health care expenditures.

Presenteeism in older workers

Presenteeism is a useful indicator of ill being at work. Presenteeism has been defined as attending work but performing sub-optimally due to poor health or ill-being (Brown et al., 2011). The construct is of key concern to employers as its costs outweigh those associated with absenteeism (Bierla et al., 2013). It has been reported that older workers are at particular risk of presenteeism with 21% of total lost productivity time arising from acute or chronic health conditions including pain (musculoskeletal, low back pain, arthritis; (Hallman et al., 2014), depressive symptoms (Stewart et al., 2003) and stress (Aronsson et al., 2000; Callen et al., 2013; Leinewber et al., 2011; Taloyan et al., 2012). However, levels of presenteeism vary among groups of older workers and this variation may depend on a range of individual, health and behavioural characteristics. While a range of factors may be important predictors of presenteeism in older workers (in particular a variety of health conditions; Schulz & Edington, 2007), research has tended to focus on the impact of negative conditions (e.g., allergies, arthritis; Schulz & Edington, 2007) rather than the role of positive health behaviours and characteristics. This is an important omission because it neglects to take into account the individual's capacity to cope with daily life challenges and to function despite the potential presence of health conditions. In the present study we focus on two important positive resources, stress resilience and physical activity (PA), because both of these are potentially modifiable via appropriate interventions.

Stress resilience

High stress has been identified as an important predictor of presenteeism (Cancelliere et al., 2011). As stress is ubiquitous in many jobs and its presence may be difficult to control, when exploring well-being, stress resilience is of particular interest. Stress resilience has been defined as the ability to 'bounce back' from stress (Smith et al.,

2008), and high levels of stress resilience foster well-being at work (e.g., Avey et al., 2010). It has been proposed that it might serve as a malleable personal resource (Smith et al., 2010). For example, mindfulness programmes appear to be a promising means by which to increase resilience in workers (Robertson, Cooper, Sarkar, & Curran, 2015). Other research has found that resilient individuals are less likely to be absent from work due to ill health (Kotze and Lamb, 2012). Thus, by inference resilient employees should function better at work (i.e., exhibit low levels of presenteeism), although this possibility remains largely unexplored. However, one recent large-scale (*n*=8,015) cross-sectional study indicated that a concept of vitality, which included the dimension of resilience (in addition to energy and motivation) negatively predicts costs of presenteeism (van Steenbergen, van Dongen, Wendel-Vos, Hildebrandt, & Strijk, 2015). This preliminary evidence provides some support for further investigating associations between resilience and presenteeism.

It has been suggested that one way people can become more resilient to stress is by exercising or engaging in PA, and there is some support for this argument (Gerber and Puhse, 2009; Hegberg and Tone, 2015). Indeed, exercise can buffer the negative effects of stress on health and well-being (von Haaren, Ottenbcher, Muenz, Neumann, Boes, & Ebner-Priemer, 2016). These findings may be partly explained by the cross-stressor adaptation hypothesis, which suggests that regular exercise can lead to a reduction in physiological responses to psychological stress (Sothmann, 2006).

The research examining associations between resilience and PA has focused on the role of moderate-to-vigorous PA engaged in during leisure time. However, associations between resilience and *different* domains of PA remain unknown. A cross-sectional study which adopted Latent Profile Analysis with a sample of 2,660 health care and insurance workers found that groups of resilient workers tended to be

more physically active than those exhibiting lower levels of resilience (Gerber et al., 2014). However, due to the measure of PA which was used (a global measure of PA), it was not possible to show whether the links between activity and resilience may have varied depending on the domain of PA examined. Similar issues relate to the literature focusing on the associations between PA and presenteeism.

Physical activity and presenteeism

It is only fairly recently that research has begun to explore associations between PA and presenteeism (e.g., Brown et al., 2011; Cancelliere et al., 2011; Schultz and Edington, 2007). The premise is that employees who engage in PA are healthier and therefore less likely to be ill; hence they are less likely to be absent from work and less likely to underperform at work compared to their less active peers. Indeed, reviews of literature in this area suggest negative associations between PA and presenteeism (Cancelliere et al., 2011; Schultz, & Edington, 2007). Experimental research shows that PA can be increased in the workplace (Conn, Hafdahl, Cooper, Brown, and Lusk, 2009), and one randomized controlled trial with overweight male shiftworkers demonstrated the potential of a complex PA intervention in reducing presenteeism (Morgan, Collins, Plotnikoff, Cook, Berthon, Mitchell, and Callister, 2012).

PA is performed in a range of contexts and little is currently known about how different domains of PA (i.e., activity performed as part of work, during leisure-time and structured sport and exercise activities) may relate to presenteeism. The research conducted so far has not tended to use multi-domain measures of PA (e.g., Brown et al., 2013; Edmunds et al., 2013). However, it is conceivable that different domains of PA relate with presenteeism in different ways. Indeed, some prospective evidence

suggests that high levels of occupational activity increase the risk of health problems across different age groups (e.g., Holtermann et al., 2012; Krause, 2007). For example, Krause et al (2007) found that high levels of occupational activity increased the risk of atherosclerosis 11 years later, even when controlling for leisure-time PA and 20 other potential relevant confounders. This is relevant as health problems (such as atherosclerosis) are key risk factors of presenteeism (Goetzel et al., 2004). Thus, the nature of the associations between PA and presenteeism may be dependent on which domains of PA are examined. Thus, an important contribution of the present study is the assessment of several domains (work, leisure and sport/exercise) of PA.

The contribution of person-centred approaches

Studies examining the links between the constructs reviewed above have used between-subjects, variable-centred designs. Person-centred analyses, in which profiles of individuals are identified based on scores on variables that are relatively similar, are useful for two main reasons. First, they can enhance understanding of the complexity of the associations between variables of interest. Specifically, this type of analysis can help enhance understanding of how interactions (in particular between more than two variables at the same time) occur within-persons, and how these interactions relate to outcome variables. Second, they can reveal sub-groups at risk (e.g., of ill-being), who could be targeted in future interventions. In the present study, we employ a specific type of person-centred analysis, latent profile analysis (LPA), to examine the profiles of older workers based on presenteeism, stress resilience, and domain-specific PA. Compared to the more commonly used cluster analysis, LPA have a number of advantages (Marsh et al., 2009; Pastor et al., 2007). For example, although LPA, like cluster analyses is exploratory in its nature, LPA is a model-based technique that offers more flexibility in terms of model specification. LPA also

provides several fit indices, giving researchers an important tool when comparing different models, ultimately resulting in a stronger platform for making less arbitrary and potentially biased choices in terms of determining the number of profiles. The present study will make a unique contribution to this extant research by examining how presenteeism characteristics cluster with individual resources (stress resilience and PA) that may protect older workers from poor health and ill being.

To help support the validity of profile solutions it is useful to compare the profiles on variables on which the profiles are likely to be conceptually distinguishable. In the present study, we examine differences between profiles in variables of relevance to work-related well-being, specifically affective well-being at work and self-rated health. Job-related affective well-being is a key constituent of work-related well-being (Warr, 1987, 1990) and predicts work performance (Wright and Cropanzano, 2000). It is also a work-related variable closely associated with PA (Thøgersen-Ntoumani et al., 2015; Thøgersen-Ntoumani et al., 2014). Further, self-rated health has been associated in previous research with presenteeism, stress resilience and PA (e.g., Froom et al., 2004; Smith, 2006; Taloyan et al., 2012).

Aims and hypotheses

The aim of the study was to explore the existence of typologies of older manual workers based on presenteeism, stress resilience, and PA, and to examine differences between these profiles on other conceptually relevant indicators of health and well-being. It also aimed to explore whether any differences existed between the profiles in socio-demographic characteristics (age, gender, education and job role). If profiles differed on any of these, the measurement of these could provide an easy practical means of identifying profiles at risk of ill being.

The lack of previous studies using person-centred analyses to identify profiles based on the constructs of interest precludes specific hypotheses pertaining to the exact composition of profiles. However, previous research provided us with some likely possible predictions. First, given extant research reviewed previously on associations between PA and presenteeism (Cancelliere et al., 2011; Schultz and Edington, 2007) and resilience and presenteeism (van Steenbergen et al., 2015), it was is tentatively hypothesized that one group would exhibit relatively high levels of (non-occupational) PA, low levels of presenteeism and high levels of stress resilience. The other profile of individuals is expected to exhibit the opposite pattern of characteristics. Further, for individuals with low levels of stress resilience, high levels of non-occupational PA may compensate for negative effects of stress. Therefore, a profile depicting low-moderate levels of presenteeism, high levels of non-occupational (i.e., sport/exercise and/or leisure-time) PA and low stress resilience was also hypothesised (H1). Second, it was hypothesized that the profiles would differ on perceived health and work-related affect. Specifically, it was expected that profiles characterised by high levels of presenteeism accompanied by low levels of stress resilience and/or non-occupational PA would report the lowest scores on perceived health and positive work-related affect, plus higher scores on negative work affect (H2). No hypotheses were proposed with regards to differences on socio-demographic characteristics.

Method

Participants

Participants n= 216 (69.1% male) with a mean age of 57.1 years (SD = 5.62 years) were recruited from various types of organisations, including supermarkets, postal

service, police force, and fire and rescue services. Most participants were married (69.9%), non-smokers (83.6%), with 38.4% having left school at 16 years old. Most participants worked in manual occupations including healthcare, fire service, engineering and manufacturing (66.7%), followed by craft/labour (12.2%) and construction (8.5%). Additionally, 46.3% of participants reported back/neck/shoulder pain. Eligibility criteria included skilled and unskilled manual workers (i.e., individuals *not* engaged mainly in office work and working with PCs) aged ≥50 years who were in paid employment for at least three months at commencement of the study, and those who were able to write and understand English and provide informed consent. Exclusion criteria included those in non-paid voluntary work, those in paid employment for less than three months, individuals aged < 50 years or whose occupation was not manual, as defined by OPCS Registrar General's Classification of Occupation (Szreter, 1984).

Procedure

The ethics review committee of [the identity of the University has been removed for blinding purposes] granted ethical approval of the study. Participants within companies deemed to employ manual workers were initially approached via e-mail (or otherwise as decided by the company representative), then followed up via telephone calls. An information sheet detailing the nature of the study and an online link via SurveyMonkey or paper copy (depending on preference) of the questionnaire was provided. Additional study information was obtained via the online link and by hard copies when requested. Participants were required to complete written informed consent online to access the survey (i.e., a series of tick boxes). Participants who wished to complete the survey via hard copy were sent paper copies of the information sheet, consent forms and the questionnaire. A researcher either collected

completed surveys and consent forms in person or provided self-addressed envelopes for postal return by the participants.

Design and Measures

The present study used a cross-sectional survey design. A range of measures were used to assess the variables of interest.

Demographics. Demographic information was extracted via the survey using items to assess age (date of birth), gender, education level (age at which participants left school), and job role.

Physical Activity. The Baecke Questionnaire (Baecke et al., 1982) was used to measure habitual levels of PA. The Baecke Questionnaire measures PA across three contexts: sport/exercise, occupational (referred to as work), and leisure-time PA in the past month, and provides total and domain-specific unit less scores. The questionnaire includes a rating of amount (hours per week, months per year) and type (swimming, jogging etc) of activity that individuals typically engage in. Example items include "do you play sport or exercise" yes/no; if yes, "how many hours a week", "how many months a year?" (sport/exercise), "at work I walk" (work), and "how many minutes do you walk and/or cycle per day to and from work, school and shopping" (leisure-time PA) with categories provided. The Baecke questionnaire has been tested in a group of workers over 1 month with a test- retest reliability of .71 (Philippaerts and Lefevre, 1998). Congruent validity and concurrent validity have been supported across three professions (Philippaerts et al., 1999). More recently, Hertogh et al. (2008) reported in a validation study that the scale can correctly classify low and high activity, but is less accurate in identifying moderate activity. The internal consistency for the full scale in the present study was $\alpha = .70$ (sport/exercise: $\alpha = .76$; work: $\alpha = .81$, leisure-time PA: $\alpha = .56$)

Presenteeism. As in previous studies, the 25-item Work Limitations Questionnaire (WLQ; Lerner et al., 2001) was used to represent presenteeism over the past 30 days (e.g., Brown et al., 2013; Gates et al., 2008). The scale measures the degree to which illness or poor health impair an employee's ability to work productively (Lerner et al., 2001; Cancelliere et al., 2011). For example, it measures the amount of difficulty experienced in performing job demands involving mental and interpersonal demands such as concentrating or communicating with others, and physical elements such as lifting and carrying loads. Given that presenteeism refers to being at work but performing below par due to health conditions or illness (Cooper & Dewe, or 2008) and reduces the individual's ability to work productively (Hemp, 2004), the WLQ is conceptually a suitable measure of presenteeism. Moreover, the WLQ has been identified in a review as being one of the most appropriate indicators of presenteeism when examining the associations between PA and presenteeism (Brown et al., 2014). The scale includes four subscales related to demands placed on the worker. Participants are asked how much time they are able to do a range of activities at work with response options ranging from 1 (*none of the time*) to 5 (*all of the time*).These include items measuring time demands (e.g., "stick to routine or schedule"), physical demands (e.g., "lift, carry, move objects"), mental demands (e.g., "concentrate on work"), interpersonal demands ("help others to work"), , and output demands (e.g. "work without mistakes"). These subscales were used in the analysis. Evidence for the adequate validity and reliability of the WLQ has been reported (Lerner et al., 2001). In the present study, the full scale had an internal consistency of $\alpha = .90$ (time demands: $\alpha = .62$; physical demands: .87; mental demands: $\alpha = .73$; interpersonal demands: $\alpha = .57$; output demands: $\alpha = .78$).

Stress Resilience. The tendency to recover from stress was measured using the Brief Resilience Scale (Smith et al., 2008). This is a one-dimensional self-report questionnaire containing six items e.g. "I tend to bounce back after hard times" with a possible response of 1 (*strongly disagree*) to 5 (*strongly agree*). Odd items were positively worded and even items were negatively worded. Scores were calculated by reverse coding the negative statements then adding them to the positive statements. A mean of the 6 items is taken to represent level of stress resilience with higher scores indicating greater levels of stress resilience. The questionnaire has previously demonstrated high internal consistency of $\alpha = .80 - .91$ (Smith et al., 2008). In the present study, the internal consistency was also high ($\alpha = .86$).

Job Related Well-being. The shortened version of the Job-Related Affective Well-Being Scale (Van Katwyk et al., 2000) was used to assess emotional reactions to the individual's job in the past 30 days. This is a two-dimensional scale, which has an arousal and a valence (pleasure) dimension. In this study, 20 of the original 30 items were used. Twenty items were split into four dimensions: high pleasure/low arousal (HPLA; akin to contentment; an example item is "My job made me feel relaxed"), high pleasure/high arousal (HPHA; akin to feelings of energy; e.g. "My job made me feel inspired"), low pleasure/low arousal (LPLA; akin to depression; e.g., "My job made me feel depressed") and low pleasure/high arousal (LPHA; akin to stress or anxiety; e.g., "My job made me feel anxious"). Items were selected according to their relevance to the study whilst ensuring that all dimensions were represented equally. The four dimensions were used as indicators in the analysis. Respondents were required to indicate how often they had experienced each emotion in the last 30 days. Responses were rated using a 5 point scale (*1 = never; 5 = always*) with high values representing high levels of that affective state. The scale has been shown to be

internally consistent with a Cronbach's alpha of .95 (Van Katwyk et al., 2000). The scale was internally consistent when examined in the present study (α= .89). The sub-scales also demonstrated satisfactory levels of internal reliability (HPLA: α = .83; HPHA: α = .89; LPLA: α = .76; LPHA: α = .79).

Self-rated health. Self-rated health was assessed using a single item asking participants to rate their overall health in the past 12 months. Response options ranged from 1 (*excellent*) to 5 (*poor*), and the item was reverse scored before it was entered into the analysis so that higher scores indicated better health.

Data Analysis

First, descriptive analysis was conducted and bivariate correlations were computed using IBM SPSS version 22. Latent Profile Analysis (LPA) using MPlus (version 7.1; Muthén and Muthén, 2012) was used as the main analysis in the study. Stress resilience, leisure-time PA, work PA, sport/exercise participation and the four presenteeism sub-scales were used as input variables. Models with 2-5 profiles were tested to determine the most suitable solution. Various criteria were inspected to determine the most suitable solution. The Bayesian Information Criterion (BIC; Nyland et al., 2007), and the sample-size adjusted BIC (SSABIC; Yang, 2006) were used, whereby lower values indicate better model fit. The Lo-Mendell-Rubin likelihood test (LMR; Lo et al., 2001) and the Bootstrapped Likelihood Ratio Test (BLRT; Arminger et al., 1999) were inspected to compare the fit of two competing models; the target solution compared to a solution with one less profile. Statistically significant LMR and BLRT values indicate that the profile solution in question fits better than a profile solution including one less profile. The precision of assigning latent class membership is interpreted using the entropy index (Aldridge and Roesch,

2008). Here, higher probability values indicate greater precision of classification. Maximum likelihood estimation was used to identify model parameters. As recommended by Geiser (2013), for relatively complex latent models, 500 sets of start values were requested in the first step of the optimization, then re-checked using 1000 sets. Further, iterations were also increased from 10 (default setting on MPlus) to 50 in the first step of the optimisation (Uebersax, 1999). To validate the selected profile solutions, one-Way MANOVA and ANOVA tests were conducted in IBM SPSS v22 to examine differences between the profiles in the auxiliary variables.

Results

Descriptive statistics, reliability analyses, and bivariate correlations

Descriptive statistics for older manual workers in this study are shown in Table 1. The sample as a whole reported to engage in average levels of PA in each index (Baecke et al., 1982), moderate to high levels of presenteeism, and moderate levels of stress resilience. Most participants reported relatively high levels of LPHA (e.g. anxious, angry) (M = 4.0, SD = 0.8) and low levels of HPHA (e.g. energetic, inspired). Health perceptions were generally high (M = 3.5, SD = 1.0). No differences existed between males and females. Small significant negative correlations between stress resilience and each of the dimensions of presenteeism were evident. Fewer significant associations existed between PA and the presenteeism dimensions existed. Specifically, only the physical demands dimension was significantly and positively correlated with work PA and leisure-time PA.

Extraction of Latent Classes

We examined the fit of models extracting between two and five classes. The fit indices for each different model tested are included in Table 2. The BIC was lowest in the four-profile solution, although the SSABIC was lowest for the five-profile solution. The BLRT suggested that each subsequent model fitted data better than a model with one less profile. The Adjusted Lo-Mendell-Rubin Likelihood ratio test (LMR) showed that a three and four-profile solution fitted better than one with one less profile. However, the five-profile model did not fit better than the four-profile model. Further, the entropy indices increased from two to four profiles but then stabilised as the five-profile solution was added. Thus, from a statistical standpoint, the four-profile solution represented the most suitable solution. However, to decide the optimal number of classes, we also examined the interpretability of each class solution. Inspecting the pattern of responses across the profiles, the results indicated that the four-profile model constituted the most substantive and parsimonious solution.

Interpretation of the best fitting four-profile solution

A description of the four different profiles is presented in Table 3 and it is graphically depicted in Figure 1 (using standardised z scores to ease interpretation). Profile one (*n*= 12; 5.5%) is characterized by low levels of stress resilience, average levels of leisure-time and work-related PA, but high levels of sport and exercise participation. Further, individuals in this profile display low levels of presenteeism. This profile is labelled 'High sport/exercise well-functioning'. Profile two (*n*=21; 9.7%) exhibit average levels of stress resilience, high levels of leisure-time and work PA, yet average levels of sport/exercise participation. In terms of presenteeism, this profile scores relatively high on time and physical demands, very low on interpersonal demands and display average levels of mental and output demands. This profile is

therefore labelled *'Physically burdened'*. The third profile (*n*=101; 46.50%) display moderate scores on most variables, although has relatively low levels of stress resilience and presenteeism due to physical demands. These individuals have moderate levels of presenteeism due to other demands. We called this profile '*Moderately active and functioning'*. The fourth and final profile (*n*=83; 38.20%) is characterized by moderate levels of stress resilience, and moderate levels of leisure-time, work and sport/exercise behaviour. However, in contrast to profile three, this profile displays relatively high levels of presenteeism across the board. This profile was called *'Moderately active, high presenteeism'*.

Differences in well-being across latent profiles

The four profiles were compared on the four categories of work affect (HPHA, HPLA, LPHA, and LPLA). In conducting the MANOVA, the four classes (dummy coded 1-4) served as the independent variable, with the four dimensions of work affect serving as the dependent variables. The MANOVA was significant: Pillai's Trace = .123; $F(12, 615) = 2.20$; $p = .01$; partial $\eta^2 = .04$. Between-subjects analysis showed that the profiles differed on HPLA ($F(3, 206) = 2.67$; $p = .049$), LPHA ($F(3, 206) = 4.94$; $p = .002$), and LPLA($F(3, 206) = 3.51$; $p = .016$). Post-hoc tests reveal non-significant differences between the profiles on HPLA, although the highest scores were found for 'High sport/exercise well-functioning'. With regard to LPHA, post-hoc tests revealed that the 'High sport/exercise well-functioning*'* individuals had significantly lower scores on this variable than individuals in the other two clusters. A similar pattern was evident for LPLA, with lower scores for High sport/exercise well-functioning compared to the 'Moderately active and functioning' and moderately active with high presenteeism*'* profiles.

An additional one-way ANOVA analysis was conducted to compare differences between the classes in health perceptions. Again, dummy coding representing the classes (1-4) was used as the independent variable. This analysis revealed significant differences in health perceptions: $F(3, 213) = 5.51$; $p = .001$; $\eta^2 = .07$. The post-hoc tests revealed that individuals in the 'Moderately active with high presenteeism' clusters reported significantly lower scores on health perceptions than participants in the other profiles. The means and standard errors for the analyses are presented in Table 4.

Comparing classes on socio-demographic characteristics

Pearson chi-square tests showed no differences in gender distribution between the classes ($\chi^2(3) = 2.46$; $p = .48$), level of education ($\chi^2(21) = 12.82$; $p = .92$), or type of occupation ($\chi^2(24) = 32.72$; $p = .11$). One-way ANOVA analyses further revealed no differences between the classes in age of leaving school ($F(3, 207) = .81$; $p = .49$; $\eta^2 = .01$), and no differences in age distribution ($F(3, 201) = .74$; $p = .53$; $\eta^2 = .01$).

Discussion

The aim of the present study was to explore latent profiles of presenteeism, stress resilience and different domains of PA in a diverse group of older manual workers aged >50 years. Four distinct profiles were identified, suggesting that it is possible to identify distinct typologies on these characteristics in older manual workers. Moreover, the profiles differed on aspects of self-rated health and well-being.

The nature of the profiles highlighted the heterogeneity in levels on the constructs across groups. In other words, as expected, the combinations of variables

differ by group. The results partially confirm the hypotheses. As expected, those engaging in high levels of structured PA (i.e., the 'High sport/exercise well-functioning' cluster) reported low levels of presenteeism, and levels of stress resilience were rather low. This result aligns with previous research, using variable-driven approaches, showing that engagement in high levels of sport or exercise is associated with lower levels of presenteeism (Cancelliere et al., 2011; Schultz & Edington, 2007).

In contrast to the rather expected results for the 'High sport/exercise well-functioning' profile, the composition of other profiles was more surprising. In particular, the results also revealed that other older workers who were relatively physically active overall experienced relatively high levels of presenteeism (i.e., the 'Moderately active with high presenteeism' cluster). This cluster can be considered the group most at risk of poor health and well-being, as participants in this profile also displayed significantly greater levels of LPHA (akin to stress or anxiety) and LPLA (akin to depression), and rated their health as poorer, compared to participants in some of the other clusters. The finding pertaining to this profile illustrates the complex associations between PA and presenteeism. It reiterates our point made earlier that it may be critical to examine multiple domains of PA and presenteeism to clarify associations between these variables. Although we cannot infer causality from this study, it is possible that engagement in structured and planned PA that is of a relatively high intensity (i.e., sport and exercise) is needed to reduce presenteeism. In other words, engaging in other types of PA that is of lower intensity may not be sufficiently effective. This possibility, as well as dose-response issues, should be examined in future experimental research. In future, researchers should also examine for whom and under which circumstances PA is effective as a buffer against stress.

Prior research suggests that high levels of occupational activity are associated with increased risks of health problems controlling for leisure-time PA (Krause et al., 2007). However, of note, participants in the 'Physically burdened' group who reported both very high levels of occupational and leisure-time activity reported better health than those in the 'Moderately active with high presenteeism' group. Participants in the 'Physically burdened' profile may be those of particularly good health who are able to deal (physically and/or psychologically) with the physical demands of work. It is possible that for these individuals, physical activity acts as buffer against stress (Gerber et al., 2014, Gerber, Lindwall, Lindegård, Börjesson and Jonsdottir, 2013). Further, given the age group we sampled, perhaps individuals with poorer health profiles would be more likely to have retired early due to ill health and were therefore not included in the study. In other words, a selection effect may partly account for these results. Indeed, ill-health combined with heavy physical workload in workers aged >50 years, is a prime reason for early/involuntary retirement (Dhaval, 2008; van den Berg et al., 2010).

Interestingly, stress resilience did not discriminate well between the profiles, although the 'high sport/exercise well-functioning' group had relatively low scores on this variable. This could be interpreted in different ways. First, it could be interpreted as support for the buffering role of physical activity. Alternatively, it could mean that in our sample of older manual workers, stress resilience did not serve as a particularly meaningful resource in the protection against presenteeism. Indeed, the participants reporting the highest level of resilience (although still moderate) were those in the 'Moderately active with high presenteeism' profile. However, this finding could be partly due to the scale we used to measure stress resilience. Indeed, while the Brief Resilience Scale assesses a disposition to bounce back from stress, Bonanno et al.

(2015) suggest that resilience likely fluctuates over time and this may account for stronger effects. Given the research design, we were unable to assess changes in stress resilience over time. Further, due to the cross-sectional research design, we cannot infer causality; thus, it is possible that people who perceive themselves to be less resilient engage in structured sport and exercise as a means of building such resilience or to compensate for relatively low levels of resilience. It is important to examine in future research whether PA is a determinant or outcome of stress resilience in longitudinal designs

Practical Implications

We examined whether demographic variables could discriminate between the classes, as this would allow for a seemingly obvious and easy way to identify individuals at risk. However, the profiles did not differ on any of the socio-demographic characteristics we examined. This result suggests that simple socio-demographic profiling will not be a useful way of identifying workers 'at risk' of poor health and well-being; more sophisticated assessments of health and well-being will likely be needed, i.e., those that were used in the present study.

While it is difficult to stipulate at this stage which interventions will be effective for which groups, the results of our study suggest that for some individuals ("high sport/exercise well functioning"), focusing interventions on maintaining high levels of PA engagement (in particular sport and exercise activities) may be a promising way of improving or retaining levels of wellbeing and functioning at work. For these individuals, employers could provide facilities for such activities on-site (which may not be possible for all companies) and access to showers for example, but could also implement flexible working time, and development of a workplace health climate in which such activities are valued and actively encouraged. Additionally,

extensive research suggests that to maintain such high levels of engagement, an autonomy supportive environment (in which individuals' feelings of autonomy, comptentence and relatedness are supported) should be provided which fosters high quality of motivation (Ng, et al., 2012).

However, for other groups of older workers, the solution may be more complex and require more multi-faceted interventions targeting several different components, with some components tackling directly work-specific issues. Research suggests that important work-related factors needing consideration include workload, fairness, rewards, and work control (Aronsson and Gustafsson, 2005; Pohling, Buruck, Jungbauer, and Leiter, 2016). Future studies should attempt to develop and test profile specific interventions to allow for an assessment of which interventions may be most suitable for each of the individual profiles.

Limitations and Strengths

It is important to note the limitations of the study. As already alluded to, due to the cross-sectional nature of our study, causal inferences should be avoided. Further, the stability of the profiles is unknown. It would be interesting in future research to examine predictors of profile stability over time adopting Latent Transition Analysis, in particular across important periods of life-events and transitions, such as the retirement transition (see Henning, Lindwall and Johansson, 2016) Using self–report rather than objective measures of PA is another limitation of this study due to the tendency for individuals to overestimate their PA levels using self-report measures (e.g., van Sluijs et al., 2007). The unit less scores derived from the PA questionnaire used in this study also precludes the identification of the level of PA that participants in each cluster engaged in. Objective measures of PA (i.e., using accelerometry) could be employed to form profiles in the future.

Notwithstanding these limitations, our study had a number of strengths. First, the use of Latent Profile Analysis to identify typologies provided a complementary view of the interactional patterns of associations within different types of individuals. More specifically, the use of person-centred analysis may afford a different perspective on how the three constructs of presenteeism, PA and resilience simultaneously interact within-persons to create unique patterns that impact other relevant outcomes linked to work and health. More traditional variable-oriented analyses are less able to capture such complex simultaneous interplay (Bergman and Andersson, 2010).

It also enabled the identification of older manual workers at risk of poor health and ill-being. Second, PA was differentiated into work, leisure and sport/exercise domains, and presenteeism was assessed using multi-dimensional measure capturing four distinct components. This enabled a more detailed understanding of associations between the variables. Finally, the study provided insight into heterogeneity in health and well-being characteristics among a group of individuals usually underserved in this type of research (i.e., older manual workers).

Conclusion

The findings from the present study add unique insight to previous literature by using a person-centred perspective to enhance understanding of health and well-being profiles of older (aged >50) manual workers. The findings suggest that the associations between presenteeism, stress resilience and PA in this group are more complex than typically depicted in the literature. The results may be useful to enhance understanding of older manual workers who may be at greatest risk of involuntary retirement and ill health into old age. Given the dramatic changes in the distribution

of active workers to pensioners, it is critical to understand more about factors that help retain older workers in the workforce.

Conflict of interest: The authors declare that they have no conflict of interest.

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Table 1. Means, Standard Deviations and Bivariate Correlations among All Variables

All variables (range)	*M (SD)*	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	57.07 (6.63)	-.03	.07	.12	-.24**	.03	.13	.01	.02	-.11	-.09	-.02	.10	.05	-.02
2. Resilience (1-5)	3.76 (.70)		.10	-.21**	-.27**	-.20**	-.16*	-.10	.09	.06	.24**	.21**	.22**	.31**	.21**
3. Physical demands (1-5)	2.00 (.78)			.45**	.48**	.25**	.50**	.39**	.17*	-.03	-.15*	.03	.03	.09	.07
4. Time demands (1-5)	2.49 (.44)				.48**	.25**	.48**	-.10	.06	.08	-.15*	-.22**	-.23**	-.16*	-.17*
5. Mental demands (1-5)	2.16 (.53)					.37**	.61**	-.16*	-.04	.04	-.04	-.17*	-.31**	-.27**	-.06
6. Interpersonal demands (1-5)	3.27 (.66)						.41**	.02	-.08	-.06	-.21**	-.22**	-.23**	-.22**	-.17*
7. Output demands (1-5)	2.32 (.49)							-.04	-.07	.08	-.03	-.18**	-.25**	-.17*	-.11
8. Work index	2.94								.16*	.05	.004	-.05	-.03	-.19**	-.03

(1-5)	(.60)							
9. Leisure index (1-5)	2.72 (.75)	.34**	.25**	.29**	-.05	.02	.12	
10. Sport index	2.73 (.77)		.12	.10	-.10	-.12	.24**	
11. HPHA (1-5)	2.83 (1.01)			.80**	.05	.24**	.15*	
12. HPLA (1-5)	3.24 (1.02)				.32**	.42**	.16*	
13. LPHA (1-5)	4.00 (.75)					.66**	.16*	
14. LPLA (1-5)	3.71 (.70)						.13	
15. Health (1-5)	3.48 (1.00)							

Table 2.

Fit Indices, Entropy, and Model Comparisons for Estimated Latent Profile Analyses Models

Model	LL	BIC	SSABIC	Entr	LMR	BLRT
2 profile	-1742.99	3419.67	3330.94	.80	149.72**	-1767.68**
3 profile	-1691.03	3403.78	3283.36	.83	101.99*	-1634.51**
4 profile	-1648.55	**3402.05**	**3249.95**	**.85**	83.37*	**-1599.67****
5 profile	-1626.20	3404.92	3221.12	.85	43.86	-1571.91**

The selected solution is indicated in bold font

LL = Log-likelihood; BIC = Bayesian Information Criterion; SSABIC = Sample Size Adjusted Bayesian Information Criterion; LMR = p-value for Adjusted Lo-Mendell-Rubin likelihood ratio test; BLRT = bootstrap likelihood ratio test.

*p<.05

**p<.01

Table 3.

M (SE) of the Four Latent Profiles (Raw Scores)

Variables	High sport/exercise well-functioning	Physically burdened	Moderately active and functioning	Moderately active with high presenteeism
Resilience	3.18 (.21)	3.45 (.31)	3.72 (.08)	3.97 (.09)
Leisure-time PA	2.41 (.21)	3.09 (.21)	2.63 (.09)	2.79 (.09)
Work PA	2.68 (.13)	3.56 (.19)	2.74 (.14)	3.06 (.10)
Sport/Exercise	3.19 (.31)	2.73 (.24)	2.63 (.09)	2.80 (.09)
Time demands	1.82 (.26)	2.75 (.15)	2.33 (.05)	2.71 (.06)
Physical demands	1.02 (.14)	2.54 (.26)	1.43 (.14)	2.65 (.09)
Mental demands	1.45 (.17)	2.18 (.21)	1.91 (.08)	2.53 (.09)
Interpersonal demands	2.61 (.16)	2.30 (.12)	3.12 (.10)	3.79 (.05)
Output demands	1.25 (.16)	2.33 (.16)	2.17 (.07)	2.64 (.07)

PA=Physical Activity

*Values with different subscripts in the same row differ significantly at $p < .05$.

Table 4.

Differences Between Latent Profiles in Well-Being

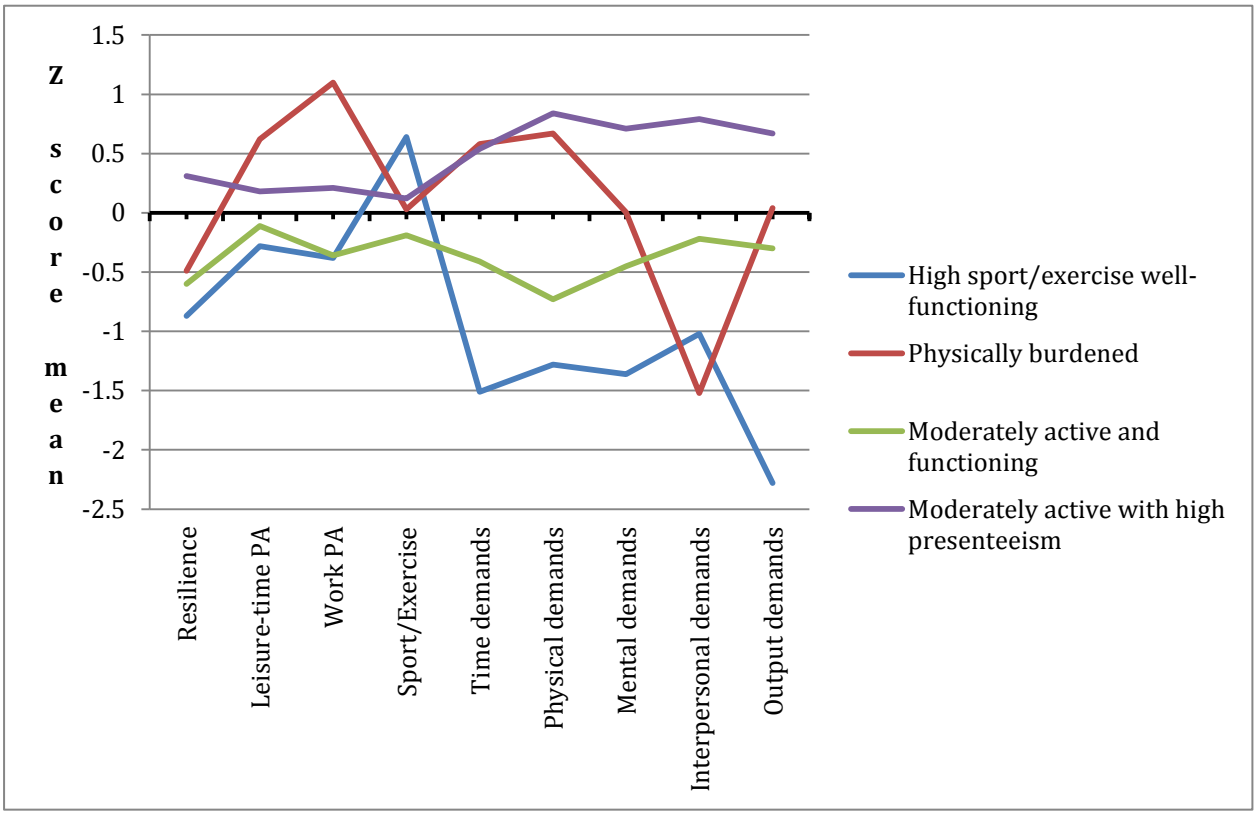
Variables	High sport/exercise well-functioning	Physically burdened	Moderately active and functioning	Moderately active with high presenteeism
	M (SE)	*M (SE)*	*M (SE)*	*M (SE)*
HPHA (1-5)	2.98 (.27)$_{a}$	2.54 (.19)$_{a}$	2.93 (.09)$_{a}$	2.99 (.10)$_{a}$
HPLA (1-5)	2.98 (.25)$_{a}$	3.07 (.18)$_{a}$	3.29 (.09)$_{a}$	3.51 (.09)$_{a}$
LPHA (1-5)	3.32(.22)$_{a}$	3.95 (.16)$_{ab}$	3.94 (.08)$_{b}$	4.17 (.08)$_{b}$
LPLA (1-5)	3.16 (.21)$_{a}$	3.49 (.15)$_{ab}$	3.73 (.07)$_{b}$	3.79 (.08)$_{b}$
Health Perceptions (1-5)	2.67 (.28)$_{ab}$	3.00 (.21)$_{a}$	2.66 (.10)$_{a}$	2.21 (.11)$_{b}$

HPHA=High Pleasure/High Arousal; HPLA=High Pleasure/Low Arousal;

LPHA=Low Pleasure/High Arousal; LPLA=Low Pleasure/Low Arousal

*Values with different subscripts in the same row differ significantly at $p < .05$.

Figure 1. Presenteeism, Stress Resilience and Physical Activity Profiles in Best Fitting Model (4 Profiles; All Scores are Standardized)


Z score mean
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
Resilience
Leisure-time PA
Work PA
Sport/Exercise
Time demands
Physical demands
Mental demands
Interpersonal demands
Output demands
High sport/exercise well-functioning
Physically burdened
Moderately active and functioning
Moderately active with high presenteeism