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Original article

## Associations Between Work Characteristics, Engaged Well-Being at Work, and Job Attitudes — Findings from a Longitudinal German Study



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### ABSTRACT

**Objective:** The Job Demand & Resources model suggests work characteristics are related to mental well-being and work engagement. Previous work describes the development of a combined construct ‘engaged well-being at work’ (EWB). To what extent changes in measures of this construct are responsive to changes in job demands and resources or associated with changes in job-related attitudes has not been established.

**Methods:** Longitudinal employee-level data from three waves (German Linked Personnel Panel) were used. Logistic and linear fixed effects regression analyses explored longitudinal associations between changes in EWB for participants over a three-year period with changes in job demands and resources and job-related attitudes (job commitment, satisfaction, and turnover intentions).

**Results:** While job resources were associated with increased odds for a change into a healthier and/or more engaged category of EWB, job demands reduced them. Job resources were more strongly related to higher EWB ( $OR_{\text{range}} = 1.22 - 1.61$ ) than job demands ( $OR_{\text{range}} = 0.79 - 0.96$ ). Especially psychological job demands showed negative associations with improved EWB ( $OR = 0.79$ ). A change from the least desirable category ‘disengaged strain’ to any other category of EWB was associated with greater odds by up to 20.6 % for increased commitment and job satisfaction and lower odds for turnover intentions.

**Discussion:** Improving work characteristics, especially job resources, could increase employees’ EWB, emphasizing the importance of job characteristics for a healthy workplace. Because EWB seems to be associated with job attitudes, an improvement of this indicator would be relevant for employees and employers.

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### 1. Introduction

A recent press release by the Deutsche Angestellten-Krankenkasse (DAK), a major German health insurance company, reported that days of sick leave due to mental health impairments have been continuously increasing since the start of recording and reached an all-time high in 2020 [1]. In this year, an additional factor is adding to this problem: The Coronavirus (SARS-CoV-2) pandemic is not only decreasing mental health (e.g. [2,3]) but also puts hardship on the economy, resulting in alarmingly high unemployment rates [4]. But even before the pandemic, mental disorders have accounted for 16.6% of days of sick leave in Germany [5]. These developments

increase the need to focus on both improving workplace mental health and work engagement to maintain productivity, preferably at low costs for employers [6]. Both mental well-being and work engagement are associated with better work-related outcomes. Employees with higher mental well-being are more productive and less often absent from work [7] and greater work engagement may lead to higher performance and innovativeness [8,9] as well as greater task performance and financial returns [10]. Therefore, it is essential for employers to find ways in which they can improve both mental well-being and work engagement.

According to the well-established Job Demand & Resources (JD-R) model (for reviews see [11,12]), both mental well-being and work

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engagement can be influenced by physical, psychological, social, or organizational aspects of the workplace: job demands and job resources. The first are associated with costs (physiological and/or psychological) because they require sustained physical and/or psychological effort [11]. The latter may reduce job demands and the associated physiological and psychological costs. Furthermore, they can be functional in goal achievement or stimulation of personal growth, learning, and development [11]. Both, summarized as work characteristics, appear to affect mental health and engagement through different psychological pathways: the health-impairment process and the motivational process [11]. Supporting the first, multiple studies showed that mainly job demands were associated with mental health-related outcomes such as burnout [13], exhaustion [14], or absence duration [15]. Supporting the latter, job resources seem to predict motivational outcomes, such as work engagement [13], or absence frequency [15]. Long-term studies support the proposed pathways: For instance, in a three-year longitudinal study, work engagement, which was influenced by job resources, predicted work commitment, while job demands predicted burnout [16]. However, job resources showed a buffering effect on burnout in this study [16], as well as in following research [17,18]. A comprehensive meta-analysis confirms these long-term associations between job demands and resources with well-being in terms of burnout and work engagement [19]. The interaction of the different components and pathways of the JD-R might indicate an underlying construct of combined workplace engagement and well-being which requires further investigations. However, to our knowledge, no long-term associations between a combined construct of workplace engagement and well-being with workplace characteristics have been investigated so far.

In line with previous attempts to combine well-being and work engagement within one model [20–22], recent research indicates that mental well-being and work engagement are correlated but distinct factors that form a two-dimensional space and that they can be combined into the new construct engaged well-being (EWB) [23]. Within this EWB frame, four categories were defined in which employees can be divided: engaged well-being, disengaged well-being, engaged strain, and disengaged strain (Table 1). Within these nominal categories, engaged well-being could be considered the most desirable state (high mental health and work-engagement), while disengaged strain would be the least desirable. Moreover, the previous study [23] has shown, that employees can change their status of engaged well-being over time, moving from one category to another. Thus, the construct of EWB might be helpful not only to monitor changes in this two-dimensional space over time but also in establishing factors to enhance such a change.

### 1.1. The present study

Since the construct of EWB (step 1 in Fig. 1) is new, it has not yet been established which workplace factors might affect it. Thus, this study aims to explore long-term relationships between work characteristics and EWB (step 2, Fig. 1). As outlined above, previous research has shown associations between well-being and work engagement and, for instance, performance and work commitment [6–9]. However, these associations have yet to be tested with the

combination of work engagement and well-being. Therefore, associations of EWB and job-related attitudes (turnover intentions, job satisfaction, and commitment) will be examined (step 3, Fig. 1).

## 2. Materials and methods

### 2.1. Data

The Linked Personnel Panel (LPP) is a longitudinal panel that links employer and employee information. Employer-level information are, for example, human resource culture or management instruments, while employee-level information include data on work-related resources and demands, health status, and socio-demographic characteristics (for more information see [24–27]). The LPP was initiated by the German Federal Ministry of Labor and Social Affairs and administered at the Institute for Employment Research (IAB). Data access to the LPP was provided via on-site use at the Research Data Center (FDZ) of the German Federal Employment Agency (BA) at the IAB and subsequent remote data access. Currently, the LPP comprises three waves (2012/13, 2014/15, and 2016/17, [28]). It is representative of private German companies that are moderate-to large-sized ( $\geq 50$  employees) in the manufacturing and service sectors [27].

Overall, the first wave (2012/2013) comprises data from 7,508 employees and 1,219 companies, while in the second wave (2014/2015), 7,282 employees and 771 companies were interviewed, and 6,779 employees and 846 companies participated in the third wave (2016/2017). Due to the longitudinal design of our analyses, one inclusion criterion was participation in at least two of the three waves. Further criteria included being between the age of 20 and 65, according to the retirement age of this cohort in Germany [29], and providing valid data on all study variables used in the regression analysis (see below), leading to an analytical sample of  $n = 4,038$  employees (76.4% of all panel cases). Fig. 2 provides a more detailed overview of how we arrived at our analytical sample. The Ethics Committee of the Medical Faculty of the University of Heidelberg approved the use of the LPP for secondary data analysis (2018-514N-MA). All participants provided informed consent.

### 2.2. Measures

#### 2.2.1. Mental Well-Being

The WHO-5 Well-Being Questionnaire (version 1998) is a commonly used and validated instrument to measure the mental well-being [30,31]. The five items assess whether during the last two weeks employees felt 'cheerful and in good spirits', 'calm and relaxed', 'active and vigorous', 'fresh and rested', and whether their daily life was filled with things that interested them. Responses were rated on a 6-point Likert scale with 0 representing 'at no time' and 5 representing 'all of the time'. The sum of the five items multiplied by four was used for the overall mental well-being index ranging from 0 to 100. Higher values of the scale indicate a better assessment of one's well-being.

#### 2.2.2. Work engagement

The Utrecht Work Engagement Scale (UWES-9) was used to measure work engagement [32–34]. Work engagement is defined as a positive, fulfilling, work-related state of mind that is characterized by vigor, absorption and dedication [33]. The nine items comprise statements like 'When I get up in the morning, I feel like going to work' (see supplementary material for full questionnaire). All items are measured on a five-point Likert scale with 1 equaling 'never' and 5 equaling 'daily' and a mean score across all nine items was calculated. The score ranges from 1 to 5 and a higher score indicating more work engagement.

**Table 1**  
Categories of EWB

	Engaged well-being	Disengaged well-being	Engaged strain	Disengaged strain
Mental well-being	+	+	–	–
Work engagement	+	–	+	–

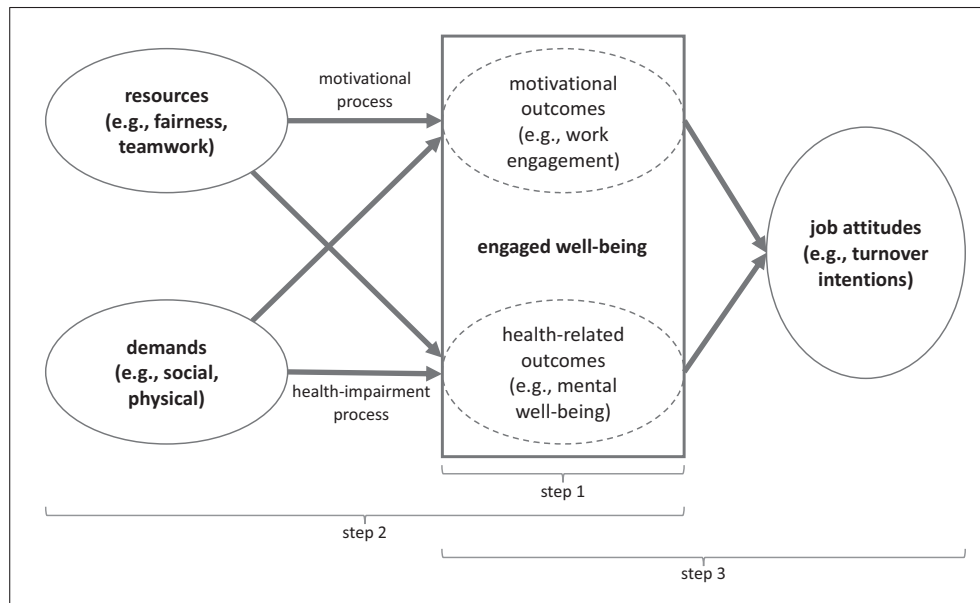


Fig. 1. Theoretical assumptions about associations between EWB, work characteristics, and job attitudes. EWB, engaged well-being.

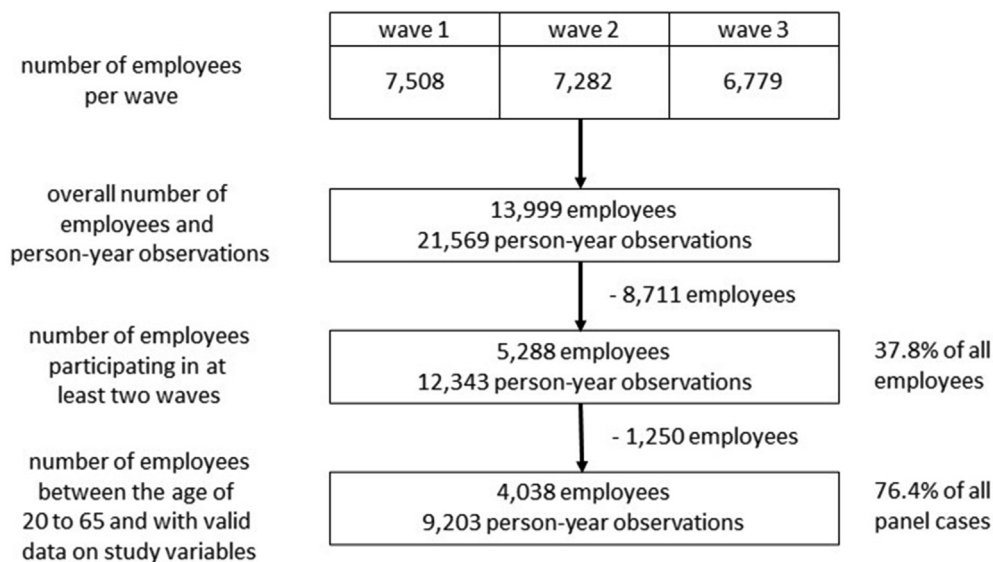


Fig. 2. Flow chart of analytical LPP-sample. LPP, Linked Personnel Panel.

### 2.2.3. EWB

EWB was based on employees' assessments of both their mental well-being and work engagement. The separation into the four categories engaged well-being, disengaged well-being, engaged strain, and disengaged strain was based on the findings of a preceding validation study [23], yielding cut-off values for the originally continuous constructs of mental well-being and work engagement. A value of  $\geq 51$  in the WHO-5 is indicative of good mental well-being and was used to distinguish between good mental well-being vs. strain [30]. High work engagement was defined as the top 60% ( $UWES-9 \geq 3.7$ ) and disengagement as the lowest 40% ( $UWES-9 < 3.7$ , REF EWB Paper 1). The resulting categories are displayed in Table 1. Even though the categories are merely nominal, it can be assumed that engaged well-being is the most desirable since it reflects both the highest degree of well-

being and work engagement. Accordingly, disengaged strain should be least desirable.

### 2.2.4. Work characteristics

Several work characteristics assessed in the LPP were classified as either job resources or job demands based on the results of a factor analysis (see supplementary material). This factor analysis indicated to summarize several items to different aspects of job resources and demands according to their factor loadings. The resources comprised work autonomy and diversity, supervisory support and organizational goals, fairness, development and job promotion, and teamwork. Job demands comprised psychological demands, physical demands, and social demands. All items were measured on a 5-point Likert scale — a higher value indicating either more resources or higher demands (see

supplementary material for description, Cronbach's alpha, and factor loadings).

### 2.2.5. Job attitudes

Employee commitment—the relative strength of an employee's identification with and involvement in an organization—was measured using a short form questionnaire [27,35]. This questionnaire includes six items measuring affective commitment on a five-point Likert scale (1 'does not apply at all'; 5 'fully applies'). The items comprise the statements like 'This organization has a great deal of personal meaning for me' or 'I do not feel emotionally attached to this organization'. The coding was reversed if an item was phrased negatively and a mean score (range 1-5) across all items was calculated. A higher value indicated greater affective commitment.

Having no turnover intentions ('How many times in the past 12 months have you thought about changing your job?'; note that the coding was reversed for analysis) was rated on a five-point Likert scale that ranged from 1 (daily) to 5 (never). Employees rated their level of job satisfaction ('How satisfied are you today with your job?') on an 11-point Likert scale ranging from 0 (completely unhappy) to 10 (completely happy).

### 2.2.6. Descriptive sample characteristics

Individual and organizational characteristics used for the description of the analytical sample were gender (male; female), age-group (20–29; 30–39; 40–49; 50–59; 60–65 years), white-collar/blue-collar status (self-report), and full-time/part-time work.

### 2.3. Analyses

The main analytical approach to test the associations between EWB, work characteristics, and job attitudes involved two steps:

In the first step, fixed effects (FEs) logistic regression models were used to estimate the longitudinal associations of job demands and resources with EWB. FE models compare within employees, not between employees [36]. Therefore, the changes in EWB within employees between waves were analyzed. Even though all 4,038 subjects that participated in all three waves were included, the analyses only analyze those whose responses reflect a change in one interval. In these models, different binary dependent variables were used, based on the comparison of two of the four categories of EWB. The analyses included the following comparisons, to compare against the most desirable category engaged well-being:

1. Disengaged strain, disengaged well-being, and engaged strain vs engaged well-being,
2. Disengaged well-being versus engaged well-being,
3. Engaged strain versus engaged well-being,
4. Disengaged strain versus engaged well-being.

All job characteristics were included as metric independent variables. Odds ratios (OR) and corresponding confidence intervals (CI) describe how increases in job resources and demands by one scale unit were associated with a change from one or multiple lower categories into a better category in subsequent waves.

In the second step, linear FE regression analyses were performed to analyze longitudinal associations between EWB and job attitudes. For all linear regression models, our coefficients represent within-individual average differences (presented as changes in %) in job attitude scores between waves in which employees' responses were categorized as reflecting 'disengaged strained' (reference) and waves in which employee responses reflected any other category.

All regression models controlled for age in years at baseline. Time-constant control variables such as gender were not included as FE-models account for all time-invariant indicators within employees. We conducted our analyses using the statistical software package STATA, version 14 [37].

## 3. Results

### 3.1. Analytical sample

Table 2 provides descriptive statistics of the analytical sample. Mental well-being was on average rated as good (62.9,  $\pm$ 20.0) and the average reported work engagement can be found in the upper third of the total scale (3.7,  $\pm$ 0.8). The sample was primarily male (73.5%), between the age of 50 and 59 years (42.9%), and consisted predominantly of white-collar workers (65.1%), and employees working in full-time jobs (87.3%). Means for job characteristics are reported in the appendix Tables A1 and A2.

The greater part of the overall analytical sample was categorized as engaged well-being (47.7%). 28.3% belonged in the category disengaged well-being and 16.3% were engaged with poor well-being (disengaged strained). With a proportion of 7.9%, the category engaged strained was the smallest category.

The results of the analysis are presented in Table 3. While increases in job resources were generally associated with higher odds for a change into a better category of engaged well-being (OR  $\geq$  1.22), increasing psychological and social demands were associated with reduced odds (OR  $\leq$  0.85, physical demands not significant).

Amongst the job resources, only an improvement in teamwork significantly raised the odds for a change from engaged strain to engaged well-being (OR = 1.41, CI = 1.06 - 1.88). With the exception of work autonomy and diversity, on the other hand, an increase in all job resources raised the odds to change from disengaged well-being to engaged well-being (OR  $\geq$  1.28). Improvements in fairness OR = 2.48, CI = 1.47 - 4.17) and work autonomy and diversity (OR = 1.86, CI = 1.20 - 2.89) were associated with higher odds for a change from disengaged strain to engaged well-being.

An increase in psychological job demands was associated with significantly lower odds regarding the change from engaged strain to engaged well-being (OR = 0.72, CI = 0.53 - 0.98).

The association between EWB and job attitudes (second step) are shown in Table 4. A change from the lowest category

**Table 2**

Descriptive statistics of the pooled analytical sample (n = 4,038; obs = 9,203)

	Mean/%	S.D./n
Mental well-being (range 0-100)	62.9	20.0
Work engagement (range 1-5)	3.7	0.8
Commitment (range 1-5)	3.8	0.8
No turnover intentions (range 1-5)	4.5	0.8
Job satisfaction (range 0-10)	7.6	1.6
Male	73.5	6761
Female	26.5	2442
20–29 years	6.5	599
30–39 years	13.2	1212
40–49 years	30.6	2812
50–59 years	42.9	3952
60–65 years	6.8	628
White-collar	65.1	5993
Blue-collar	34.9	3210
Part-time	12.7	1167
Full-time	87.3	8036



**Table 3**

Odds ratios (OR) and confidence intervals (CI) in brackets of changes in EWB when employees' report an increase of job demands or resources of one scale unit – results from logistic fixed effects regression analyses

	Change from any lower category <sup>†</sup> to engaged well-being (n = 1,227)	Change from engaged strain to engaged well-being (n = 353)	Change from disengaged well-being to engaged well-being (n = 723)	Change from disengaged strain to engaged well-being (n = 230)
<i>Resources:</i>				
Work autonomy and diversity	1.30 [1.10-1.52] **	1.31 [0.98-1.76]	1.12 [0.90-1.40]	1.86 [1.20-2.89] **
Supervisory support and organizational goals	1.61 [1.32-1.99] ***	1.33 [0.91-1.93]	2.04 [1.53-2.71] ***	1.14 [0.69-1.87]
Fairness	1.34 [1.10-1.64] **	0.92 [0.64-1.30]	1.46 [1.10-1.94] **	2.48 [1.47-4.17] **
Development and job promotion	1.22 [1.06-1.41] **	1.07 [0.84-1.36]	1.28 [1.04-1.56] *	1.41 [0.95-2.08]
Teamwork	1.49 [1.26-1.75] ***	1.41 [1.06-1.88] *	1.58 [1.26-1.97] ***	1.28 [0.82-2.01]
<i>Demands:</i>				
Psychological demands	0.79 [0.66-0.94] **	0.72 [0.53-0.98] *	0.84 [0.65-1.09]	0.69 [0.46-1.04]
Physical demands	0.96 [0.83-1.09]	0.97 [0.76-1.23]	1.02 [0.84-1.22]	0.74 [0.50-1.07]
Social demands	0.85 [0.73-0.98] *	0.92 [0.72-1.18]	0.89 [0.71-1.10]	0.69 [0.47-1.02]

Note: \*\*\*p < .001, \*\*p < .01, \*p < .05; <sup>†</sup>disengaged strain, engaged strain, and disengaged well-being.

disengaged strain to any other category of EWB was associated with increased commitment and job satisfaction and reduced turnover intentions. The lowest increases can be found in changes from disengaged strain to disengaged well-being. The associations were especially strong when employees changed from disengaged strain to engaged well-being. The highest rate of changes was found for the reduction in turnover intentions (up to 20.60%, CI = 16.85-24.34).

**4. Discussion**

The aim of the present study was to test the longitudinal associations of job resources and demands with EWB, as well as those between EWB and job attitudes. The results suggest that improving work characteristics in the form of increased resources and reduced demands were associated with increased employees' EWB and that, in turn, was associated with better job attitudes (more job satisfaction and commitment, less turnover intentions). These associations indicate that employers have the possibilities to increase employees' EWB whereby both employees and their employers may profit from these improvements.

The findings presented above are consistent with the JD-R model [11] in general and add to it the dimension of EWB: Improvements in job resources were associated with increased EWB, while increases in job demands were associated with decreased EWB. These results can also be interpreted as support for the pathways proposed in the JD-R model. In line with the health-

impairment process [11], especially higher psychological and social demands reduced the odds to change from engaged strain to engaged well-being, indicating that the job demands are mainly associated with the mental well-being dimension of EWB. On the other hand, improvements in work engagement (i.e., changing from disengaged well-being to engaged well-being and from disengaged strain to engaged well-being) showed strong associations with increased job resources, supporting the motivational process proposed in the JD-R model [11].

While job demands did not always show significant associations, we found that job resources and improved EWB in general were strongly associated. Job resources are not only expected to increase mental well-being and especially work engagement but also to decrease the negative effects of job demands [11], which might explain the missing associations of job demands. Future studies should analyze the direct and indirect effects of job resources on EWB. Overall, the results emphasize the importance of job resources in the promotion of employees' EWB. Additionally, there were no associations between physical demands and EWB. This might be explained by the fact that psychological and social demands as well as EWB reflect mental processes or states and should therefore be more strongly associated with one another. However, it could also be argued that due to the shifts in work in Western societies to less physical work [38], physical job demands have become less relevant for most occupations. More detailed analyses focusing on jobs that are more physically straining should be conducted to get a better picture of these professions.

The positive associations between EWB and job attitudes, such as job satisfaction, turnover intentions, and commitment, indicate that EWB is important not only on an employee but also on an employer level as well. As pointed out above, both mental health and work engagement are associated with greater productivity, increased performance, reduced absence, and decreased turnover intentions [7–10,39,40]. In this study, EWB as a combined construct was significantly associated with job attitudes, i.e., commitment, no turnover intentions, and job satisfaction. Interestingly, especially increases in work engagement seemed to be associated with greater increases in desirable job attitudes, and lowest increases were found for changing from disengaged strain to disengaged well-being. This stresses the importance of the need to focus not only on mental well-being but also on work engagement when planning workplace

**Table 4**

Changes in job attitudes (in %, CI in brackets) when employees' EWB status changes from disengaged strain (reference category) to any higher category – results from linear fixed effects regression analyses (n = 4,038)

	Commitment	no turnover intentions	Job satisfaction
Engaged well-being	8.23 * [6.75-9.70]	20.60 * [16.85-24.34]	13.37 * [11.69-15.06]
Disengaged well-being	3.12 * [1.83-4.42]	12.23 * [15.35 - 9.12]	7.22 * [5.73-8.71]
Engaged strain	7.55 * [5.74-9.37]	15.47 * [20.28-10.66]	11.04 * [8.97-13.11]
Disengaged strain	ref.	ref.	ref.

Note: \*p < .001.

interventions. On the other hand, as outlined in the introduction, mental well-being is important for higher productivity and fewer days of sick leave [1,7]. Thus, a construct that combines both dimensions should be highly valuable for employers as well as employees. Focusing on a construct such as EWB should lead to more lasting organizational success by providing employees with necessary resources to reach organizational goals. Future studies should test this assumption by analyzing the long-term effects of EWB on productivity and other more objective indicators of organizational success.

The results extend the existent JD-R model [11] by combining the two dimensions of mental well-being and work engagement. This construct of EWB with its defined cut-offs provides an easily applicable tool. It could be used in organizations as a metric for indicating whether improvement of work characteristics is needed not only to promote employees' EWB but also to improve organizational success. Especially if many employees are observed in the lower categories of EWB, improvements might be pursued. The measurement of EWB could then be used to observe whether the implemented changes are successful over time, an important responsibility that organizations face [41].

#### 4.1. Strength and limitations

The longitudinal design as well as the use of established and validated indicators of mental well-being and work engagement are a strength of the present study. However, the presented analyses do not allow a causal interpretation. Moreover, since two separate regression analyses were calculated, it cannot be determined whether EWB might be a mediator between job characteristics and job attitudes. It might be interesting to test this in future studies. Furthermore, job resources and demands have not been defined a priori but have been identified through a factor analysis. The identified factors showed a meaningful classification and a moderate to high internal consistency. However, it cannot be ruled out that valuable resources and demands were not covered or that some factors might overlap. In addition, some items showed similarities to items in standardized instruments, like for the questionnaires of the Job-Demand Model [42] and the Effort-reward-imbalance Model (ERI Model, [43,44]). However, since only few items bear a resemblance to some of the items in standardized questionnaires, it was not possible to operationalize the psychosocial work characteristics according to these models in this study. Further limitations are a potential selection bias as we have conducted a complete case analysis. Additionally, the sample is primarily male, older, and working full-time, and results should therefore be interpreted carefully as they might not be representative for certain work populations. Future studies should test our results using study populations with different sociodemographic characteristics. Furthermore, we assumed in our FE analyses that variables such as occupational classification, wage, or job duration remained stable over time. Future studies could assess and include such variables as possible confounders since past research has indicated that age and change of job influence well-being [45]. A bias due to common method variance cannot be excluded, as all items were measured subjectively and based on self-reports. However, the longitudinal design of the study should reduce common method variance, as situational factors that might influence responses are not likely to occur at all three points of measurement [46]. Last but not least, all variables used in the analyses were measured on self-rating scales, probably resulting in a social desirability bias [47]. Future studies should therefore measure aspects like the work characteristics with other methods or consider social desirability by adding a scale to assess this bias as suggested by Larson [47].

#### 4.2. Conclusion

In the reported analyses, changes in job demands and resources were associated with changes in EWB over time. This might be especially helpful to provide employers with a measurement to monitor the improvements in job characteristics. It also emphasizes the importance of job characteristics in creating a healthy workplace environment. Additionally, we provided evidence that an increase in EWB was associated with more positive job-related attitudes, making this construct even more relevant for employers.

#### Ethics approval and consent to participate

Participants provided informed consent and the Ethics Committee of the Medical Faculty of the University of Heidelberg approved the use of the LPP for secondary data analysis (2018-514N-MA).

#### Availability of data and materials

The data that support the findings of this study are available from the Research Data Center (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data access can be requested from the Research Data Center (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB).

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#### Authors contributions

LLB and CB wrote the manuscript under the guidance of RMH. CB performed data preparation and analysis. CB, LLB, and RMH interpreted the results. JEF contributed to the conception and design of this study. JEF led and supervised the study. All authors revised the final draft of the manuscript critically for important intellectual content, and approved the version to be published.

#### Conflicts of interest

JEF has received royalties for lectures regarding occupational health from various companies and public agents. The authors declare that they have no conflict of interest.

#### Acknowledgments

This study uses the Linked Personnel Panel (LPP), waves 1 and 2. Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data access. This work was supported by a grant from the Federal Ministry of Labor and Social Affairs. We also want to thank Dr. David Litaker (from the Mannheim Institute of Public Health) for his valuable recommendations throughout the writing process.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.shaw.2022.03.003>.

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