DR TOMIETTO MARCO (Orcid ID: 0000-0002-3813-1490)

Article type : Original Research: Empirical research - quantitative

Short informative title

WORK ENGAGEMENT AND PERCEIVED WORK ABILITY: AN EVIDENCE-BASED MODEL TO ENHANCE NURSES' WELL-BEING.

• Short running title

WORK ENGAGEMENT AS PIVOTAL TO ENHANCE NURSES' WELL-BEING.

List of all authors

Marco TOMIETTO¹, Eleonora PARO², Riccardo SARTORI³, Rita MARICCHIO⁴, Luciano CLARIZIA², Paola DE LUCIA², Giuseppe PEDRINELLI², Rosanna FINOS², on behalf of PN NURSING GROUP.

- 1. PhD, RN, Post-Doctoral Researcher, Research Unit of Nursing Science and Health Management, University of Oulu, Oulu, Finland; PhD, RN, Azienda per l'Assistenza Sanitaria n. 5 "Friuli Occidentale", Pordenone, Italy;
- 2. MSc, RN, Azienda per l'Assistenza Sanitaria n. 5 "Friuli Occidentale", Pordenone, Italy;
- 3. Associate Professor in Work and Organizational Psychology, Department of Human Sciences, University of Verona, Italy.
- 4. PhD, RN, Lecturer, University of Ferrara, Italy;

Acknowledgments

The authors are grateful to the nurses of the health care facility involved in the study. Authors acknowledge the PN Nursing Group: Bortolin Paola, Brait Rosanna, Coassin Maurizio, Copat Maria, Doimo Ylenia, Doro Romina, Gaudenzi Carla, Minato Angelo, Pessot Giuliana, Pin Stefania, Quas Franca, Turchet Daniela.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/jan.13981

Conflict of interests:

No conflict of interest has been declared by the author(s).

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Corresponding author:

Dr. Marco TOMIETTO (Orcid ID: 0000-0002-3813-1490; Scopus ID 25823540700)

Research Unit of Nursing Science and Health Management

University of Oulu

Aapistie 5, 90220, Oulu, Finland

e-mail: marco.tomietto@oulu.fi

Azienda per l'Assistenza Sanitaria n.5 "Friuli Occidentale"

Via della Vecchia Ceramica, 1

33070, Pordenone (PN) – Italy

marco.tomietto@aas5.sanita.fvg.it

Twitter: @marco_tomietto

Abstract

Aims. The study aims are 1. to test a model developed to estimate the impact of work engagement on work ability as it is perceived by nurses; 2. to test the parameters between work ability and job satisfaction and between job satisfaction and turnover intention.

Design. Cross-sectional.

Methods. This study involved 1024 nurses from January - May 2018. The response rate was 70.7%. The Work Ability Index and the Utrecht Work Engagement Scale were used. Path analysis was performed, both in the whole sample and in age-categories (<45yy - >45yy). Model's parameters and fit indexes were estimated.

Results. The comprehensive model was validated through the multi-group approach. Fit indexes were adequate in the general model and in the multi-group testing. Parameters confirmed the association between work engagement and work ability and between work ability and job satisfaction and turnover intention. Parameters highlighted different age-dependent patterns.

Conclusion. This study states the contribution of work engagement to enhance work ability in nursing profession. Findings contribute in understanding motivational dynamics in nurses and they suggest the use of tailored strategies for different age-categories. Further research could address the model to deepen generational patterns in work-engagement, work ability and organizational outcomes.

Impact. The study highlights how to address nursing management to improve nurses' motivation and work ability and to improve organizational outcomes. Main findings point out different age-dependent patterns to tailor managerial strategies. Health care organizations have new elements to design human resources management and to improve job satisfaction and nurses' retention.

Keywords. work engagement, work ability, nursing, job satisfaction, turnover intention.

Introduction

Psychosocial work environment, which pertains to interpersonal and social interactions that influence the way people live in their workplace, is one of the major topics in health care organizational research (Tuvesson & Eklund, 2014). This area is deeply linked to nursing shortage and nurses' ageing (Camerino et al., 2006), because the shortage and ageing of nurses inevitably has an impact on their workload and their work-related stress levels (Eman & Sabah, 2018).

Nursing teams in health care settings are exposed to many demanding situations due to e.g. workforce shortages, increasing complexity of patients care, decreasing mental and physical work ability of the health professionals (Eman & Sabah, 2018). These elements have an impact on nurses' empathy (Cunico et al. 2012), motivation (Simpson, 2009), turnover intention (Tomietto et al., 2015), intention to leave the profession (Camerino et al., 2006), job satisfaction (Derycke et al., 2012) and patients' safety (Ausserhofer et al., 2014; Laschinger et al., 2006).

Background

Strategies to improve organizational stability, to enhance job satisfaction and to decrease turnover intention are one of the most challenging topics in nursing research (Liu et al., 2016; Eman & Sabah, 2018). Nursing shortage is a worldwide problem (Snavely, 2016; Sermeus et al., 2015) and it contributes in poor quality of care and adverse outcomes (Ausserhofer et al., 2014; Rafferty et al., 2007). It is widely known that a nurse to patient ratio over 1:6 increases the mortality risk of 7% (Sermeus, 2015); and missing nursing care due to nursing shortage is 41% in European Countries (Sasso et al., 2017). Together with nursing shortages, another

sensitive topic is nursing workforce ageing (Guardini et al., 2011) and its impact on nurses' work ability to perform nursing care and to face job demands (Camerino et al., 2008).

As for work ability, it is defined as the ability of employees to cope with the demands of the work environment. It involves both physical and psychological resources of employees together with their health, competences, attitudes and values and it depends on the congruence between individual variables (such as age) and workplace characteristics (Tuomi et al., 1998). This is in line with the Job Demands-Resources model (JD-R) explaining the balance between job demands and resources in affecting organizational and individual work-related outcomes (Bakker et al., 2007). In detail, the JD-R model proposes that, in a work environment, organizational outcomes depend on the interaction between Job Demands (e.g. workload, workplace incivility, lack of support) and Job Resources (e.g. career opportunities, access to information, coworker support, role clarity) (Bakker et al., 2007; von Bonsdorff et al., 2014). It is pivotal to study which job resources can enhance workplaces and health professionals to effectively perform in nursing care and to improve quality of care, patient safety and organizational outcomes.

In the JD-R model, the concept of work engagement has a prominent position. It is considered as a positive outcome, resulting from an optimal interaction between job demands and job resources and is defined as a positive state of mind in the workplace characterized by feelings of vigor (persistence in work demands, work as something to which devote time and efforts), dedication (work as meaningful pursuit) and absorption (work is something on which employees are fully concentrated) (Bakker & Leiter, 2010). Although it is usually treated as an outcome, research has already stated the role of work engagement as a motivational variable which is in turn able to improve other organizational outcomes, such as job satisfaction, intention to stay and health-care quality outcomes (Nahrgang et al., 2011; Simpson, 2009; Bakker et al., 2003). For example, as it is possible to read in Costantini et al. (2017, p. 2),

"Work engagement is linked to a variety of individual and organizational outcomes; at an individual level, it is related to the mental and physical health of employees at work. Studies show that employees with higher levels of work engagement report fewer health-related complaints and higher levels of mental health (Leijten et al., 2015; Shimazu et al., 2016). At an organizational level, work engagement has been associated with important organizational outcomes; studies proved that work engagement influences job satisfaction (Alarcon & Lyons, 2011), organizational commitment (Hallberg & Schaufeli, 2006) and intention to quit among employees (Takawira, Coetzee & Schreuder, 2014)". Again, recent research findings have shown that work engagement has a positive impact on work ability in fire-fighters: the most work-engaged employees are also the ones who demonstrate the highest work ability (Airila et al., 2012), even in a ten years follow-up (Airila et al., 2014).

In the light of these findings, which suggest that work engagement is also a determinant and not only an outcome, in the study we are going to present in this paper work engagement, with its three components of vigor, dedication and absorption, is treated as a determinant possibly able to foster work ability. To our knowledge, no piece of research has been carried out so far to investigate the relationship between work engagement and work ability in nursing teams, even if work ability has been deeply explored in occupational health research among different sectors (Ilmarinen, 2009). In nursing research, work ability is considered a useful concept to predict early retirement, sickness absence and turnover intention (Rongen et al., 2014; Derycke et al., 2012; Camerino et al., 2006), quality of care, burnout and job satisfaction (Olsen et al., 2017; Schmidt et al., 2014).

As for nursing workforce ageing, mean age of nurses is increasing worldwide: in 2030 in the United States the 45% of nursing workforce is expected to be over 50 years old (Auerbach et al., 2017). From 2001 to 2005 in Australia, the percentage of nurses older than 50 has increased of 25.1% (Graham & Duffield, 2010). In European Countries, nurses older than 45 in

2008 were 28.8%; in Finland, they were 44.7%; in Italy, 23.3% (Camerino et al., 2006). Some authors have stated that in 2022 nurses older than 45 will be over 70% (Auerbach et al., 2017).

Age has a strong impact on nurses' work ability and in the JD-R framework, psychosocial work environment can be both a job demand and a job resource to face stressful situations in the workplace. Previous research suggests that nurses older than 45 are more vulnerable to lowest scores in work ability, poor job satisfaction and higher turnover intention and intention to leave nursing profession. Moreover, work ability is related to sickness absence and effectiveness in perform nursing care competences (Tomietto et al., 2011; Camerino et al., 2006).

According to JD-R model and work ability research, this study aims to explore the link between work engagement and work ability in nurses; in addition, it aims to estimate the role of work ability explaining job satisfaction and turnover intention in the organization and outside the organization. A comprehensive model was tested to verify these parameters and the model was stratified among >45 years old nurses and <45 years old nurses, according to literature review, to understand whether different age-dependent dynamics occur or not.

The study

Hypotheses

- H1. Work engagement factors [vigor (a), dedication (b), absorption (c)] are positively related to work ability;
- H2. Work ability is positively related to job satisfaction;
- H3.Job satisfaction is negatively related to turnover intention outside the organization (a) and in the organization (b);

Parameters are tested also in > 45 years old nurses and <45 years old nurses. Figure 1 displays the research model.

Design

The study adopted a cross-sectional design. Validated tools to assess work engagement and work ability were used and tested for reliability and validity in this study before running the model. Single items were used to assess job satisfaction and turnover intention and a background questionnaire was administered to collect socio-demographic data. Data were collected from January to May 2018.

Participants

Nurses from 3 Hospitals and community healthcare services were involved in the study. Healthcare facilities gave the permission to carry out the study. In total, 1024 questionnaires were distributed, and 724 respondents gave the questionnaire back (response rate 70.7%). Missing data were calculated in the variables (work engagement, work ability, job satisfaction and turnover intention) to test research hypotheses for each record and, if missing data were over 5%, the record was deleted listwise: 42 records were deleted according to this criterion (Graham, 2009). Final sample was composed of 682 valid respondents. The mean age of the sample was 43.4 years (SD 10.3yy, median 45yy, min 22, max 69), 88.9% (598/672, 10 missing data) respondents were female, 62.4% (385/617, 65 missing data) were married and 31.4% (194/617, 65 missing data) were single. The average number of years spent in nursing profession was 20.3 (SD 11.6yy, median 23yy, min 0, max 43), while the average number of years spent in the same ward/service was 10.1 (SD 9.2yy, median 8yy, min 0, max 41). Respondents from hospital wards were 491/682 (72.0%) and the remaining 28.0% was

Data were collected from January to May 2018. Two validated questionnaires were used, according to the nomothetic and quantitative approach (Sartori, 2010): the Utrecht Work Enwas considered as consent to participate in the study.

from community healthcare services. Nurses employed on 24h shifts were 51.5% (351/665, 11 missing). 89.3% (584/654, 28 missing) of the sample had a Bachelor degree, the remaining 10.7% has a master degree or other advanced education levels.

Data Collection and scales' description

gagement Scale (UWES) (Schaufeli et al., 2006) and the Work Ability Index (WAI) (Tuomi et al., 1994). Job satisfaction was assessed by a single item ("I'm satisfied with my job") using a Likert rating scale from 1 (minimum) to 7 (maximum) (Dolbier et al., 2005). Turnover intention from the ward/service and from the health care facility were assessed by a single item each using a Likert rating scale from 1 (minimum) to 7 (maximum) ("I would like to move to another wards/service in this health care facility within 1 year" and "I would like to move to another health care facility within 1 year") (Burro et al., 2011; Galletta et al., 2011). Background data were collected to describe the sample (age, gender, ward/service, marital status and education). An information letter was given to participants to explain the project and the procedures to ensure privacy policy in handling data. Participants resubmitted the questionnaire in an envelope to the ward manager. The restitution of the filled questionnaire

Utrecht Work Engagement Scale (UWES)

The nine-item version of the UWES was used. The UWES has been widely adopted in different occupational sectors (Leiter & Bakker, 2010). Each item is rated on a 7-point Likert scale of frequency from 1 (never) to 7 (always). Participants are invited to rate how often they ex-

perience in their work a defined feeling or attitude linked to 3 factors (vigor, dedication and absorption): e.g. "In my job, I feel bursting with energy" (vigor), "My job inspires me" (dedication), "I am immersed in my work" (absorption) (Schaufeli et al., 2006). In nursing research, the UWES' Cronbach alpha ranges from 0.85-0.92 (Tomietto et al., 2016; Balducci et al., 2010; Simpson, 2009).

Work Ability Index (WAI)

The Work Ability Index (WAI) is widely used in international research about occupational health and it was already adopted in nursing in 10 European Countries (Camerino et al., 2006). The WAI describes how employees perceive their own work ability by assessing both the mental and physical demands of the workplace and the employees' health condition: for example, a poor work ability indicates that there is no balance between the workload and the employee's resources in facing work demands. The WAI score varies from 7-49 points and higher scores indicate higher work ability: work ability is excellent from 44-49 points, good from 37-43, moderate from 28-36 and poor from 27-7 points (Tuomi et al., 1994). The calculation method of the WAI score was drawn by the official handbook of the authors and healthcare sector criteria were used (Tuomi et al., 1998). The WAI has 7 items:

- 1. Estimation of the perceived current work ability compared to the best life-time performance (0-10 points);
- 2. Work ability compared to the mental and physical job demands (2-10 points, weighted according to the occupational sector);
- 3. Number of current diseases diagnosed by a physician (1-7 points);
- 4. Perceived work impairment due to diseases (1-6 points);
- 5. Sickness absenteeism in the past 12 months (1-5 points);

- 6. Their own prognosis of work ability in the next 12 months (1, 4 or 7 points);
- 7. Perceived personal mental resources in their own life in general (1-4 points).

In previous studies WAI demonstrated a Cronbach Alpha of 0.72 and satisfactory construct validity, discriminant power and test-retest reliability (Gobulic et al., 2009).

Validity and reliability

The validity and the reliability of the scales adopted in the study were tested according to Sartori & Pasini (2007). The WAI Cronbach alpha in this study is 0.81. If items are deleted one by one, the total reliability of the scale decreases, so items' reliability is verified (Ferketic et al., 1991). Item to total correlations range from 0.32-0.62.

The UWES Cronbach alpha is 0.92 and reliability decreases after one by one item deletion, item to total correlations range from 0.57-0.79. Cronbach alpha is 0.86 in the vigor factor, 0.89 in dedication and 0.77 in absorption. CFA was performed and fit indexes are: RMSEA=0.062 (CI90%=0.046-0.078), CFI=0.989 e TLI=0.978.

Ethical considerations

The project has been approved by the healthcare facility management. Privacy policy was warranted according to the National law, data confidentiality was ensured in data collection and in data analysis phases. Each participant received an information letter about the project and the restitution of the filled questionnaire was considered as the participant's consent to the study.

Data Analysis

Preliminary data analyses were performed: missing data over 5% were considered as a trigger for listwise record deletion (Graham, 2009). Cronbach alpha was measured to assess scales' reliability: values over 0.90 are considered excellent, values from 0.70-0.90, good, from 0.60-0.70, acceptable and under 0.60, non-acceptable (DeVellis, 2016; Sartori & Pasini, 2007). Variation of alpha values when each item was deleted one by one was calculated to identify the contribution of each item to the overall internal consistency: if the scale's reliability increases over 0.10, the item should be deleted (Ferketic et al., 1991). Corrected item to total correlations were calculated and they are considered acceptable over 0.30 (De Vellis, 2016, Sartori & Pasini, 2007).

The UWES validity was tested with Confirmatory Factor Analysis (CFA), using as estimator the Maximum Likelihood approach (ML) and calculating fit indexes. In detail, fit indexes are considered acceptable if: RMSEA (Root Mean Square Error of Approximation) < 0.06, CFI (Comparative Fit Index) and a TLI (Tucker-Lewis Index) > 0.95 (Kline, 2010). The WAI, according to previous studies, was tested for reliability with Cronbach alpha. Descriptive statistics were calculated to describe the sample. A t-test was performed to test age differences (<45yy and >45yy) in scales' scores, significance was verified for p<0.05.

Research hypotheses were tested by performing a path analysis model with Full Imputation Maximum Likelihood (FIML) estimator. Model's regression parameters and statistical significance were reported for the general model and for the age categories (<45yy and >45yy). Chi-square and fit indexes (RMSEA, TLI, CFI) were reported to state the general and the multigroup models' fit (Loehlin & Beaujean, 2016).

Results

The mean score of work engagement was 5.4 (SD 1.1, median 5.7, min 1, max 7). In detail, vigor had a mean score of 5.1 (SD 1.2, median 5.2, min 1, max 7), dedication of 5.6 (SD 1.2, median 6.0, min 1, max 7) and absorption of 5.5 (SD 1.1, median 5.7, min 1, max 7). Work engagement mean score was 5.5 (SD 0.9) in <45 years sample and 5.4 (SD 1.1) in >45 participants and the difference is statistically significant (t=2.104; p=0.036).

In this study, 4.4% of the sample (30/682) reported poor work ability, 26.8% (183/682) moderate, 48.2% (329/682) good and 20.5% (140/682) excellent. The mean overall perception of work ability in the sample was 7.3 (SD 1.6, median 8, min 0, max 10).

Musculoskeletal health problems were the most reported (from 10.1% to 18.2%), followed by thyroid diseases 10.4%, gastritis 10.7%, hypertension 9.8% and allergies 8.7%. The mean WAI score was 40.0 (SD 5.4) in <45 years old sample and, in >45 years old participants, it was 37.7 (SD 5.8) (t=5.276; p<0.001).

Job satisfaction had a mean value of 5.1 (SD 1.5, median 5.0, min 1, max 7), turnover intention from the ward/service had a mean score of 2.8 (SD 2.3, median 1.0, min 1, max 7) and turnover intention to other healthcare facilities had a mean value of 2.2 (SD 1.9, median 1.0, min 1, max 7).

Respectively, no statistical differences emerged for job satisfaction in the two age groups (t=0.626; p=0.531) with a mean value of 5.2 (SD 1.5) in the <45 group and 5.1 (SD 1.5) in the >45 group. Turnover intention to other wards/services was, respectively, 2.9 (SD 2.3) and 2.5 (SD 2.2) in the two groups (t=2.483; p=0.013) and turnover intention to other health care facilities was 2.5 (SD 2.1) and 1.8 (SD 1.7) (t=5.143; p<0.001).

The general model confirmed the study hypotheses, except that the parameter between absorption and work ability is slightly negative (-0.06), even if it is not statistically significant (z=-1.33; p=0.183) (H1c). The main work engagement factor which contributed to work ability was dedication (0.51; z=9.93; p<0.001) (H1b), followed by vigor (0.35; z=6.09; p<0.001) (H1a). Work ability was positively and significantly explained job satisfaction (0.35; z=13.50; p<0.001) (H2). H3a and H3b were verified with, respectively, a parameter of -0.41 (z=-8.55; p<0.001) and -0.63 (z=-11.71; p<0.001). Table 1 reports the detailed parameters estimated. The general model's fit was verified with RMSEA=0.058 (CI90%=0.037-0.081), CFI=0.976 and TLI=0.956 (Table 2).

The same trends are confirmed in the two age groups about H1c, H2 and H3a and H3b. However, about H1a and H1b there are some differences in the parameters, depending on age category: in detail, in the <45 group, the parameter between vigor and work ability was 0.41 (z=5.39; p<0.001) and in the >45 group it was 0.24 (z=3.17; p<0.001) (H1a). The parameter between dedication and work ability was, respectively, 0.40 (z=6.01; p<0.001) and 0.54 (z=7.24; p<0.001) in the two age groups (H1b) (Figure 2). Table 1 reports the details of parameters and statistical significance. The multi-group model's fit indexes were: RMSEA=0.054 (CI90%=0.034-0.084), CFI=0.976 and TLI=0.956 (Table 2).

Discussion

Response rate in this study was high (70.7%) compared to other studies in this field, where response rate ranged from 32.4% and 76.9% (Camerino et al., 2006). This study states that work ability antecedents and outcomes are age-dependent and, in detail, nurses older than 45 have different patterns in motivational levels and perceived work ability. In addition, there are different strengths in parameters with job satisfaction and turnover intention. This is con-

sistent with previous research (Camerino et al., 2006), where nurses older than 45 were more exposed to poor work ability, lower job satisfaction and higher turnover intention. Our findings highlight that the motivational factors to enhance work ability are different in the two age-groups: for nurses older than 45, it is important to foster dedication and, in particular, to drive nurses' motivation to meaningful work and pursuit, to enhance work ability. For nurses younger than 45, vigor is an important motivational factor. In this vein, the persistence in work demands and to perceive work as something to which devote time and efforts are pivotal to enhance work ability in younger nurses. Nurses younger than 45 may desire to find a balance between private life and professional involvement or to find career opportunities, prospects or coherent rewards in their job. These assumptions are in line with generational trends in nursing profession: generation X (born between 1965-1980) or Y (1981-2000) typically need to find a balance in their life or to have concrete rewards to their efforts to be involved and motivated (Stevanin et al., 2018; Lavoie- Tremblay et al., 2008). Findings from organizational socialization research confirm that, after the first year of onboarding, newcomers need to find prospects in the organization to decrease their turnover intention (Tomietto et al., 2015). Nurses older than 45, on the other side, need to find a positive involvement and meaning in their job and to develop a coherence between their professional values and the organizational opportunity to act their values in the actual nursing care (Lavoie-Tremblay et al., 2008).

Previous research highlighted that work engagement and its factors have positive correlations with work ability in fire-fighters (Airila et al., 2012; 2014) and teachers (Hakanen et al., 2006). In this vein, previous research did not confirm the hypothesis of the dark side of work engagement stated by Bakker and Leiter (2010): highly engaged employees could experience detrimental consequences in their subjective well-being and balance. In our study, the absorption factor of work engagement is not associated with work ability. This result confirms the

theoretical dark side effect of work engagement, at least in nurses. Being intensively involved and concentrated in their own work could be perceived by nurses as a negative factor for work ability: it may lead to burnout due to the unbalance between the private life and the professional one. In nursing profession, it is necessary to foster a balance between empathy and involvement in the work and in the relationship with patients to cope with stressful situations (Adriaenssens et al., 2017). In this way, differently from other professional sectors, absorption could be perceived as a negative motivational factor in nursing profession.

Work ability is highly related to job satisfaction and the parameter is similar in the two age-groups. This finding demonstrates that work ability is a stable employee's trait to gather job satisfaction and organizational strategies are not age-dependent in this part of the model. According to previous research, job satisfaction negatively predicts turnover intention both outside and inside the organization (Chen et al., 2015). This study demonstrated that job satisfaction has a strong impact in decreasing turnover intention, especially in <45 years old nurses. It is important to enhance organizational strategies to maintain work ability and to improve both work engagement and job satisfaction in nurses: these strategies are pivotal to ensure organizational stability and, definitely, to improve group cohesion and nursing care quality (Eklöf et al., 2014). Research indicates that job autonomy, task variety, perceived control on their own job, coworker and supervisors support, competence development and prospects are effective strategies to enhance work engagement and job satisfaction (Olsen et al., 2017, Bakker & Leiter, 2010). This study contributes to define a comprehensive model to drive human resource management in nursing and to suggest that age-tailored organizational strategies improve workplace well-being and organizational outcomes.

Limitations and strengths

This study considered mainly hospital nurses and the inference on community nurses is limited. On the other hand, the sample was well-balanced according to age groups (median 45 years) and this was important to effectively estimate models' parameters. The cross-sectional design allowed to recruit the nurses at work: so, nurses out of duty because of health impairment were not recruited and they could be a sub-sample with different levels of work engagement, work ability, job satisfaction and turnover intention.

Futures Lines of Research

Further research could deepen the effectiveness of organizational interventions to improve work engagement and job satisfaction. Moreover, strategies to maintain work ability and to effectively allocate nurses with health impairments are pivotal to enhance human resource management and individuals' well-being.

Conclusions

Work ability is a major topic in nursing research and its antecedents and outcomes are pivotal in designing human resource management. To our knowledge, this study is the first one to highlight the contribution of work engagement to enhance work ability in nursing profession. Moreover, the study findings empirically confirm for first a hidden theoretical assumption about work engagement research and they contribute in understanding motivational dynamics in nurses and in suggesting tailored strategies for nursing profession in different age-categories.

This study confirms that fostering work ability is beneficial in improving job satisfaction and in decreasing turnover intention in nurses. Findings contributed to validate a comprehensive model to drive human resource management in nursing and to support organizational decision-making.

Author contributions

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

- Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- 2. Drafting the article or revising it critically for important intellectual content.

(*http://www.icmje.org/recommendations/)

References

Adriaenssens, J., De Gucht, V., & Maes, S. (2015). Determinants and prevalence of burnout in emergency nurses: A systematic review of 25 years of research. *International journal of nursing studies*, 52(2), 649-661.

Airila, A., Hakanen, J. J., Schaufeli, W. B., Luukkonen, R., Punakallio, A., & Lusa, S. (2014). Are job and personal resources associated with work ability 10 years later? The mediating role of work engagement. *Work & Stress*, 28(1), 87-105.

Airila, A., Hakanen, J., Punakallio, A., Lusa, S., & Luukkonen, R. (2012). Is work engagement related to work ability beyond working conditions and lifestyle factors?. *International archives of occupational and environmental health*, 85(8), 915-925.

Alarcon, G.M., & Lyons, J.B. (2011). The relationship of engagement and job satisfaction in working samples. *The Journal of Psychology*, *145*, 463–480.

https://doi.org/10.1080/00223980.2011.584083.

Auerbach, D. I., & Staiger, D. O. (2017). How fast will the registered nurse workforce grow through 2030? Projections in nine regions of the country. *Nursing outlook*, 65(1), 116-122.

Ausserhofer, D., Zander, B., Busse, R., Schubert, M., De Geest, S., Rafferty, A. M., ... & Sjetne, I. S. (2014). Prevalence, patterns and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study. *BMJ Qual Saf*, 23(2), 126-135.

Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of managerial psychology*, 22(3), 309-328.

Bakker, A. B., & Leiter, M. P. (Eds.). (2010). Work engagement: A handbook of essential theory and research. London, UK: Psychology press.

Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2003). Dual processes at work in a call centre: An application of the job demands–resources model. *European Journal of Work and Organizational Psychology*, 12, 393–417.

Balducci, C., Fraccaroli, F., & Schaufeli, W. B. (2010). Psychometric properties of the Italian version of the Utrecht Work Engagement Scale (UWES-9). *European Journal of Psychological Assessment*, 46(2), 143-149.

Burro, R., Sartori, R., & Vidotto, G. (2011). The method of constant stimuli with three rating categories and the use of Rasch models. *Quality & Quantity*, 45, 43-58.

Camerino, D., Conway, P. M., Van der Heijden, B. I. J., Estryn- Behar, M., Consonni, D., Gould, D., & Hasselhorn, H. M. (2006). Low- perceived work ability, ageing and intention to leave nursing: a comparison among 10 European countries. *Journal of advanced nursing*, 56(5), 542-552.

Chen, I. H., Brown, R., Bowers, B. J., & Chang, W. Y. (2015). Work- to- family conflict as a mediator of the relationship between job satisfaction and turnover intention. *Journal of advanced nursing*, 71(10), 2350-2363.

Costantini, A., De Paola, F., Ceschi, A., Sartori, R., Meneghini, A.M., & Di Fabio, A., (2017). Work engage-ment and psychological capital in the Italian public administration: A new resource-based intervention pro-gramme. *SA Journal of Industrial Psychology*/SA Tydskrif vir Bedryfsielkunde, 43(0), a1413. https://doi.org/10.4102/sajip.v43i0.141

Cunico, L., Sartori, R., Marognolli, O., & Meneghini, A.M. (2012). Developing empathy in nursing students: a cohort longitudinal study. *Journal of Clinical Nursing*, *21*, 2016-2025.

Derycke, H., Clays, E., Vlerick, P., D'Hoore, W., Hasselhorn, H. M., & Braeckman, L. (2012). Perceived work ability and turnover intentions: a prospective study among Belgian healthcare workers. *Journal of advanced nursing*, 68(7), 1556-1566.

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26). Thousand Oaks, CA: Sage publications.

Dolbier, C. L., Webster, J. A., McCalister, K. T., Mallon, M. W., & Steinhardt, M. A. (2005). Reliability and validity of a single-item measure of job satisfaction. *American Journal of Health Promotion*, 19(3), 194-198.

Eklöf, M., Törner, M., & Pousette, A. (2014). Organizational and social-psychological conditions in healthcare and their importance for patient and staff safety. A critical incident study among doctors and nurses. *Safety science*, 70, 211-221.

Eman, A. S., & Sabah, M. E. (2018). Psychosocial work environment and oxidative stress among nurses. *Journal of Occupational Health*, 60(2), 182-191.

Galletta, M., Portoghese, I., Penna, M. P., Battistelli, A., & Saiani, L. (2011). Turnover intention among Italian nurses: The moderating roles of supervisor support and organizational support. *Nursing & health sciences*, *13*(2), 184-191.

Graham, E. M., & Duffield, C. (2010). An ageing nursing workforce. *Australian Health Review*, *34*(1), 44-48.

Guardini, I., Deroma, L., Salmaso, D., & Palese, A. (2011). Stima del trend di invecchiamento della popolazione infermieristica di due ospedali del Friuli Venezia Giulia: applicazione di un modello matematico deterministico. *G Ital Med Lav Erg*, 33(1), 55-62.

Hallberg, U.E., & Schaufeli, W.B. (2006). 'Same same' but different? *European Psychologist*, 11, 119–127. https://doi.org/10.1027/1016-9040.11.2.119.

Hakanen, J. J., Bakker, A. B., & Schaufeli, W. B. (2006). Burnout and work engagement among teachers. *Journal of school psychology*, *43*(6), 495-513.

Ilmarinen, J. (2009). Work ability—a comprehensive concept for occupational health research and prevention. *Scandinavian journal of work, environment & health*, 1-5.

Kline, R. B. (2010). *Principles and practice of structural equation modeling*. New York, NY: The Guilford Press.

Kroezen, M., Dussault, G., Craveiro, I., Dieleman, M., Jansen, C., Buchan, J., ... & Sermeus, W. (2015). Recruitment and retention of health professionals across Europe: a literature review and multiple case study research. *Health Policy*, *119*(12), 1517-1528.

Laschinger, H. K. S., & Leiter, M. P. (2006). The impact of nursing work environments on patient safety outcomes: The mediating role of burnout engagement. *Journal of Nursing Administration*, 36(5), 259-267.

Lavoie- Tremblay, M., Wright, D., Desforges, N., Gélinas, C., Marchionni, C., & Drevniok, U. (2008). Creating a healthy workplace for new- generation nurses. *Journal of Nursing Scholarship*, 40(3), 290-297.

Leijten, F.R., Van den Heuvel, S.G., Van der Beek, A.J., Ybema, J.F., Robroek, S.J., & Burdorf, A. (2015). Associations of work-related factors and work engagement with mental and physical health: A 1-year follow-up study among older workers. *Journal of Occupational Rehabilitation*, 25, 86–95. https://doi.org/10.1007/s10926-014-9525-6

Liu, Y., Aungsuroch, Y., & Yunibhand, J. (2016). Job satisfaction in nursing: a concept analysis study. *International Nursing Review*, 63(1), 84-91.

Loehlin, J. C., & Beaujean, A. A. (2016). Latent variable models: An introduction to factor, path and structural equation analysis. Austin, TX: Taylor & Francis.

Nahrgang, J. D., Hoffman, D. A., & Morgeson, F. P. (2011). Safety at work: a meta-analytic investigation of the link between job demands, job resourses, burnout, engagement and safety outcomes. Journal of Applied Psychology, 96, 71–94.

Olsen, E., Bjaalid, G., & Mikkelsen, A. (2017). Work climate and the mediating role of workplace bullying related to job performance, job satisfaction and work ability: A study among hospital nurses. *Journal of advanced nursing*, 73(11), 2709-2719.

Rafferty, A. M., Clarke, S. P., Coles, J., Ball, J., James, P., McKee, M., & Aiken, L. H. (2007). Outcomes of variation in hospital nurse staffing in English hospitals: cross-sectional analysis of survey data and discharge records. *International journal of nursing studies*, 44(2), 175-182.

Rongen, A., Robroek, S. J., Heijden, B. I., Schouteten, R., Hasselhorn, H. M., & Burdorf, A. (2014). Influence of work- related characteristics and work ability on changing employer or leaving the profession among nursing staff. *Journal of nursing management*, 22(8), 1065-1075.

Sartori, R. (2010). Face validity in personality tests: psychometric instruments and projective techniques in comparison. *Quality & Quantity*, 44, 749-759

Sartori, R., & Pasini, M. (2007). Quality and quantity in test validity: How can we be sure that psychological tests measure what they have to? *Quality and Quantity*, 41, 359-374.

Sasso, L., Bagnasco, A., Zanini, M., Catania, G., Aleo, G., Santullo, A., ... & Sermeus, W. (2017). The general results of the RN4CAST survey in Italy. *Journal of advanced nursing*, 73(9), 2028-2030.

Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and psychological measurement*, 66(4), 701-716.

Schmidt, S. G., Dichter, M. N., Bartholomeyczik, S., & Hasselhorn, H. M. (2014). The satisfaction with the quality of dementia care and the health, burnout and work ability of nurses: a longitudinal analysis of 50 German nursing homes. *Geriatric Nursing*, *35*(1), 42-46.

Sermeus, W. (2016). Understanding the role of nurses in patient safety: from evidence to policy with RN4CAST. *BMC Nursing*, 15.

Shimazu, A., Mastsudaira, K., Jonge, J.D., Toska, N., Watanabe, K., & Takahashi, M. (2016). Psychological detachment from work during non-work time: Linear or curvilinear relations with mental health and work engagement? *Industrial Health*, *54*, 282–292. https://doi.org/10.2486/indhealth.2015-0097

Simpson, M. R. (2009). Engagement at work: A review of the literature. International journal of nursing studies, 46(7), 1012-1024.

Snavely, T. M. (2016). A brief economic analysis of the looming nursing shortage in the United States. *Nursing Economics*, *34*(2), 98.

Stevanin, S., Palese, A., Bressan, V., Vehviläinen- Julkunen, K., & Kvist, T. (2018). Work-place- related generational characteristics of nurses: A mixed- method systematic review. *Journal of advanced nursing*, 74, 1245-1263.

Takawira, N., Coetzee, M., & Schreuder, D. (2014). Job embeddedness, work engagement and turnover intention of staff in a higher education institution: An exploratory study. *SA Journal of Human Resource Management*, *12*, 1–10.

Tomietto, M., Comparcini, D., Simonetti, V., Pelusi, G., Troiani, S., Saarikoski, M., & Cicolini, G. (2016). Work- engaged nurses for a better clinical learning environment: a ward- level analysis. *Journal of nursing management*, 24(4), 475-482.

Tomietto, M., Rappagliosi, C. M., Sartori, R., & Battistelli, A. (2015). Newcomer nurses' organisational socialisation and turnover intention during the first 2 years of employment. *Journal of nursing management*, 23(7), 851-858.

Tuomi, K., Ilmarinen, J., Jahkola, A., Katajarinne, L., & Tulkki, A. (1994). Work ability index. Helsinki: Institute of Occupational Health.

Tuomi, K., Ilmarinen, J., Jahkola, A., Katajarinne, L., & Tulkki, A. (1998). Work Ability Index (WAI). *Helsinki: Finnish Institute of Occupational Health*.

Tuvesson, H. & Eklund, M. (2014). Psychosocial Work Environment, Stress Factors and Individual Characteristics among Nursing Staff in Psychiatric In-Patient Care. *International Journal of Environmental Research and Public Health*, 11(1), 1161-1175.

von Bonsdorff, M. E., von Bonsdorff, M. B., Zhou, Z. E., Kauppinen, M., Miettinen, M., Rantanen, T., & Vanhala, S. (2014). Organizational justice, selection, optimization with compensation and nurses' work ability. *Journal of occupational and environmental medicine*, 56(3), 326-330.

Model	Outcome variable	Explanatory variable	Parameter	Standard Error	z-test	p-value
General	WAI <-	Vigor	0.35	0.06	6.09	<0.001
		Dedication	0.51	0.05	9.93	<0.001
		Absorption	-0.06	0.05	-1.33	0.183
	Satisfaction <-	WAI	0.35	0.03	13.50	<0.001
	T.O. other H <-	Satisfaction	-0.41	0.05	-8.55	<0.001
	T.O. other W	Satisfaction	-0.63	0.05	-11.71	<0.001
<45yy	WAI <-	Vigor	0.41	0.08	5.39	<0.001
		Dedication	0.40	0.07	6.01	<0.001
		Absorption	-0.03	0.07	-0.36	0.716
	Satisfaction <-	WAI	0.41	0.04	9.43	<0.001
	T.O. other H <-	Satisfaction	-0.54	0.08	-6.87	<0.001
	T.O. other W <-	Satisfaction	-0.78	0.08	-9.68	<0.001
≥45yy	WAI <-	Vigor	0.24	0.08	3.17	0.002
		Dedication	0.54	0.07	7.24	<0.001
		Absorption	-0.07	0.06	-1.19	0.233
	Satisfaction <-	WAI	0.38	0.04	8.82	<0.001
	T.O. other H <-	Satisfaction	-0.31	0.06	-5.38	<0.001
	T.O. other W	Satisfaction	-0.54	0.07	-7.48	<0.001

Table 1. Model's parameters estimation and statistical tests. (z-test and p-values)

Model	Chi-square	р	RMSEA (90%CI)	SRMR*	CFI	TLI
General	32.95	<0.001	0.058 (0.037-0.081)	/	0.976	0.956
Multigroup	42.35	<0.001	0.059 (0.034-0.084)	/	0.976	0.956

^{*}SRMR not reported because of missing values

Table 2. Model's fit indexes

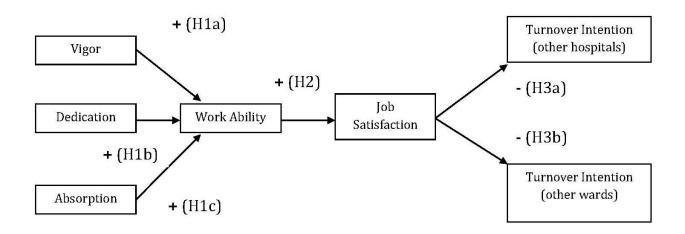


Figure 1. Research model.

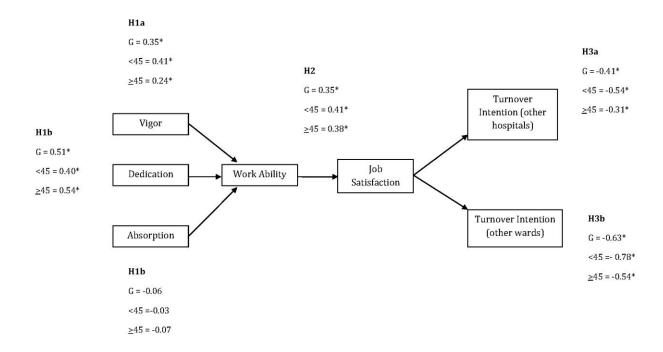


Figure 2. General and multi-group path diagram (G=general model; <45=<45yy model; ≥45=≥45yy model; *=statistical significance).