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**ORIGINAL ARTICLE /** *ARTIGO ORIGINAL*

# Testing the "Work Ability House" Model in hospital workers

## *Testando o Modelo da Casa da Capacidade para o Trabalho entre profissionais do setor hospitalar*

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**ABSTRACT:** ***Objective:*** To test the Work Ability House model, verifying the hierarchy of proposed dimensions, among a group of hospital workers. ***Methods:*** A cohort study (2009–2011) was conducted with a sample of 599 workers from a hospital in the city of São Paulo. A questionnaire including sociodemographics, lifestyle and working conditions was used. The Brazilian versions of Job Stress Scale, Effort–Reward Imbalance, Work-Related Activities That May Contribute To Job-Related Pain and/or Injury, and the Work Ability Index (WAI) were also used. A hierarchical logistic regression analysis was performed: the independent variables were allocated into levels according to the dimensions of the theoretical model in order to evaluate the factors associated with work ability. ***Results:*** Variables associated with impairment of work ability in each dimension were as follows: (a) sociodemographics: age < 30 years ($p = 0.20$), (b) health: without report of occurrence of work injuries ($p = 0.029$), (c) professional competence: low educational level ($p = 0.008$), (d) values : intensified in overcommitment ($p < 0.001$), and (e) work: intensification of effort–reward imbalance ($p = 0.009$) and high demands ($p = 0.040$). ***Conclusion:*** The results confirmed the dimensions proposed for the Work Ability House model, indicating that it is valid as a representation of a multidimensional construct of multifactorial determination and can be used in the management of work ability.

**Keywords:** Work capacity evaluation. Occupational health. Workers. Workload. Work environment. Health personnel.

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**RESUMO:** ***Objetivo:*** Testar o Modelo da Casa da Capacidade para o Trabalho, verificando a hierarquia das dimensões propostas para um grupo de trabalhadores do setor hospitalar. ***Métodos:*** Estudo de coorte (2009–2011) conduzido com 599 trabalhadores de um hospital na cidade de São Paulo. Foi usado um formulário com questões sobre dados sociodemográficos, estilo de vida e condições de trabalho, e as versões brasileiras da Escala Estresse no Trabalho, Desequilíbrio Esforço-Recompensa, *Work-Related Activities That May Contribute To Job-Related Pain and/or Injury* e Índice de Capacidade para o Trabalho (ICT). Foi realizada análise de regressão logística hierárquica: as variáveis independentes foram alocadas em níveis de acordo com as dimensões do modelo teórico para avaliar os fatores associados ao comprometimento da capacidade para o trabalho (CT). ***Resultados:*** As variáveis associadas ao comprometimento da CT em cada dimensão foram: (a) dimensão sociodemográfica: idade < 30 anos (p = 0,20), (b) dimensão saúde: história de acidente de trabalho (p = 0,029), (c) dimensão competência profissional: baixo nível educacional (p = 0,008), (d) dimensão valores: intensificação do excesso de comprometimento (< 0,001), e (e) dimensão trabalho: intensificação do desequilíbrio esforço-recompensa (p = 0,009) e das demandas elevadas (p = 0,040). ***Conclusão:*** Os resultados do estudo confirmaram as dimensões propostas para o Modelo da Casa da Capacidade para o Trabalho, indicando que ele é válido como representação de um construto multidimensional de determinação multicausal, podendo ser utilizado na gestão da CT.

***Palavras-chave:*** Avaliação da capacidade de trabalho. Saúde do trabalhador. Trabalhadores. Carga de trabalho. Ambiente de trabalho. Pessoal de saúde.

## INTRODUCTION

The concept of work ability (WA) concerns the ability of the worker to perform his/her tasks at work. It is conditioned by the work demands, health status, and physical and mental abilities[1-3]. WA is considered to be a measurement of functional aging[1-3], and it is seen as an index for the health of the worker[2,4]. This concept has been expanding based on the centrality of health for models that integrate aspects related to health, well-being, and macrosocial environment[2,4,5].

Theoretical models have been proposed to explain the process to determine WA and/or the dimensions associated with this construct, such as the one based on the Stress–Strain Model or the Tetraedric Model[4].

Among these models, the multidimensional Work Ability House stands out. It considers that the WA depends on the balance between individual resources, work-related factors, and the macrosocial environment[2,4,5]. The model is expressed by a four-floor House and a roof inserted in an encircling environment. The individual resources comprise the dimensions represented in the three lower floors. The first floor represents the base that supports the building and concerns health status and functional capacity, including physical, mental, and social aspects. The second floor relates to professional competence (knowledge and skills, training and learning at work) and its continuous development used to meet the demands of working life. The third floor represents the internal aspects

of the individual, manifested as values, attitudes, and motivation. These aspects can be affected by the external environment, that is, by the relationship between work, society, and personal life. The last floor represents factors related to work such as work conditions, demands and content, organization and communitarian environment, management and supervision: this is the "heaviest" floor in the building and can affect the other dimensions, which also support it. The WA is also influenced by the surroundings of the macrosocial environment, which includes matters related to public and social policies, health care and occupational safety, and in special, the structure and support of family and community. The roof of this building is the WA, resulting from the interaction and balance between the previous dimensions[2,4,5].

This model has been assessed by a number of international studies[6,7]. In Brazil, analyses about WA have been conducted since the 1990s, using the Work Ability Index (WAI) as the research instrument[3]; however, there are only a few national studies testing the theoretical model under discussion. Considering these matters, this study aimed at testing the theoretical Work Ability House model, verifying the hierarchy of the proposed dimensions for a group of workers in the hospital sector of the city of São Paulo.

## METHODS

This is a two-year follow-up longitudinal study (2009 to 2011) carried out in a private high complexity hospital in the city of São Paulo, Brazil. In 2009, all active workers were invited to participate in the study. This occupational group was chosen because hospital work is characterized by relevant physical and mental demands, which are associated with negative outcomes for the worker, such as WA impairment[8-10].

The adherence rate was 87.9% (1,226 people). Among them, 599 workers (48.5%) participated in 2011, and most of them were from the Nursing (51.8%) and Hospitality sectors – hygiene, gastronomy, and patients' admission (18.5%). The main causes of losses were dismissals (54.7%) and not answering the questionnaire (39.7%).

Participants differed from nonparticipants in terms of the following factors: gender (57.2% of women versus 40.9% of men, $p < 0.001$), work sector (greater losses in the administrative sectors of Planning and Commercial, respectively, with 87.1 and 81.6% of losses, respectively, $p < 0.001$), age (participants mean age 35,7 years, SD = 8.3 years versus losses 34.6 years, SD = 8.9 years, $p = 0.022$), and working time (years) in the studied hospital (participants 6.1 years, SD = 6.5 years versus losses with 4.8 years, SD = 5.8 years, $p < 0.001$).

Data collection was performed by a self-report comprehensive questionnaire. The first part included items on sociodemographics, lifestyle, and functional aspects. The second part was the short version of the Job Stress Scale (JSS)[11], based on the demand-control model. JSS assesses the strain resulting from stressors (demand, control and social support) of the psychosocial work environment[11]. The third part included the Effort–Reward

Imbalance (ERI) questionnaire[12], whose variables (effort, reward, and overcommitment) also evaluate other psychosocial work stressors. The fourth part was the questionnaire of Work-Related Activities that May Contribute to Job-Related Pain and/or Injury (WRAPI)[13]. The last part was the Work Ability Index (WAI)[1,3], used to measure the variable of interest in this study – WA. All questionnaires were validated to Brazilian Portuguese and are being used in current use.[1,3,11-13].

The results of Cronbach's alpha to assess the reliability of questionnaires in the beginning of the follow-up were: WAI = 0.69; demand = 0.69; control = 0.57; social support = 0.82; effort = 0.74; reward = 0.83; overcommitment = 0.75; and WRAPI = 0.92. Considering the complexity of the phenomena to be assessed and their importance to understand the analyzed construct[8], we chose to maintain the dimensions that presented alpha < 0.70.

The study variables were selected and placed in groups according to the dimensions (or floors) of the Work Ability House model:

- sociodemographics features: sex, age, marital status, family income and responsibility for underage children;
- health and functional capacity: alcohol consumption, smoking, nutritional status (based on body mass index), practice of regular physical activity, and recent work injury;
- professional competence: age at the time of joining the workforce, working time at the studied hospital, years in the profession, and position;
- values: overcommitment (6 to 24 points);
- work-related characteristics – work sector, work shift, working hours (adding those in the hospital, a second job, and domestic chores), work violence (7 to 21 points), demands at work (5 to 20 points), control at work (6 to 24 points), social support at work (6 to 24 points), ERI (0.17 to 5.00 points), and WRAPI (0 to 150 points);
- work ability – WAI, with a score of 7 to 49 points.

The independent variables were measured in the beginning of follow-up (2009). The exception included the variables regarding work stressors and WAI, assessed in the beginning and in the end of the follow-up. For each one of these variables, the difference between the initial and final scores was calculated, and a new variable was provided, categorized into "no changes," "aggravation," or "improvement". These variables were then dichotomized for the logistic modeling. Cutoff points were analyzed according to the distribution of frequencies, as to the best of our knowledge we did not find references in the literature.

A descriptive analysis was conducted by means, medians, standard deviations, and minimum and maximum values for the quantitative variables and proportions for categorical variables. The associations between independent variables and WA were assessed by the $\chi^2$-test. The theoretical Work Ability House model was tested by a hierarchical multiple logistic regression with predicted levels of hierarchy. In each level, modeling was

conducted step by step. Gender was maintained as a control variable. The risk measurement was the odds ratio (OR), and in all analyses, the associations were considered to be significant when $p < 0.05$.

The research project was approved by the Research Ethics Committee of the School of Public Health, Universidade de São Paulo, protocol n. 257.518. The project was in agreement with the principles of the Declaration of Helsinki, established by the World Medical Association (WMA). The participation in in this study was voluntary. Workers signed an informed consent form. Individual results were kept confidential.

## RESULTS

In 2009, the mean score of the WAI was 43.0 points (SD = 4.0); in 2011, it was 42.5 points (SD = 4.7). The change in WAI score since the beginning to the end of the follow-up was, in average, of -0.5 points (SD = 4.6), representing a slight impairment.

Table 1 shows the descriptive analysis of the variables representing the sociodemographic characteristics, and dimensions of health and professional skills. The highest proportions of participants were women (72.6%), married people/or living with a partner (50.1%), and monthly family income higher than 5 minimum wages (51.6%). The mean age was 36.7 years (SD = 8.3), and 73.1% of them were older than 30 years (73.1%). Regarding health, 91.3% of them reported sporadic alcohol consumption, 90.8% were non-smokers, 54.9% were eutrophic, 36.9% reported the regular practice of physical activities, and most denied recent occurrence of workplace injury (88.1%). For the variables representing professional competence, 94.2% had at least incomplete high school,and 69.8% were in the current profession in the past 6 years. The highest proportions were of Nursing Technicians (29.2%), Specialized Administrative staff (17.0%), Registered Nurses (16.9%), and General Assistants, all working in different sectors (15.0%).

Table 2 presents the variables representing the dimensions of values and work. During follow-up, 31.4% of the workers reported aggravation in overcommitment. In the beginning of the follow-up (2009), the mean of overcommitment was 12.3 points (SD = 3.1), in a score ranging from 6.0 to 24.0 points. Table 2 shows that participants were working mainly in the Nursing Service (51.8%) and Hospitality Sectors (18.5%). The distribution regarding work shift was relatively homogeneous; 64.8% of the workers did not consider being exposed to circumstances of workplace violence, and 41.7% denied changes in the weekly work load throughout the studied period.

In 2009, the mean score of work demands was 14.1 points (SD = 2.3), and 32.7% reported aggravation during follow-up. The mean score of work control was of 17.8 points (SD = 2.4), and 22.5% reported aggravation. The mean score of social support was 20.7 points (SD = 2.8), and 35.2% reported aggravation. The mean ERI score was 0.42 points (SD = 0.18), and 36.2% reported aggravation. The mean WRAPI was 57.5 points (SD = 34.6), and 34.2% reported aggravation.

Table 1. Descriptive statistics of sociodemographics, health and professional competence, according to changes in work ability, private hospital, São Paulo, 2009 – 2011.

| Variable | Maintaining | | Aggravation | | Total | | p-value* |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Sociodemographics | | | | | | | |
| Gender | | | | | | | |
| Female | 281 | 72.6 | 154 | 72.6 | 435 | 72.6 | 0.993 |
| Male | 106 | 27.4 | 58 | 27.4 | 164 | 27.4 | |
| Age group | | | | | | | |
| < 30 | 90 | 23.3 | 70 | 33.0 | 160 | 26.7 | 0.010 |
| ≥ 30 | 296 | 76.5 | 142 | 67.0 | 438 | 73.1 | |
| Not informed | 1 | 0.3 | 0 | 0.0 | 1 | 0.2 | |
| Marital status | | | | | | | |
| Single | 144 | 37.2 | 90 | 42.5 | 234 | 39.1 | 0.420 |
| Married/partner | 201 | 51.9 | 99 | 46.7 | 300 | 50.1 | |
| Separated/divorced/widow(er) | 38 | 9.8 | 20 | 9.4 | 58 | 9.7 | |
| Not informed | 4 | 1.0 | 3 | 1.4 | 7 | 1.2 | |
| Monthly Family income | | | | | | | |
| ≥ 5.1 minimum wages | 209 | 54.0 | 100 | 47.2 | 309 | 51.6 | 0.074 |
| < 5.0 minimum wages | 164 | 42.4 | 107 | 50.5 | 271 | 45.2 | |
| Not informed | 14 | 3.6 | 5 | 2.4 | 19 | 3.2 | |
| Responsibility for underage children/ | | | | | | | |
| No | 188 | 48.6 | 108 | 50.9 | 296 | 49.4 | 0.656 |
| Sporadically/yes | 188 | 48.6 | 100 | 47.2 | 288 | 48.1 | |
| Not informed | 11 | 2.8 | 4 | 1.9 | 15 | 2.5 | |
| Health and functional capacity | | | | | | | |
| Alcohol consumption | | | | | | | |
| Sporadic consumption (0 – 1 day/ week) | 355 | 91.7 | 192 | 90.6 | 547 | 91.3 | 0.736 |
| Regular consumption (≥ 2 days/ week) | 23 | 5.9 | 14 | 6.6 | 37 | 6.2 | |
| Not informed | 9 | 2.3 | 6 | 2.8 | 15 | 2.5 | |

Continue...

Tabela 1. Continuation.

| Variable | Maintaining | | Aggravation | | Total | | p-value* |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Smoking | | | | | | | |
| Never smoked/former smoker | 345 | 89.1 | 199 | 93.9 | 544 | 90.8 | 0.135 |
| Yes, I smoke | 37 | 9.6 | 13 | 6.1 | 50 | 8.3 | |
| Not informed | 5 | 1.3 | 0 | 0.0 | 5 | 0.8 | |
| Nutritional status | | | | | | | |
| Eutrophic | 203 | 52.5 | 126 | 59.4 | 329 | 54.9 | 0.249 |
| Overweight | 132 | 34.1 | 60 | 28.3 | 192 | 32.1 | |
| Obesity | 46 | 11.9 | 23 | 10.8 | 69 | 11.5 | |
| Not informed | 6 | 1.6 | 3 | 1.4 | 9 | 1.5 | |
| Practice of physical activities | | | | | | | |
| Yes | 143 | 37.0 | 78 | 36.8 | 221 | 36.9 | 0.994 |
| No | 235 | 60.7 | 128 | 60.4 | 363 | 60.6 | |
| Not informed | 9 | 2.3 | 6 | 2.8 | 15 | 2.5 | |
| Work injury | | | | | | | |
| No | 335 | 86.6 | 193 | 91.0 | 528 | 88.1 | 0.032 |
| Yes | 35 | 9.0 | 9 | 4.2 | 44 | 7.3 | |
| Not informed | 17 | 4.4 | 10 | 4.7 | 27 | 4.5 | |
| Professional competence | | | | | | | |
| Educational Level | | | | | | | |
| Elementary school | 8 | 2.1 | 12 | 5.7 | 20 | 3.3 | 0.023 |
| incomplete/finished high school | 366 | 94.6 | 198 | 93.4 | 564 | 94.2 | |
| Not informed | 13 | 3.4 | 2 | 0.9 | 15 | 2.5 | |
| Years in the profession | | | | | | | |
| Less than 6 | 96 | 24.8 | 72 | 34.0 | 168 | 28.0 | 0.011 |
| 6 and more | 285 | 73.6 | 133 | 62.7 | 418 | 69.8 | |
| Not informed | 6 | 1.6 | 7 | 3.3 | 13 | 2.2 | |
| Position | | | | | | | |
| Others | 367 | 94.8 | 190 | 89.6 | 557 | 93.0 | 0.017 |
| Technicians | 20 | 5.2 | 22 | 10.4 | 42 | 7.0 | |
| Not informed | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | |
| Total | 387 | 100.0 | 212 | 100.0 | 599 | 100.0 | |

*$\chi^2$ test.
Obs.: Results for the first year of data collection (2009).

Table 2. Descriptive statistics of personal values and work features , according to changes in work ability, private hospital, São Paulo, 2009 – 2011.

| Variable | Maintaining | | Aggravation | | Total | | p-value* |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Values | | | | | | | |
| Overcommitment | | | | | | | |
| No changes | 161 | 41.6 | 74 | 34.9 | 235 | 39.2 | < 0,001 |
| Aggravation | 98 | 25.3 | 90 | 42.5 | 188 | 31.4 | |
| Improvement | 120 | 31.0 | 43 | 20.3 | 163 | 27.2 | |
| Not informed | 8 | 2.1 | 5 | 2.4 | 13 | 2.2 | |
| Work | | | | | | | |
| Work violence (points) | | | | | | | 0.602 |
| 7 (no violence) | 254 | 65.6 | 134 | 63.2 | 388 | 64.8 | |
| 8 | 67 | 17.3 | 29 | 13.7 | 96 | 16.0 | |
| 9 | 34 | 8.8 | 23 | 10.8 | 57 | 9.5 | |
| 10 or more | 14 | 3.6 | 9 | 4.2 | 23 | 3.8 | |
| Not informed | 18 | 4.7 | 17 | 8.0 | 35 | 5.8 | |
| Work sector | | | | | | | |
| Corporate areas | 34 | 8.8 | 12 | 5.7 | 46 | 7.7 | 0.320 |
| Hotel | 62 | 16.0 | 49 | 23.1 | 111 | 18.5 | |
| Other operations/services | 13 | 3.4 | 6 | 2.8 | 19 | 3.2 | |
| Nursing services | 207 | 53.5 | 103 | 48.6 | 310 | 51.8 | |
| Medical superintendence | 32 | 8.3 | 16 | 7.5 | 48 | 8.0 | |
| Services of diagnosis and therapy | 21 | 5.4 | 13 | 6.1 | 34 | 5.7 | |
| Supplies | 18 | 4.7 | 13 | 6.1 | 31 | 5.2 | |
| Not informed | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | |
| Work shift | | | | | | | |
| Administration | 102 | 26.4 | 43 | 20.3 | 145 | 24.2 | 0.246 |
| Morning | 101 | 26.1 | 55 | 25.9 | 156 | 26.0 | |
| Afternoon | 75 | 19.4 | 53 | 25.0 | 128 | 21.4 | |
| Night | 106 | 27.4 | 56 | 26.4 | 162 | 27.0 | |
| Not informed | 3 | 0.8 | 5 | 2.4 | 8 | 1.3 | |

Continue...

Tabela 2. Continuation.

| Variable | Maintaining | | Aggravation | | Total | | p-value* |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Work load | | | | | | | |
| No changes | 153 | 39.5 | 97 | 45.8 | 250 | 41.7 | 0.531 |
| Aggravation | 76 | 19.6 | 40 | 18.9 | 116 | 19.4 | |
| Improvement | 89 | 23.0 | 45 | 21.2 | 134 | 22.4 | |
| Not informed | 69 | 17.8 | 30 | 14.2 | 99 | 16.5 | |
| Work demands | | | | | | | |
| No changes | 180 | 46.5 | 110 | 51.9 | 290 | 48.4 | 0.010 |
| Aggravation | 123 | 31.8 | 73 | 34.4 | 196 | 32.7 | |
| Improvement | 81 | 20.9 | 23 | 10.8 | 104 | 17.4 | |
| Not informed | 3 | 0.8 | 6 | 2.8 | 9 | 1.5 | |
| Effort-reward imbalance | | | | | | | |
| No changes | 75 | 19.4 | 41 | 19.3 | 116 | 19.4 | < 0.001 |
| Aggravation | 117 | 30.2 | 100 | 47.2 | 217 | 36.2 | |
| Improvement | 181 | 46.8 | 59 | 27.8 | 240 | 40.1 | |
| Not informed | 14 | 3.6 | 12 | 5.7 | 26 | 4.3 | |
| Social support | | | | | | | |
| No changes | 184 | 47.5 | 91 | 42.9 | 275 | 45.9 | 0.002 |
| Aggravation | 119 | 30.7 | 92 | 43.4 | 211 | 35.2 | |
| Improvement | 82 | 21.2 | 26 | 12.3 | 108 | 18.0 | |
| Not informed | 2 | 0.5 | 3 | 1.4 | 5 | 0.8 | |
| Control over work | | | | | | | |
| No changes | 208 | 53.7 | 115 | 54.2 | 323 | 53.9 | 0.524 |
| Aggravation | 84 | 21.7 | 51 | 24.1 | 135 | 22.5 | |
| Improvement | 88 | 22.7 | 40 | 18.9 | 128 | 21.4 | |
| Not informed | 7 | 1.8 | 6 | 2.8 | 13 | 2.2 | |
| Situations that favor pain/injury | | | | | | | |
| No aggravation (delta < 15,0) | 254 | 65.6 | 113 | 53.3 | 367 | 61.3 | 0.004 |
| Aggravation (delta ≥ 15,0) | 117 | 30.2 | 88 | 41.5 | 205 | 34.2 | |
| Not informed | 16 | 4.1 | 11 | 5.2 | 27 | 4.5 | |
| Total | 387 | 100.0 | 212 | 100.0 | 599 | 100.0 | |

*$\chi^2$ test.
Obs.: Figures for the first year (2009). For the variables categorized according to type of change, the results presented difference in the scores between 2009 and 2011.

Tables 1 and 2 show the variables that were significantly associated with WA impairment in univariate analyses such as age group ($p = 0.10$), report of workplace injury ($p = 0.032$), all variables related to professional competence, overcommitment ($p< 0.001$), work demands ($p = 0.010$), ERI ($p< 0.001$), social support (0.002), and WRAPI ($p = 0.004$).

Table 3 presents the results of multiple hierarchical analyses. Among the demographic variables, the age group was kept in the modeling (OR = 0.64; $p = 0.020$). Regarding the dimension of health/functional capacity, previous occurrence of workplace injury was associated with WA impairment (OR = 0.43; $p = 0.029$). Regarding professional competence, educational level remained in the modeling (OR = 0.27; $p = 0.008$). Overcommitment, representing the values, remained associated with WA impairment (OR = 2.11; $p < 0.001$). Regarding work, the variables associated with changes in WA were ERI (OR = 1.72; $p = 0.009$) and work demands (OR = 1.77; $p = 0.040$). Some of the dimensions related with "values" and "work" showed higher chances of WA impairment, even after the adjustment by other variables. Gender was kept in the model as a control variable.

## DISCUSSION

The results of this study confirmed the Work Ability House as a multidimensional model, in which characteristics of the individual, work and encircling environment are associated to WA. In this study, the factors that have been associated with changes in WA were age group, previous occurrence of workplace injury, years in the current profession, educational level, overcommitment, ERI, and work demands. Analyses were adjusted by the variables of each evaluated dimension (demographics, health, professional competence, values and work) in the hierarchical modeling. Moreover, in agreement with the theoretical model, the work dimension was the one with higher risk for WA impairment, with the variable regarding values (overcommitment).

The first set of variables included those related to sociodemographics features. These variables do not compose the four floors from the central structure of the House, but they are part of the surrounding environment[5]. The theoretical model emphasizes that factors surrounding the House influence WA, even if less directly than the floors composing its core structure[5]. Only the age group remained associated with WA impairment. These results do not mean that the social surrounding are not important for WA. They only show that, in the present study, such factors were of minor relevance. Partly this is explained as it was included only demographics and family features without the inclusion of broader aspects of the macro environment. Older age (≥30 years) proved to be a protective factor for WA. Even though the effect of chronological aging in relation to functional aging is consistently demonstrated[2,5], this effect is not always linear or present. It can be mediated by the level of knowledge, experience, skills, and job ties, which older workers tend to show more than

Table 3. Determinants of work ability identified by the hierarchized logistic regression, private hospital, São Paulo, 2009 – 2011.

| Dimension/variable | Univariate | | Multiple | | |
|---|---|---|---|---|---|
| | $OR_{crude}$ | p-value | $OR_{adjusted}$ | 95%CI of $OR_{adj}$ | p-value |
| Sociodemographics | | | | | |
| Gender | | | | | |
| Female | 1.00 | 0.993 | 1.00 | 0.63 – 1.35 | 0.672 |
| Male | 1.00 | | 0.92 | | |
| Age group | | | | | |
| < 30 | 1.00 | 0.011 | 1.00 | 0.43 – 0.93 | 0.020 |
| ≥ 30 | 0.62 | | 0.64 | | |
| Family income | | | | | |
| ≥ 5.1 minimum wages | 1.00 | 0.074 | 1.00 | 0.53 – 1.05 | 0.093 |
| < 5.0 minimum wages | 1.36 | | 0.74 | | |
| Health/functional capacity* | | | | | |
| Previous occurrence of work injuries | | | | | |
| No | 1.00 | 0.032 | 1.00 | 0.20 – 0.92 | 0.029 |
| Yes | 0.45 | | 0.43 | | |
| Smoking | | | | | |
| Never smoked/quit | 1.00 | 0.138 | 1.00 | 0.30 – 1.18 | 0.141 |
| Current smoking | 1.64 | | 0.60 | | |
| Professional competence (knowledge/skills)** | | | | | |
| Years in the profession | | | | | |
| < 6 | 1.00 | 0.012 | 1.00 | 0.47 – 1.12 | 0.149 |
| ≥ 6 | 0.62 | | 0.73 | | |
| Job title | | | | | |
| Others | 1.00 | 0.019 | 1.00 | 0.95 – 3.46 | 0.073 |
| Technicians | 2.13 | | 1.81 | | |
| Educational level | | | | | |
| Concluded elementary school | 1.00 | 0.028 | 1.00 | 0.11 – 0.71 | 0.008 |
| Incomplete high school and more | 0.36 | | 0.27 | | |

Continue...

Tabela 3. Continuation.

| Dimension/variable | Univariate | | Multiple | | |
|---|---|---|---|---|---|
| | $OR_{crude}$ | p-value | $OR_{adjusted}$ | 95%CI of $OR_{adj}$ | p-value |
| Values (attitude/motivation)*** | | | | | |
| Overcommitment | | | | | |
| No aggravation | 1.00 | <0.001 | 1.00 | 1.46 – 3.06 | < 0.001 |
| Aggravation | 2.21 | | 2.11 | | |
| Work**** | | | | | |
| Work shift | | | | | |
| Others | 1.00 | 0.088 | 1.00 | 0.82 – 1.95 | 0.284 |
| Afternoon | 1.42 | | 1.27 | | |
| Work sector | | | | | |
| Others | 1.00 | 0.033 | 1.00 | 0.99 – 2.47 | 0.055 |
| Hotel | 1.58 | | 1.56 | | |
| Effort-reward imbalance | | | | | |
| Improvement | 1.00 | < 0.001 | 1.00 | 1.15 – 2.58 | 0.009 |
| No improvement | 2.25 | | 1.72 | | |
| Social support | | | | | |
| No aggravation | 1.00 | 0.002 | 1.00 | 0.88 – 1.93 | 0.187 |
| Aggravation | 1.76 | | 1.30 | | |
| Work demands | | | | | |
| Improvement | 1.00 | 0.003 | 1.00 | 1.03 – 3.04 | 0.040 |
| No improvement | 2.13 | | 1.77 | | |
| Situations that favor pain/injury | | | | | |
| No aggravation | 1.00 | 0.004 | 1.00 | 0.80 – 1.80 | 0.371 |
| Aggravation | 1.69 | | 1.20 | | |

*Multiple analysis adjusted by the variables sex and age; **Multiple analysis adjusted by the variables sex, age, and history of work accident; ***Multiple analysis adjusted by the variables sex, age, history of work accident, and educational level; ****Multiple analysis adjusted by the variables sex, age, history of work accident, educational level, and overcommitment.
Obs.: Figures for the first year (2009). For the variables categorized according to type of change, the results presented difference in the scores between 2009 and 2011.

younger ones[9,14]. Another aspect is the possibility of the healthy worker effect, as those who remain active are the ones with better health.

The core structure of the House has the individual resources, including health and functional capacity, professional competence, and values[4,5]. The second set included the dimension of health/functional capacity. This dimension composes the first floor of the House, the base that supports the building, because this is the resource that is more clearly related with WA[4-6]. In this dimension, the previous occurrence of workplace injury appeared as a protective factor against WA impairment. This result requires a careful interpretation. Workplace injuries generate temporary or permanent disabilities, so they can compromise the functional capacity of the workers[15]. Most work injuries involving health professionals are related to musculoskeletal disorders and hands needlestick/sharp objects injuries[16,17]. Musculoskeletal injuries may generate a prolonged or definitive disability, and in the latter there is the risk for transmission of infectious diseases, leading to emotional and behavioral changes[16,17]. The healthy worker effect may have excluded those who presented more severe lesions, returning to work those with better health conditions.

The third set included variables representing the second floor of the House, concerning professional competence. In this dimension, workers with a higher educational level presented lower WA impairment. A study conducted with Finnish workers showed that one out of three workers with lower schooling had WA compromise, while this relationship was lower than one for those with higher schooling[18,19]. These differences must be interpreted from the point of view of the socioeconomic conditions reflected by education, translated into economic, occupational, and social terms, along with health conditions and professional specialization[19].

The variables representing the third floor of the House concerns the internal aspects of the individual, manifested in values. Values were demonstrated by overcommitment. Overcommitment is defined as an individual motivational pattern of excessive search for accomplishment and high performance at work, which can become more intense owing to the pressure in the work environment, thereby making these professionals more prone to exhaustion and stress[20]. In this study, individuals with higher overcommitment presented higher WA impairment than the other workers, regardless of the other variables. This association is identified in other studies[9,21].

The last set included the variables representing work. Work, with individual characteristics and resources, composes the structure of the House[4,5]. It is considered to be the wider and heavier floor; so, it can affect the others. If the workloads are disproportional to the individual resources, WA will be impaired[4,5]. In the work dimension, the variable associated with WA impairment was the greater imbalance between efforts and rewards and the exposure to work demands. The social and organizational context of work represented by ERI is pointed out as a predictor of WA, even more than other evaluated stressors[9,22]. It even presents a predictive value for the early exit of the nursing profession[8]. The ERI model is structured based on the conception of

social reciprocity, in which the imbalance between the efforts made and the rewards obtained can generate negative emotions, which is prone to neuroendocrine and autonomic activation. If these situations are maintained, they can trigger adverse effects on health[20]. Interventions in these aspects help to reduce the stress load, with favorable effects on health and WA[10]. The associations between the perceptions of aggravation in the exposure to psychosocial work demands and WA impairment reflect the fact that the more intense and frequent the work demands, the higher the risks to health and WA[20,23] among healthcare workers[8,10].

Studies with different methodologies confirm the theoretical considerations of the Work Ability House model[6,7,23], which results agree with the ones found here. A study conducted in a population sample of Finnish workers showed the dimensions of work and health presented higher power of explanation for the WA results[6]. Values, competence, and community surroundings also were associated with WA[6], thus confirming the complex structure of the model. A study evaluating Finnish teachers identified that the variables in the different dimensions of the House were associated with WA – use of medications, body mass index, percentage of body fat, aerobic capacity, muscle strength, stress, burnout, motivation, work organization, and work community[24]. In a systematic review, the authors emphasized the multifactorial nature of the construct, after identifying a variety of factors associated with WA impairment such as, lack of free time for physical activities, impaired musculoskeletal capacity, chronological aging, obesity, high mental and physical demands, lack of autonomy, and precarious physical work place[23].

WA impairment has a predictive value for negative outcomes for workers, institutions and society, resulting in absenteeism, lack of productivity, illnesses, early exit of the profession and higher mortality, including the health sector[2,10,18,23]. The knowledge of WA determinants allows subsidizing institutional and public policies in order to promote health and well-being for the workers, to protect and recover WA and favor employability[2,5,10,18,23]. A valid theoretical model to understand WA determinants represents a useful resource in the management of the worker's health, applicable in planning, development, and evaluation of intervention actions addressed to the individual and collective aspects of work[4,5,24].

The longitudinal design of this study allows establishing causality in the observed relations and confirming the tested theoretical model. However, some limitations must be mentioned. The first one is the rate of response (48.5%). In the period of the study (3 years), there was a significant turnover; so, the sample losses were mainly caused by dismissals (54.7%). High rates of turnover are commonly observed in the hospital sector, especially among nursing staff[25]. This occurs as hospital work is characterized by relevant physical and mental demands resulting from the work object (involving human health and life), the physical environment, the processes, and organization of work, which are usually unfavorable, conflicting interpersonal and work relationships and restricted forms of recognition[8,25]. Another limitation was the restricted number of variables analyzed in each dimension of the House, because of the structure of

the cohort; so, some measurements could not be assessed such as objective aspects of functional capacity. Finally, the study was conducted in a specific work group. Despite the limitations, the external validity can be extended for institutions with similar work characteristics and organization.

## CONCLUSIONS

The results of this study among hospital workers confirmed the dimensions proposed for the Work Ability House model. It showed it is a valid model representing WA as a multidimensional construct, which is determined by different causes. These results have implications for institutional and public policies, because the tested model represents a useful tool in planning, development, and evaluation of actions addressed to the promotion and recovery of WA. More studies approaching other occupational groups are welcome.

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