

Work-Related Stress Questionnaire: confirmatory factor analysis for construct validation by the PHRASI study

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Abstract. – OBJECTIVE: The purpose of this study is to validate the 13-item version of the Work-Related Stress Questionnaire (WRSQ) on a representative sample of Italian public health residents.

MATERIALS AND METHODS: The WRSQ was administered as part of the Public Health Residents' Anonymous Survey in Italy (PHRASI) from 14 June to 26 July 2022.

Collinearity between each questionnaire item was assessed with Kendall's τ statistic. The latent factors identified associating similar items based on the authors' observations were workplace, job demand, support and unpleasant workplace.

Goodness-of-fit was assessed with confirmatory factor analysis calculating: Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root-Mean-Residual (SRMR). Cronbach's alpha (α) and Omega McDonald (ω) were calculated to evaluate the reliability of the questionnaire. R 4.2.2 was used to perform the analyses.

RESULTS: 379 Public Health residents (58% women) responded to the questionnaire. No significant collinearity was found between the items (τ range -0.31 to 0.49). Confirmatory Factor Analysis showed CFI = 0.975, TLI = 0.967, RMSEA = 0.041 and SRMR = 0.051. Internal consistency of the WRSQ Total Score was $\alpha = 0.80$ and $\omega = 0.85$.

CONCLUSIONS: Although validated in a sectorial subpopulation of healthcare workers, the WRSQ proved to be an excellent tool for assessing work-related stress. Unpleasant workplace latent factors showed lower factor loading and internal consistency than others. This could be due to the fact that topics investigated with unpleasant workplace items (e.g., abuse and discrimination) are experienced on a less regular basis than the ones assessed through the other items.

Key Words:

Work-related stress, Risk assessment, Occupational medicine, Phrasy study.

Introduction

Work-related disorders are a widespread problem and a crucial topic of occupational health, not only in Europe but also worldwide¹. Almost 60% of the world's population is employed and potentially exposed to the risk of developing disorders related to their work².

The work environment can be a place that enhances or undermines mental health and has the potential to negatively impact it, particularly in the form of stress. Research demonstrated that both unsafe physical and psychosocial work environments create risk factors for mental health and might be correlated to stress, i.e., “any experience or sensation that creates a physiological, psychological and behavioral imbalance within a person”³, highlighting a close association between work-related psychosocial factors and the mental health of workers⁴.

The psychosocial risks that can lead to the development of work-related stress (WRS) are not so evident because they may be related to different factors such as the specific characteristics of the workplace, the job content or the work schedule, or the opportunities for career development⁵⁻⁸.

It has long been known that several work-related stressors, such as having too much work, low job control or influence at work, inadequate pay, low social support at work, poor organizational structure, conflicts at work and a mismatch between workplace and personal values⁶⁻⁸, may trigger employees' health problems (e.g., mental health problems) and may be associated with common mental disorders^{9,10} also through a biohumoral effect¹¹.

In the last decades, the greater job-related psychosocial stressors have generated harmful physical and emotional reactions among workers and have increased psychiatric morbidity^{8,10}. Job insecurity and living under the chronic threat regarding the continuity of the job, considered among the most common job stressors^{12,13}, have evidenced a positive relationship with psychological stress and have generated adverse consequences and poor health outcomes¹⁴⁻¹⁸. The COVID-19 pandemic and the consequent worldwide financial crisis have increased these feelings of job insecurity among employees and have worsened their work and psychological well-being also through new ways of working such as teleworking¹⁹ and especially in healthcare professionals²⁰⁻²².

The World Health Organization defined this stress caused or made worse by work as “the response people may have when presented with work demands and pressures that are not matched

to their knowledge and abilities and which challenge their ability to cope”²³. WRS has been recognized as a risk factor for disease onset and progression²⁴ and has been demonstrated to be associated with physical and mental health risks²⁴⁻²⁶.

Beyond the effects on the individual, WRS can also harm companies and cause financial burdens to organizations and society at large due to health care costs and sickness absence that reduce productivity^{27,28}. Across the world, if work stress could be reduced or prevented, its adverse consequences could also be heavily mitigated and preventive interventions are needed to moderate the effects on workers^{29,30}.

The search for a valid tool that makes it possible to evaluate the worker's subjective perception and exposure to psychosocial risks is still an open challenge. In this regard, the Research Unit of Sapienza University conducted a pilot study in which an instrument was tested for its internal consistency twice to select a lighter questionnaire³¹. The proposed instrument, the Work-Related Stress Questionnaire (WRSQ), was included in the PHRASI study (Public Health Residents' Anonymous Survey in Italy), conducted by the Public Mental Health working group of the Medical Residents' Assembly of the Italian Society of Hygiene and Preventive Medicine, to first carry out a confirmatory factor analysis and subsequently a psychometric evaluation of the instrument itself³².

The purpose of this research is to present the results of the confirmatory factor analysis of the WRSQ on a representative sample of Italian Public Health residents investigated in the PHRASI study.

Materials and Methods

The Work-Related Stress Questionnaire (WRSQ) is a validated tool designed by De Sio et al³¹ and intended to assess working wellness. The pre-pilot study proposes two different versions of the same questionnaire: the full version with 33 items and the shorter one with 13³¹. Both evaluated the factors that affect workers' mental health, such as job satisfaction, workplace, working role, workload, social network, support by colleagues and boss/manager during working activities, willingness to change job position/workplace, and emotional stress. Since this tool was highly reliable for each item, the working group of the Medical Residents' Assembly of the Italian Society of Hygiene and Preventive Medicine has designed the Public Health Residents' Anonymous Survey in Italy

(PHRASI) protocol study to explore public health residents' mental status of all over Italian School in Hygiene and Preventive Medicine during COVID-19 pandemic through a cross-sectional study based on a self-administrated online anonymous questionnaire, also focusing on working aspects³². To reach this purpose, the full version of WRSQ by De Sio et al³¹ was modified into the 13-item WRSQ and was introduced in the questionnaire described in the PHRASI protocol study, in which the study methodology has been detailed³². Considering the anonymity of the questionnaire and encryption of collected data as Italian and European law sanction, the approval of an ethics committee was not needed³³⁻³⁵.

Questionnaire

The WRSQ was included in the online questionnaire created with Google Form (©2022 Google, Mountain View, Santa Clara, CA, USA). The link was spread through the Medical Residents' Assembly of the Italian Society of Hygiene and Preventive Medicine network³². The total number of participants in this cross-sectional study was 379 out of nearly 1,600 medical residents in Public Health School during from 14 June to 26 July 2022.

Questions about socio-economic (sex, age, region of residence, cohabitation, offspring, and monthly income sufficiency) and working factors (prevalent workplace, off-site worker, commuter worker, course biennium in the Italian specialization school, working with another specialization-compatible contract, willingness to work in

the current workplace/training site, training in another site at the same period, willingness to repeat specialization schools/general practitioner test) with related fixed answers were previously described in the PHRASI study on depression³⁶.

Table I provides an overview of the 13-item WRSQ and its scoring system. In brief, the answers are reported on a five-point Likert scale. Possible answers are: "Never", "Rarely", "Sometimes", "Often" and "Always". The points for each item range from 1 ("Never") to 5 ("Always"), except for items 4, 8, 10, 11 and 13, whose scoring system is reversed (5="Never" to 1="Always").

Statistical Analysis

All data collected with the online questionnaire were aggregated. Categorical variables were presented as absolute frequencies and percentages, whereas continuous variables were reported as mean and standard deviation (SD) for normal distribution or median and interquartile range (IQR) otherwise. Normality was assessed using the Shapiro-Wilk test.

Collinearity between each questionnaire item was assessed using a correlation plot, whose coefficients were identified from the Kendall rank correlation coefficient (Kendall's τ statistic). A τ coefficient equal to or higher than 0.50 or equal to or lower than -0.50 was considered a cut-off for a strong correlation between two items. Factor validity was assessed through Bartlett's test of sphericity and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) to perform factor analysis, as appropriate.

Table I. Items of the Work-related Stress Questionnaire, possible answers, and related scoring system.

1	I feel comfortable at work	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
2	I am given all the tools and instruments I need to do my job	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
3	It is clear to me how my work contributes to achieve the goals of my organization	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
4	My workload is excessive	Never ⁵	Rarely ⁴	Sometimes ³	Often ²	Always ¹
5	I have the freedom to decide when to take a break	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
6	I can rely on the help of my colleagues	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
7	I can rely on the help of my boss	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
8	I have been victim of physical and/or verbal abuse at work	Never ⁵	Rarely ⁴	Sometimes ³	Often ²	Always ¹
9	Employees are always consulted regarding planned changes	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
10	My work often interferes with my family, social or personal duties	Never ⁵	Rarely ⁴	Sometimes ³	Often ²	Always ¹
11	In the workplace I have to hide my real emotions and I have to express others	Never ⁵	Rarely ⁴	Sometimes ³	Often ²	Always ¹
12	The equipment that I use are useful for carrying out my work, they comply with safety regulations and are of the latest generation	Never ¹	Rarely ²	Sometimes ³	Often ⁴	Always ⁵
13	In the workplace there is discrimination related to either gender, sexual orientation, religious faith, ethnicity or other	Never ⁵	Rarely ⁴	Sometimes ³	Often ²	Always ¹

The superscript numbers represent the score attributed to each answer.

Latent factors were explored by associating similar questions in the 13-item WRSQ based on the authors' observations, considering the main aspects of workers' wellness determinants such as workplace (items 1, 2, 3 and 12), job demand (items 4, 5, and 10), supporting (item 6, 7, and 9) and unpleasant workplace (item 8, 11, and 13).

A Confirmatory Factor Analysis (CFA) using a weighted least-square-mean and variance-adjusted estimator was conducted. The overall goodness-of-fit was assessed using the following indexes and cut-off points: Comparative Fit Index (CFI; CFI ≥ 0.95), Tucker-Lewis Index (TLI; TLI ≥ 0.95), Root Mean Square Error of Approximation (RMSEA; RMSEA < 0.06), Standardized Root-Mean-Residual (SRMR; SRMR ≤ 0.08). Cronbach's alpha and Omega McDonald were assessed to evaluate the reliability of the 13-item questionnaire and each subscale.

A *p*-value < 0.05 was considered statistically significant. All analyses were performed using R 4.2.2.

Results

Population Characteristics

Table II provides an overview of the sample's characteristics. In the study population, 58% (219 PHR) are women, and the median age is 29, ranging from 25 to 61. Regarding the area of residence, 41% (157 PHR) of the participants dwelt in northern Italy, followed by 25% (96 PHR) in central Italy and 33% (126 PHR) in southern Italy and the islands. Considering the geographical location of the workplace, 47% (178 PHR) reported working in Northern Italy, 30% in Central Italy, and 23% in Southern Italy and the islands. 44% (168 PHR) of the participants reported being off-site workers, while 31% (121 PHR) were commuters. Approximately a quarter (26%, 98 PHR) of the respondents lived alone, while 86% (327 PHR) had no children. 57% (217 PHRs) stated they were struggling to reach the end of the month on their own economic resources. Over three quarters (77%, 292 PHRs) of the survey respondents were in the first two out of four years, and 64% (242 PHR) had no employment contract compatible with the specialization course. Furthermore, 15% (58 PHR) were in two different internships simultaneously, and 67% (254 PHR) of respondents stated that they wished to work at the current training site in the future. On the other hand, 5% of PHRs expressed the willingness to retake the residency test or the general practitioner one next year, while 12% were uncertain about it.

Collinearity Assessment

All Kendall's τ coefficients were between -0.31 and 0.49, resulting in absence of collinearity between the items of the WRSQ. All the coefficients are shown in Figure 1.

Factor Validity

Bartlett's test of sphericity was significant, $\chi^2(78) = 1225.14$, $p < 0.001$, and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) analysis returned an overall value of 0.821 and values between 0.705 (item 4) and 0.906 (item 11) for all variables, indicating that our data were suitable for factor analysis.

Table II. Socio-demographic characteristics.

Characteristic	N = 379 ¹	
Sex	Female	219 (57.78%)
	Male	160 (42.22%)
Age		30 (29.00, 34.00)
Region of residence	Center	96 (25.33%)
	North	157 (41.42%)
	South	126 (33.25%)
Prevalent workplace	Center	113 (29.82%)
	North	178 (46.97%)
	South	88 (23.22%)
Cohabitation	Alone	98 (25.86%)
	With Others	281 (74.14%)
Number of children	0	327 (86.28%)
	1	32 (8.44%)
	>1	20 (5.28%)
Off-site worker	No	211 (55.67%)
	Yes	168 (44.33%)
Commuter worker	No	258 (68.07%)
	Yes	121 (31.93%)
Living with the own income until the end of the month	Easily	162 (42.74%)
	Hardly	217 (57.26%)
Course year in the Italian specialization school	1 st biennium	292 (77.04%)
	2 nd biennium	87 (22.96%)
Having a work contract compatible with the specialization school currently	No	242 (63.85%)
	Yes	137 (36.15%)
Willingness to work in the current workplace/ training site	No	125 (32.98%)
	Yes	254 (67.02%)
Trainings in another site at the same period	No	321 (84.70%)
	Yes	58 (15.30%)
Willingness to repeat specialization schools/ general practitioner test	No	315 (83.11%)
	Maybe	46 (12.14%)
	Yes	18 (4.75%)

¹ Median (IQR); n (%)

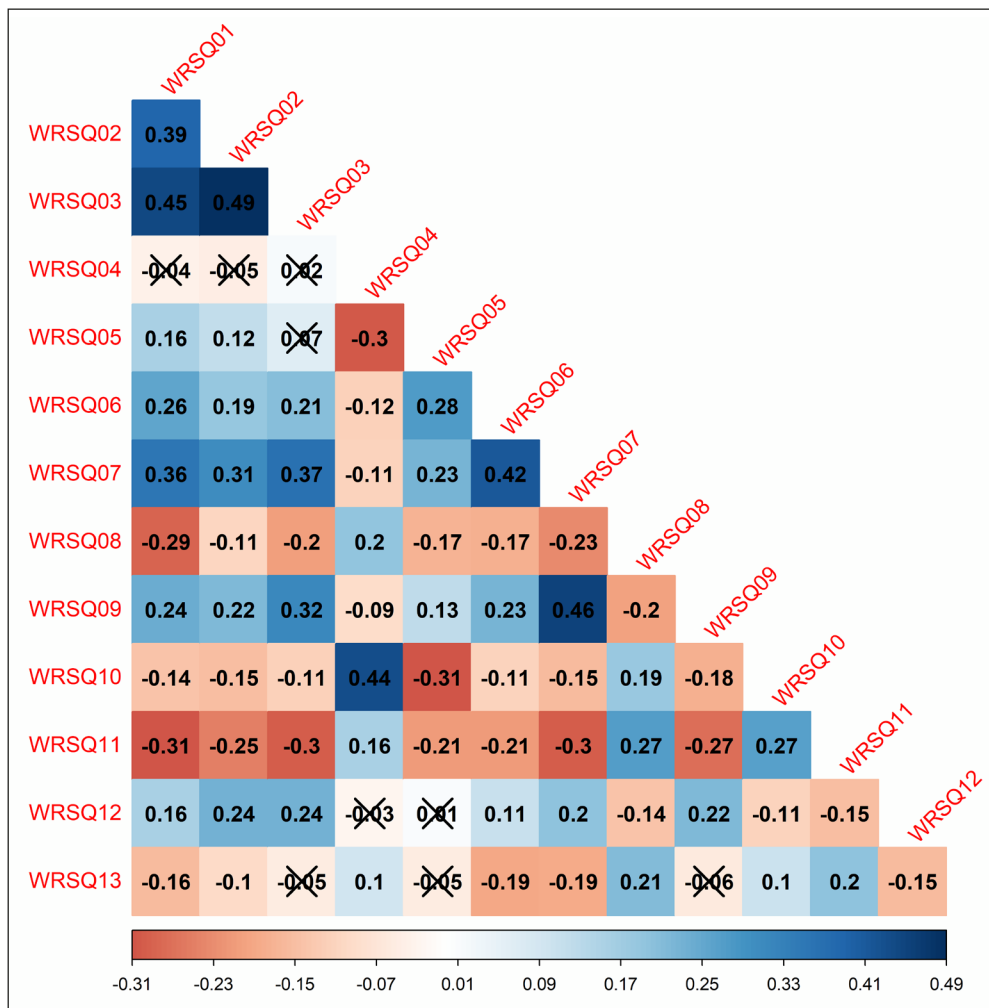


Figure 1. Collinearity between each item of WRSQ.

Confirmatory Factor Analysis

A four-factor model was created for CFA. The factors were workplace, job demand, supporting and unpleasant workplace. Workplace latent factor was constituted with items 1, 2, 3 and 12; job demand with items 4, 5, 10; supporting with 6, 7, 9; and unpleasant workplace with 8, 11, 13.

After the results of the first model (Model 1), a four-factor latent in which workplace and job demand were uncorrelated (Model 2) was evaluated. The goodness-of-fit indexes for the two models are shown in Table III.

Model 1 showed the best goodness-of-fit indexes and was chosen for our analysis. In particular, Comparative Fit Index was 0.975, while Tucker-Lewis Index was 0.967. Root Mean Square Error of Approximation was 0.041 (90% Confidence Interval: 0.030 - 0.053). Finally, Standardized Root

Mean Square Residual was 0.051. Results are showed in Table IV and Table V. Figure 2 shows a graphical representation of Model 1 with standardized coefficients and covariances.

Reliability

Table VI displays the internal consistency of the whole questionnaire and the linear combination of each latent factor. The WRSQ Total Score ($\alpha = 0.80$ and $\omega = 0.85$) shows good internal consistency. While the workplace ($\alpha = 0.70$ and $\omega = 0.72$), job support ($\alpha = 0.69$ and $\omega = 0.73$) and job demand ($\alpha = 0.67$ and $\omega = 0.68$) demonstrate an acceptable McDonald Omega coefficient and Cronbach's alpha, unpleasant workplace reliability ($\alpha = 0.55$ and $\omega = 0.56$) is uncertain.

Reliability if an item is dropped did not improve the Cronbach's alpha coefficients (considering the newer alpha between 0.77 and 0.80).

Discussion

This study examined the structure of the Work-Related Stress Questionnaire developed by De Sio et al³¹ in Italy. The WRSQ demonstrates a good factorial distribution. However, to the best of our knowledge, the tool was not previously validated, and this is the first study to develop a validation for this questionnaire. The validation population consisted of medical residents in public health in Italy.

In the present study, no items were excluded from the factor analysis. The standardized loading factor for the chosen model ranged from 0.340 to 0.796. Our CFA shows that the items in the job support cluster were the ones with higher factor loading (especially item 7 “I can rely on the help of my boss”), while the items in the unpleasant workplace cluster were the ones with lower factor loading (especially the item 13 “In the workplace there is discrimination related to either gender, sexual orientation, religious faith, ethnicity or other”). This may be related to the fact that the elements of job support are experienced by all workers on a daily basis, especially in a public health setting, based on the relationship with superiors (item 7) and the transfer of information (item 9), while not all workers may be less

Table III. Goodness of fit indices for confirmatory factor analyses.

Goodness of fit index	Model 1	Model 2
CFI	0.975	0.972
TLI	0.967	0.964
RMSEA	0.041	0.055
RMSEA 90%	0.030 – 0.053	0.043 – 0.067
Confidence Interval		
SRMR	0.051	0.063

CFI= Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual.

affected by episodes of discrimination (item 13) or abuse at work (item 8). The goodness-of-fit indexes were very high, considering the constraints set in the statistical analysis section.

Regarding reliability, good internal consistency coefficients were obtained for the whole questionnaire and acceptable internal consistency coefficients were obtained for workplace, job demand and job support clusters. No improvements in reliability were found if an item is dropped. Regarding the dimensions, workplace showed the highest internal consistency values, while the lowest could be found for unpleasant workplaces. These

Table IV. Confirmatory factor analysis from model 1.

Latent factor	Item	Standardized Coefficient	95% Confidence Interval	p-value
Workplace	Item 1	0.717	0.626 - 0.808	0.000
	Item 2	0.648	0.556 - 0.739	0.000
	Item 3	0.729	0.648 - 0.810	0.000
Job Demand	Item 12	0.386	0.273 - 0.498	0.000
	Item 4	0.531	0.399 - 0.664	0.000
	Item 5	0.623	0.508 - 0.738	0.000
Job Support	Item 10	0.740	0.623 - 0.857	0.000
	Item 6	0.546	0.430 - 0.662	0.000
	Item 7	0.796	0.718 - 0.875	0.000
Unpleasant Workplace	Item 9	0.633	0.551 - 0.714	0.000
	Item 8	0.554	0.456 - 0.652	0.000
	Item 11	0.704	0.610 - 0.797	0.000
	Item 13	0.340	0.210 - 0.469	0.000

Table V. Covariance between latent factors.

Covariance	Latent factor	Standardized Coefficient	95% Confidence Interval	p-value
Workplace	Job Demand	0.238	0.095 – 0.382	0.001
Workplace	Supporting	0.724	0.621 – 0.826	<0.001
Workplace	Unpleasant Place	0.654	0.516 – 0.791	<0.001
Job Demand	Supporting	0.423	0.279 – 0.567	<0.001
Job Demand	Unpleasant Place	0.563	0.416 – 0.711	<0.001
Supporting	Unpleasant Place	0.694	0.567 – 0.820	<0.001

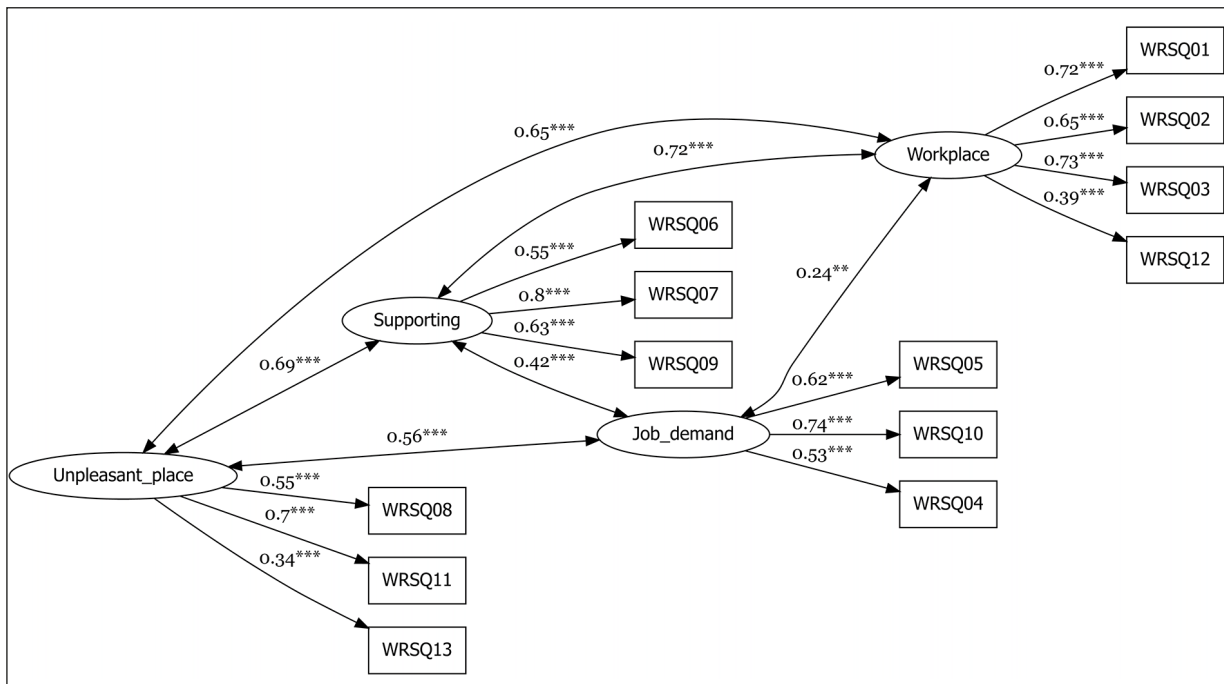


Figure 2. Graphical representation of model 1 with standardized coefficients and covariances.

results can be explained by the fact that workplace, job demand and job support clusters investigate different facets of the working environment and the stress related to it, while the questions belonging to the unpleasant workplace cluster, although of great importance for the stress they can cause in the workplace, are more related to emotional and abuse aspects which constitute a more sectoral element and which fortunately concern a part and not the entirety of the workers. Furthermore, having reduced the number of items in the questionnaire, although of great importance for the purposes of practicality and for the more feasible administration of the questionnaire, goes to the detriment of its internal consistency. The results show the absence of multicollinearity, demonstrating that the items assess different aspects of the work-related stress phenomenon, although they are all referable to it. Globally, the WRSQ was found to be an excellent tool for assessing work-related stress.

The study has some strengths, one of which is the sample size. The questionnaire was completed by 379 participants, a relevant number considering that the total number of Italian Public Health residents is about 1,600. Moreover, the questionnaire was based on Google Forms, so it was easy to disseminate the tool through institutional e-mails, social networks and instant messaging apps.

A limitation of the study is the sectoriality of the reference population, made up of public health residents. That of medical residents is a population already subjected to severe work-related stress³⁷. The burden became even greater for health workers during the COVID-19 pandemic^{22,38}. The tool is a good instrument usable by the occupational physician for assess within companies WRS in workers, validated for the reference population, but further studies are needed in order to extend it to the general population.

The questionnaire represents a very effective tool used in various areas of research and on specific populations^{39,40}, and in this specific case very useful for analyzing the subjective perception of the risks leading to work-related stress and its consequences on health^{41,42}.

Table VI. Internal consistency of whole questionnaire and subscales.

Subscale	Standardized Cronbach's alpha	Omega McDonald's Coefficient
Whole Questionnaire	0.81	0.85
Workplace	0.70	0.72
Job Demand	0.67	0.68
Job Support	0.69	0.73
Unpleasant workplace	0.55	0.56

Conclusions

Analyzing the perception of work-related stress in the workplace represents a major challenge for occupational health and is pivotal to implementing corrective actions. The WRSQ represents a valuable tool for the exploration of several known domains of psychosocial risks that can lead to consequences for workers' health and that need to be moderated to improve well-being in the workplace.

Conflict of Interest

The authors declare that they have no conflict of interest.

Funding

None.

Ethics Approval

This study was conducted in conformity with the Declaration of Helsinki. In addition, the participation was completely anonymous and voluntary, and it did not induce undue psychological stress or anxiety. For these reasons, the ethics approval is not applicable. As required by the Institutional Review Board (IRB) of Sapienza University, a self-certification was provided about compliance of ethical principles.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Authors' Contributions

Concept: F.C., L.S., A.C., V. Gi., S.D.S., R.P., G.B.; Design: F.C., L.S., A.C., V.Gi.; Supervision: V.Gi., S.D.S., S.A.S., G.L.T. H.N.; Materials: N.B., V.D.N., M.C., A.A., G.M., C.M., C.C., V.G.; Data: N.B., V.D.N., M.C., A.A., G.M., C.M., C.C., V.G.; Analysis: L.S., F.C.; Literature search: N.B., V.D.N., M.C., A.A., G.M., C.M., C.C., V.G.; Writing: F.C., L.S., A.C., N.B., V.D.N., M.C., A.A., G.M., C.M., C.C., V.G.; Critical revision: F.C., L.S., V. Gi., S.D.S., S.A.S., G.L.T. H.N.

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