

## THE USE OF ASSESSMENT TOOLS IN A SAMPLE OF CROATIAN PROFESSIONAL FIRE-FIGHTERS

Dijana Poplašen<sup>1</sup>, Darko Marčinko<sup>2</sup>, Zlatko Ulovec<sup>3</sup>, Vlatka Brumen<sup>4</sup>,  
Željko Verzak<sup>3</sup> & Mladen Kratochvil<sup>5</sup>

<sup>1</sup>Occupational Health Services, Public Health Care Centre of the Zagreb County, Samobor, Croatia

<sup>2</sup>Department of Psychiatry, University Hospital Centre Zagreb, Zagreb, Croatia

<sup>3</sup>Department of Paediatric Dentistry, School of Dental Medicine University of Zagreb, Zagreb, Croatia

<sup>4</sup>Department of Managerial Systems & Work Environment, University of Applied Health Sciences, Zagreb, Croatia

<sup>5</sup>Occupational Health Services, Public Health Care Centre of the Ministry of Interior of the Republic of Croatia, Zagreb, Croatia

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### SUMMARY

**Background:** This article aims at testing of psychometric characteristics of the Beck Depression Inventory (BDI) and the Defense Style Questionnaire – 40 (DSQ-40) in a sample of Croatian professional fire-fighters, so as to justify their use in Occupational Health. A pioneer effort to interrelate mental states and psychological job demands, ranked using the WAI questionnaire, was made as well.

**Subjects and methods:** Upon informed consent, the tools were tested on a sample of 300 members of the operative fire-fighting squad of the City of Zagreb, all men (average age 43; average years of fire-fighting service 18.5). The participation was voluntary and anonymous.

**Results:** The average BDI score was 2.34, revealing a low representation of depression in the target population. The score indicating severe depression was seen in 0.7% of examinees only. Cronbach alpha of 0.92 showed satisfactory inner tool consistency. As for DSQ-40, mature, neurotic and immature defence mechanisms were evaluated. The highest mean score of 75.24 ( $\pm 26.07$ ) was obtained with immature defence (Cronbach alpha 0.87). Self-assessed current working capacity was revealed to be strongly dependent on total years of service ( $r = -0.134$ ;  $p = 0.021$ ), while the representation of neurotic defence positively correlated with the respondents' age and total years of service. Immature defence strongly positively correlated with the total years of fire-fighting service.

**Conclusions:** The employed tools were shown to be appropriate for use in Croatian professional fire-fighting population. Nevertheless, the interrelations disclosed by this pioneer research should be investigated further.

**Key words:** psychological assessment tools – Beck Depression Inventory – Defense Style Questionnaire – professional fire-fighters – Occupational Health – work capacity

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### INTRODUCTION

Professional fire-fighting squads are entrusted with tasks that fall within the category of jobs performed under special work conditions, hence demanding regular and thorough health surveillance. Whenever choosing among applicants tending to occupy such positions, fire-fighting included, Occupational Health services resort to professional selection that allows for choosing “the best man for the job” based on individual psychosomatic profile that best fits the job description. Owing to such a rigorous selection, the “healthy worker phenomenon” has been witnessed in these populations, best described as the discrepancy between anticipated and actual impact of workplace hazards on workforce health (Siebert et al. 2001). Nevertheless, as the years of service go by, cumulative health effects can be expected, presenting in a variety of somatic and mental disorders. The battery of psychological tests currently included into the pertaining health surveillance algorithm provides an overall rather than detailed insight into the psychological status of workers performing

under special working conditions. On the other hand, a number of additional and more informative instruments have been developed insofar, allowing for a higher-quality selection of applicants and a broader insight into the health status of workers occupying workplaces that require performance under special conditions and/or special skills and competencies. Some of these tools shall briefly be introduced hereinafter.

Beck's Depression Inventory (commonly abbreviated and hereinafter referred to as: BDI) was developed as early as in 1961 (Beck et al. 1961) and revised in 1996 (Beck et al. 1996). Since then, it has become one of the instruments most frequently used for the assessment of depression severity across various patient and general population groups (Berlanga & Flores-Ramos 2006, Hellerstein et al. 2008, Knekt et al. 2008). Scores spanning from 0-13 speak in favour of a minimal depression, those spanning from 14 to 19 support the diagnosis of a mild depression, while scores spanning from 20 to 28 speak in favour of a moderate depression. Respondents having a score of 29 to 63 are labelled as severely depressed.

Defence Style Questionnaire – 40 (commonly abbreviated and hereinafter referred to as: DSQ-40), represents a shortened version of the original +80-item tool created in 1986 by Bond and Vaillant (Bond & Vaillant 1986). It comprises 40 statements descriptive of 20 defence mechanisms and 3 major defence styles (mature, neurotic and immature) (Andrews et al. 1993).

On top of the above-mentioned, in the 90-ties a Finnish research team affiliated with the Finish Institute of Occupational Health (FIOH) developed the questionnaire termed the Work Ability Index (commonly abbreviated and hereinafter referred to as: WAI) (Tuomi et al. 1998). The input provided by the respondents allows for work capacity estimation, while the tool itself has undergone several revisions so as to better reflect the experience gained through its use. In the last decade, WAI has been broadly used both in an everyday occupational medical practice and research conducted in this field of expertise (de Zwart et al. 2002, Kujala et al. 2005, Rotenberg et al. 2008). A part of this questionnaire addresses not only physical, but also psychological job demands.

Nevertheless, in order to be used across a specific population, any given instrument should be tested for its suitability for a particular purpose/population. This article aims to bring the psychometric characteristics of the assessment tools tested in a sample of Croatian professional fire-fighting population, to the effect of determining the justifiability of their implementation into the algorithm of health surveillance of professional fire-fighting squad members conducted by Occupational Health services. A pioneer effort to test the relationship between various mental states (depression, anxiety) and psychological job demands ranked by our examinees within the broader context of this study using the WAI questionnaire was made as well.

## SUBJECTS AND METHODS

### Subjects

BDI and DSQ-40 were tested on a sample of 300 professional fire-fighters, members of the operative fire-fighting squad of the City of Zagreb. All of them were men, aged 43 ( $\pm 7.8$ ) on the average (range, 29-61), having an average of 18.5 ( $\pm 7.7$ ) years of the fire-fighting service (range, 8-38).

### Methods

BDI, DSQ-40 and WAI questionnaires were distributed among, and filled by the examinees following a detailed explanation and precise instructions provided by the Chief Investigator (the first author). The participation in this study was voluntary and anonymous at all times. The study was approved by the Board of Ethics of the School of Dental Medicine University of Zagreb where its shall eventually be presented in form of a PhD thesis, and the Board of Ethics of the Public Healthcare Centre operating under the wing of the Ministry of

Interior of the Republic of Croatia, and fully conforms to the provisions of the Helsinki Declaration. Each and every participating member of the professional fire-fighting squad of the City of Zagreb signed an informed consent.

### Statistical analysis

Within the frame of the statistical analysis, a description of relevant demographic variables and tool items was provided. Reliability/inner consistency of the psychological assessment tools in use was ascertained using the Cronbach alpha coefficient. Cronbach alpha coefficient represents the most commonly used measure of reliability of a metric instrument, underpinned by the inner consistency of the latter. It boils down to averaging of the correlation coefficient established between the items comprised by the instrument under validation, and is expressed as a single number spanning from 0 to 1. The closer to 1 the Cronbach alpha, the more reliable the instrument. The inner consistency can also be assessed based on the impact of omission of a certain item/items from the instrument on the Cronbach alpha value. In case such an omission results in a marked increase in Cronbach alpha value, the item can or even should be omitted from the instrument so as to make it more reliable or suitable for the purpose/target population. As oppose to that, when the omission in question results in lower alpha values, the omitted item/items should definitely be reincorporated into the instrument and deemed essential for its integrity and proper use.

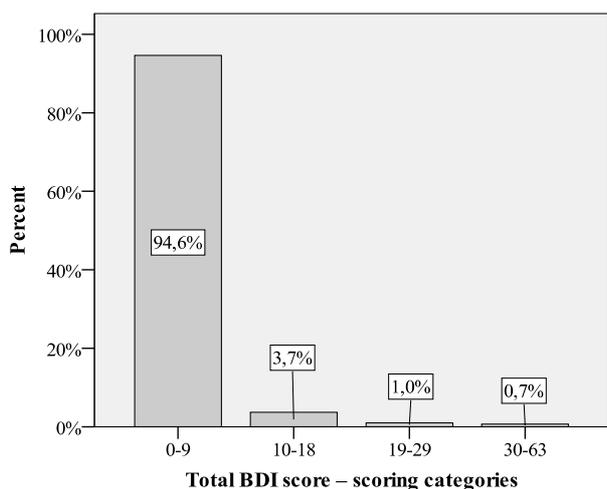
Variable interdependence was assessed using both Spearman correlation coefficient and linear regression. Error threshold was set at 0.05. Data analysis made use of IBM SPSS Statistics 20 software package.

## RESULTS

BDI questionnaire was filled by 298 out of 300 examinees (2 returned unfilled; response rate, 99.3%) that scored 2.34 (SD =5.25) on the average (score range, 0-61) (Table 1). BDI score distribution is displayed in Figure 1. Almost 95% of the examinees (94.6%, to be exact) scored below 10, which tagged them as minimally depressed. The percent-share of those scoring 10 to 18 and therefore being labelled as minimally to mildly depressed, amounted to 3.7%, while only 1% of the examinees scored 19 to 29 and were therefore tagged as mildly to moderately depressed. The score of 30 to 63 speaking in favour of a severe depression was seen in no more than 0.7% of our examinees. Judging by the Cronbach alpha coefficient ( $\alpha=0.92$ ), the inner consistency of the BDI questionnaire is satisfactory.

**Table 1.** Characteristics descriptive of the Beck depression Inventory (BDI)

| Test | n   | Mean | SD   | Range | Cronbach $\alpha$ |
|------|-----|------|------|-------|-------------------|
| BDI  | 298 | 2.34 | 5.25 | 0-61  | 0.92              |



**Figure 1.** Total score on the Beck Depression Inventory (BDI) – scoring categories distribution (n=298)

Questions posed within the DSQ-40 frame were answered by 295 out of 300 examinees (the remaining 5 questionnaires returned either blank-2x, or partly filled-3x; response rate, 98.3). When it comes to mature defence mechanisms, the mean score of 39.45 ( $\pm 10.75$ ) ranging from 8-67 was obtained, with the pertaining Cronbach alpha of 0.67. As for neurotic defence mechanisms, the mean score equalled to 31.62 ( $\pm 10.42$ ), with the span of 8-60 and the pertaining Cronbach alpha of 0.62. The highest mean score of 75.24 ( $\pm 26.07$ ) was obtained with immature defence mechanisms, spanning from 25 to 178 and being featured by Cronbach alpha of 0.87. The consistency of the above mechanisms taken as a whole (Cronbach alpha) was 0.89.

Of note, the omission of certain items for validity testing purposes had no significant bearing on Cronbach alpha coefficients of any of the instruments under study, indicating that no item adjustments should be made in order to apply them to the studied population, since the instruments had been proven suitable for the purpose in their original format.

We also made a pioneer effort to relate the above psychological questionnaires' item scores to the obtained WAI scores descriptive of psychological job demands. For the sake of this article, the results reported herein shall be narrowed down to statistically significant Spearman correlations only (Table 2).

Self-assessed current working capacity as compared against the working capacity at one's prime was revealed to be strongly dependent on the total years of service ( $r=-0.134$ ;  $p=0.021$ ), with the dropping tendency as the years of fire-fighting service go by. The items comprised by the DSQ-subscale descriptive of neurotic defence mechanisms positively correlated with the respondents' age and their total years of service, showing the rise in representation of such mechanisms with aging and longer service. Immature defence mechanisms strongly positively correlated with the total years of fire-fighting service, showing an increasing representation with longer service. Virtually the same goes for DSQ-40 on the whole ( $r=0.142$ ;  $p=0.015$ ).

**Table 2.** Statistically significant WAI-DSQ Spearman correlations

| Items or variables | n   | r      | p     |
|--------------------|-----|--------|-------|
| WAI 2-1 - TYS-FFSY | 297 | -0.134 | 0.021 |
| NEU - AGE          | 295 | 0.137  | 0.019 |
| NEU - TYS          | 295 | 0.130  | 0.026 |
| NEU – TYS-FFSY     | 295 | 0.156  | 0.007 |
| IM – TYS-FFSY      | 295 | 0.126  | 0.031 |
| DSQ – TYS-FFSY     | 295 | 0.142  | 0.015 |

WAI – Work Ability Index; DSQ - Defence Style Questionnaire; TYS – Total years of service; FFSY- Fire-fighting service years; NEU – Neurotic defence mechanisms; IM – Immature defence mechanisms

## DISCUSSION

Pursuant to the provisions of the Ordinance on Mental, Physical and Health Requirements to be Met by Authorised Personnel Acting in the Capacity of Officers & Officials and Fire-Fighters Affiliated with the Ministry of Interior (Official Gazette No 8/93 & 88/94), occupational health surveillance of these professional categories includes psychological workup aiming at the adjudication of overall intellectual capacities and special skills (mechanical, spatial & perception factor, oculomotor coordination). Nevertheless, in line with the holistic approach to the assessment of mental disorders (Jakovljević 2008), we had decided on an integrative assessment of psychosomatic profile of the professional fire-fighting population under this study. To that goal, several tools already implemented and adopted for use in other professional and general population groups had been employed.

The prevalence of depressive disorders seen in primary healthcare settings has long been estimated at 13-22%, but only some 50% of such cases get to be recognised (Coyne et al. 1994). The use of patient-administered screening tools enabling a quick and reliable first-step depression assessment and/or treatment response monitoring, is ever more increasing (Steer et al. 1999, Williams et al. 2002, Wancata & Friedrich 2011). One of the tools most frequently employed to the above goal is BDI. Yin and Fan (2000) performed a meta-analysis of reliability estimates for BDI scores obtained across studies. Only 7.5% of the reviewed studies (n=1,200) reported meaningful reliability estimates. The outcome of this meta-analysis suggests that not only reliability estimates, but also standard errors of measurement should be considered when interpreting individual BDI scores.

A 2002 review of the referent literature sources (Williams et al. 2002) found the median sensitivity of 16 instruments including BDI, CES-D (Centre for Epidemiological Studies Depression Scale), SDS (Zung Self-Rating Depression Scale) and GDS (Geriatric Depression Scale) to be 85%, ranging from 50-97%, with the median specificity of 74%, ranging from 51-98%. Moreover, recent studies conducted on Croatian samples have indicated high screening accuracy in

primary care setting (Jakšić et al. 2013) and utility in the assessment of pre- and postpartum depression (Čuržik & Jokić Begić 2012) for the BDI-II (a newer, and very similar, version of the original BDI). Therefore, given its satisfactory profile, we decided to use the BDI within the frame of our study on professional fire-fighting population. Our results showed this population to be free from any major depression symptoms, so that, when it comes to depression, this occupation should not be perceived as risky. Namely, the occurrence of depression as one of the most represented mental disorders across the modern society, seen in our professional fire-fighting population, proved itself significantly lower than in the general population.

DSQ was first introduced by Bond and co-workers (Bond et al. 1983) as a self-appraisal measure of conscious derivatives of defence mechanisms defined as automatic psychological processes that protect an individual against anxiety arising from the awareness of internal or external dangers or stressors. DSQ originally consists of 88 items on a 9-point scale comprising 24 defence mechanisms. Factor analyses performed in the process of creating the instrument showed that defences tend to cluster into styles and can be categorised as maladaptive (immature defences such as passive aggression, regression, acting out), image-distorting (primitive idealization, splitting, denial, omnipotence, devaluation), self-sacrificing (pseudo-altruism, reaction formation) and adaptive (sublimation, humour). Within the frame of the survey conducted in 1995 on 270 healthy university students and published three years later (Nishimura 1998), 3 factors - immature defences, neurotic defences, and mature defences - were extracted from the DSQ through factor analysis. Immature defence mechanisms were featured by Cronbach alpha of 0.71 ( $M=3.48$ ;  $SD=0.85$ ), neurotic defences by Cronbach alpha of 0.65 ( $M=4.62$ ;  $SD=1.09$ ), and mature defences by Cronbach alpha of 0.71 ( $M=5.00$ ;  $SD=0.90$ ), leading the author to raise a slight suspicion on DSQ-scores reliability. As for immature defence mechanisms, test/re-test reliability examination yielded Cronbach alpha coefficient of 0.70, which pointed toward a slight uncertainty regarding stability. However, with neurotic and mature defences stability was definitely acceptable (Cronbach alpha 0.85 and 0.83, respectively). In the study conducted in 2006 (Ruutu et al. 2006), psychometric DSQ-40 properties (internal consistency, factor structure, and discriminative and concurrent validity) were studied in 211 adolescent psychiatric outpatients aged 13 to 19 years and 199 age- and sex-matched controls. Principal components' analysis yielded four internally consistent components: mature, neurotic, image-distorting, and immature defence styles. The outpatients were more prone to exercise immature, image-distorting, and neurotic styles and less prone to resort to the mature defence style as compared to the controls, suggesting an adequate discriminative validity of the tool. As a demonstration of convergent and concurrent validity, the severity of psychiatric

symptoms assessed by the General Health Questionnaire and psychosocial adjustment assessed by the Global Assessment of Functioning Scale meaningfully correlated with different defence styles, leading the authors to conclude that DSQ-40 is a reliable and valid instrument when it comes to adolescents.

Validation of DSQ-40 in Croatian population (Vulić-Prtorić 2008) came up with fairly low reliability coefficients (Cronbach alpha of 0.52 for mature defence mechanisms, 0.50 for neurotic defence mechanisms and 0.71 for immature defence mechanisms). In the author's opinion, DSQ item clustering could be better explained by virtue of two-factor (mature and immature defence styles) than three-factor (mature, neurotic & immature defence mechanisms) analysis.

Given the highest Cronbach alpha obtained with the instrument on the whole, our results suggest that, when it comes to professional fire-fighting population, one should probably stick to a three-factor approach.

What authors of this article believe to be the strongest study suit is the fact that, to the best of our knowledge, the relationship between the states of depression and/or anxiety and WAI mental job demands' ranking had been established on a representative Croatian workforce sample for the first time ever.

In recent decades, WAI has been a common practical tool to measure individual work capacity in many European, Asian and South American countries. Just as a showcase, a multiple regression analysis done within the frame of a recent cross-sectional study conducted among 420 male workers of various occupational backgrounds (Mazloumi et al. 2012) revealed a significant association between mean WAI score and age, job tenure, educational level, rest and sleep status and vocational education. The level of one's skills & competencies and co-workers' & supervisors' support were positively associated with the mean WAI score, while job demands & strains and job insecurity showed an inverse association with the latter.

Within the frame of our study, self-assessed current working capacity as compared against the working capacity at one's prime was revealed to be strongly dependent on the total years of service with the dropping trend as the years of fire-fighting service go by. Neurotic defence mechanisms positively correlated with the respondents' age and total years of service, showing the rise in representation of such mechanisms with aging and longer service. Immature defence mechanisms strongly positively correlated with the total years of fire-fighting service, showing an increasing representation with longer service. Virtually the same goes for the integral DSQ-40 as well.

Given the importance of inter-subjectivity (Marčinko 2011), i.e. the relation between an individual and his/her living and working environment (family members, the attending physician, co-workers) which we did not assess at this study point, a comprehensive explanation of age- and duration of service-related immature and

neurotic defence mechanisms seen across our study sample is still lacking. Given that defence mechanisms are strongly influenced by a personal structure, living & working environment and actual stressors (Jakovljević et al. 2010), further investigation on an even larger sample that should take more personal factors and mental symptoms-related stigma into account, should be launched to better understand the immature defence mechanisms to which the professional fire-fighting population seemingly tends to resort “at the end of the day”. At this point, our lack of input in this regard is perceived by the authors as a limitation to the study.

## CONCLUSIONS

Our initial testing of the psychological assessment tools employed within the frame of this study showed the instruments to be appropriate for use as an integral part of health surveillance of Croatian professional fire-fighting population. Nevertheless, further research should be done to better understand and elaborate the interrelations disclosed by this pioneer research, but the promising results encourage us to continue pursuing this path both in our research and in our everyday medical practice.

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**Conflict of interest:** None to declare.

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*Correspondence:*

Zlatko Ulovec, MD, PhD  
Department of Social Medicine and Epidemiology  
School of Dental Medicine University of Zagreb  
Gundulićeva 5, 10000 Zagreb, Croatia  
E-mail: zlatko.ulovec@sfzg.hr