

# **THE COMPLEXITY OF BURNOUT**

Doctoral (Ph.D.) thesis

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## **Table of contents**

1. List of abbreviations	3.
2. Introduction	4.
2.1. Burnout	4.
2.2. Neuropathic pain	6.
3. Objectives	8.
4. Burnout among social workers	9.
4.1. Introduction	9.
4.2. Methods	9.
4.3. Results	11.
4.4. Discussion	16.
5. Association of burnout and neuropathic low back pain	19.
5.1. Introduction	19.
5.2. Methods	19.
5.3. Results	21.
5.4. Discussion	26.
6. Summary of new results	29.
7. Publications related to the thesis	30.
8. References	31.

## **1. LIST OF ABBREVIATIONS**

ANOVA:	Analysis of Variance
BDI:	Beck Depression Inventory
COPSOQ:	Copenhagen Psychosocial Questionnaire
DAS:	Dysfunctional Attitudes Scale
ISZB:	Ischemic Heart Disease
MBI:	Maslach Burnout Inventroy
SDS:	Support Dimension Scale
PD-Q:	PainDETECT Questionnaire

## **2. INTRODUCTION**

### **2.1 Burnout**

Burnout is a common phenomenon among workers in the modern age, which mainly affects those employed in the helping / service - paradoxically, perhaps most the healthcare workers- profession (1-3).

Due to its frequency, it is also called the epidemic of our time (in addition to diabetes) Overload / performance constraints (either due to internal motivation or external factors - labor shortages), increased stress, work dependence and work mania are the most important factors in the development of the syndrome, especially in cases where the work is aimed at people for a long time, requires long-term concentration and emotional involvement, active intervention, while spectacular results and positive feedback is relatively rare (4-6).

In research on burnout, negative cognition has been a major part of explaining underlying mechanisms in development and manifestation. Therefore, the concepts of dysfunctional attitudes and attribution have been of particular interest in the development of burnout. Negative distortions can be characterized, for example by arbitrary conclusions, selective abstraction, overgeneralization and over- or understatements. Distortions may be due to negative schemas or dysfunctional assumptions. Research showed that specific attitudes and beliefs (such as distorted or negative thinking, overgeneralized assumptions, or selective information processing) are apparent in depressed patients, thus concluding that such dysfunctional attitudes illustrate a vulnerability for burnout (7).

Furthermore, an imbalance of high professional effort (requirements, obligations) and low reward (money, esteem, career opportunities, and job security) is considered to be a non-specific factor for an increased, stress-associated risk of illness, especially for the development of depression and burnout (8).

Social support commonly refers to the various forms of support and assistance provided by the individual's social network system, such as care, attention, or respect from other members in the social network, which directly affect the individual's health. The stress model believes that any factors related to increased stress levels may cause mental burnout (9).

There is disagreement among researchers who study burnout as to whether there is an overlap between burnout and depression as people who suffer from burnout look and act as if they were depressed. Indeed, we cannot overlook the fact that some of the burnout symptoms

appear to resemble the ones of depression; as it is characterized by anhedonia, i.e., the loss of interest or pleasure, depressed mood, fatigue or loss of energy, impaired concentration, and feelings of worthlessness, decreased or increased appetite, sleep problems (hypersomnia or insomnia) and suicidal ideation (10).

Burnout is a common phenomenon among workers in the modern age, which mainly affects those employed in the helping / service - paradoxically, perhaps most the healthcare workers- profession. Current studies are usually focusing on those working in healthcare, but burnout can occur in all types of workers. Although it is categorized as an occupational phenomenon and not as a medical condition, it seems to be strongly associated with diabetes, cardiovascular disorders, chronic musculoskeletal pain, headaches, changes in pain experiences, gastrointestinal issues, respiratory problems, severe injuries and youth deterioration of health (below the age of 45 years) as well as with psychiatric complications such as insomnia, depressive symptoms and mental disorders based on a recent systematic review (11-13). The burnout syndrome maybe associated with not only the physical (for example cardiovascular, musculoskeletal disease, diabetes, etc), but also psychical (including anxiety, depression, etc) diseases and neuropathic pain (14).

## **2.2. Neuropathic pain**

Neuropathic pain, defined as pain caused by a lesion or disease of the somatosensory nervous system, can be induced by factors such as infection, nerve injury, chemotherapy, and diabetes. Pain symptoms are characterized by spontaneous pain, mechanical or thermal allodynia, and hyperalgesia to stimuli (15).

The key pathophysiological process behind each of these syndromes is central sensitization (16). Imaging studies have confirmed altered activity of afferent and descending pain pathways, as well as atrophy of different pain perception regions of the brain, which can result in psychiatric symptoms such as increased activation in areas involved in somatosensory-discriminative, affective, and cognitive processing of pain-primary/secondary somatosensory cortex, anterior and posterior cingulate, insula, prefrontal cortices and thalamus also known as “pain matrix” (17). One key brain area involved in the pain (neuro) matrix is the amygdala, often referred to as the fear-memory centre of the brain, which has an important role in the process of negative emotions (in parallel with the anterior cingulate cortex so called the fear network of the brain) (18,19).

These significant activation changes can powerfully modulate spinal cord synaptic transmission leading to increased excitability of dorsal horn neurons, that is, central sensitization, partly via suppressing inhibitory synaptic transmission (19). Further potent inhibitory neurons, such as descending pathways originating in the brainstem, contribute to modulation of pain processing. Lesions that affect opiodergic and monoaminergic systems lead to exacerbation of the pain disinhibition (15-19).

Chronic pain is a devastating disease and has recently been highlighted as one of the most prominent causes of disability worldwide. For example, lower back and neck pain were the leading global cause of disability in 2015 in most countries (19,20). Chronic pain is usually defined as any pain lasting more than three months (apart from its origin) and affects about one-fifth of the total population. One out of ten people suffer from chronic widespread pain, especially in the elderly (21,22). Although the clinical phenotypes of different pain syndromes are variable, they are linked through neuropsychiatric complications that include mood disorders, persistent fatigue, cognitive dysfunction, headache, irritable bowel syndrome, and insomnia (23,24).

Chronic pain often has neuropathic components. In addition to diabetic neuropathy and several common neuropathic pain syndromes, there is limited evidence regarding the treatment of chronic pain; therapeutic strategies are mainly based on the most likely mechanism(s) of pain, instead on therapies based focusing on the cause of pain. This paradigm however may be difficult to implement in clinical practice . Furthermore, based on recent functional brain imaging, chronic pain and burnout share similarities in the activation of brain areas raising the possibility of common roots (25-27).

### **3. OBJECTIVES**

My PhD thesis can be divided into two main parts. The first part contains the data of a cross-sectionnel study focusing on the complexity of burnout among social workers, the second part contains another cross-sectional study examining the possible association of burnot and neuropathic pain.

#### **3.1. Burnout among social workers.**

We were taking the above mentioned parameters into account:

- a.) prevalance and severity of burnout
- b.) demographical determinants of burnout
- c.) the effect of type of work and working conditions on burnout
- d.) associations among burnout, depression, dysfunctional attitudes, effort- reward – imbalance, social support and burnout,
- e.) independent risk factors of burnout in a multivariate analysis

#### **3.2. Association of burnout and neuropathic low back pain**

We were taking the above mentioned parameters into account:

- f.) prevalance of low back pain (including neuropathic low back pain)
- g.) demographical determinants of neuropathic low back pain
- h.) the effect of type of work and working conditions on neuropathic low back pain
- i.) associations among burnout, depression, dysfunctional attitudes, effort- reward – imbalance, social support and neuropathic low back pain,
- j.) independent risk factors of neuropathic low back pain in a multivariate analysis

## **4. BURNOUT AMONG SOCIAL WORKERS**

### **4.1. Introduction**

Social workers have previously been identified as being at risk of experiencing stress and burnout as their work is strongly client-based, with workers being involved in complex social situations. As such they can experience many of the conflicts that are evident in human service work, in addition, the last decade has seen a transformation in the nature and practice of social work, as a result of administrative, societal, and political change (28). Issues related to workload, control, values, fairness, reward, and community directly impact the workers ability and desire to maintain passion. When this happens, the worker, organization, and client suffer (29).

The burnout poses a challenge to healthcare workers in the 21th century, exacerbated by increased mental and physical strain, job performance, the weight of decisions make during daily work and the high number of working hours. Maintaining the health of the healthcare worker plays a key role, as the overwork of overburdened staff reduces their work capacity and ability to perform, as a result, the quality of the healthcare they provide also decreases.

The aim of our study to carry out a cross-sectional study focusing on the complexity of burnout among social workers as we have to face the lack of studies in Hungary.

### **4.2. Methods**

This questionnaire based cross- sectional study was carried out between 01 April 2018 and March 2019 in Hungary among social workers in a legal relationship in Agota Social Foundation (main center in Kecskemét, Hungary). The study was approved by the Ethical Committee of the University of Pecs (reference number: PTE/96773-2/2018).

The sampling was simple, not random sampling. Inclusion criteria were working with human services being employed at the time of the study apart from the type of employment

(public servant, sub-contractor etc). Employees who were permanently absent at the time of the investigation were not included.

A total of 473 questionnaires were distributed and 441 fully completed questionnaires were returned by the end of the investigation period. Incomplete questionnaires were not taken into account, so when examining each factor, the total number of sample items may not have included the questionnaires containing the incomplete data.

Demographic criteria included age, gender, marital status, number of children, education, type of work, years spent with work, work schedule, legal relation, secondary employment.

Burnout was measured with the widely used Maslach Burnout Inventory (MBI), which is an introspective psychological (easy to fill) inventory consisting of 22 items pertaining to three dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment. The Maslach Burnout Inventory focuses on defining burnout syndrome in a workplace context (30,31). Responses were rated on a 7-point (0-6) Likert Scale by respondents. The total score of burnout can be determined by summing the degree of burnout, and the total score of each burnout dimension can be determined by summing the burnout dimensions: low (between 0–33%, 0-44 total score), moderate (between 34–66%, 45-88 total score) and severe (between 67–100%, 89-132 total score) burnout (30-31).

The abbreviated Dysfunctional Attitude Scale (DAS-SF1) is a validated version of the 17-item scale developed by Weismann et al. Total 9 items measure how characteristic the given phenomenon is for the respondent, between the total agree and total disagree extremes. It is designed to identify and measure approval, need for love, performance, perfectionism, the need for omnipotence, external control, and legitimacy (32,33).

Severity of depression was measured by the Beck Depression Inventory (BDI) which is a 9-question inventory. It is composed of following symptoms: withdrawal, indecision, sleep disturbance, fatigue, excessive anxiety about physical symptoms, incapacity of work, pessimism, dissatisfaction, lack of joy, self-blame. Each item is rated from 1 to 4, can be separated when evaluating the scale severe / moderate / mild depression and normal (34,35).

The Effort-Reward-Imbalance Questionnaire the work-related stress questionnaire developed by Siegrist et al. consists of three main dimensions of work-related effort, rewards, and overcommitment (36,37). 15 questions analyze how typical the statements are for respondents on a four- and five-point Likert Scale, respectively. An important factor in the

development and severity of burnout is whether the work effort made by the given employee and the reward, remuneration and recognition received for it are in line with each other's judgment. If an employee perceives a discrepancy between the quantity and quality of the work the human performs and the financial and moral recognition the worker has received for it, it can lead to stress at work.

Social support is a positive benefit for the individual in the form of emotional reinforcement and help, so having a negative effect on stressors. Social support is closely related to burnout and helps to overcome the symptoms of burnout syndrome. Hungarian adaptation of of Caldwell et al.'s Support Dimension Scale (SDS) [50], the Copenhagen Psychosocial Questionnaire (COPSOQ II) examines workplace psychosocial risk factors along 28 scales and 7 dimensions (38,39).

Statistical analysis were performed using IBM SPSS version 25.0. Statistical analysis data were evaluated as means, frequency, standard deviation and distribution ratios. The data were analyzed using descriptive statistics, linear regression analysis, correlation, analysis of variance and factor analysis. The examinations were performed with 95%-os confidence interval,  $p < 0,05$  was considered statistically significant.

## **4.2. Results**

A total of 320 questionnaires were distributed and 300 (106 males and 194 females) fully completed questionnaires were returned by the end of the investigation period (response rate of 93.8%)

More than the half of the examined workers was between 26–45 years of age (52.2%). 35.5 % were married, 29.2 lived in a relationship and 24.1% were single. The number of childless workers was 38.6%. 22.6% had secondary employment. The vast majority (44.2%) of our study population has been working for 6-20 years (Table 1).

A total of 35.1% (38/300) suffered from mild, 60.6% (152/300) from moderate and 4.3% (13/300) from severe burnout based on the Maslach Burnout Inventory. Mean value of burnout was  $53.9 \pm 18.7$ ) overall, taking the subcategories into account: emotional exhaustion  $25.91 \pm 9.4$  points, depersonalization  $19.67 \pm 6.7$  points, personal accomplishment  $9.37 \pm 5.1$  points. Mild emotional exhaustion occurred in 52.9% as moderate, in 43.5% as severe, and in

3.6% of all workers. The rate of mild, moderate and severe depersonalization was 32.2%, 58.8% and 9%, respectively. A total of 34.3% suffered from mild, 56.3% from moderate and 3.4% from severe personal accomplishment (Table 2).

<b>Gender</b>	%
Female	64.7
Male	35.3
<b>Age</b>	
18-25 years	15.6
26-35 years	26.4
36-45 years	25.8
46-55 years	18.1
56-62 years	8.7
above 62 years	5.4
<b>Marital status</b>	
single	24.1
relationship	29.2
married	35.5
divorced/widow	11.2
<b>Number of children</b>	
have no child	38.6
1 child	29.9
2 children	21.4
3 or more children	10.1
<b>Years spent with work</b>	
1-12 months	11.3
1-5 years	22.0
6-10 years	21.7
11-20 years	24.3
21-30 years	12.7
31-40 years	6.1
above 40 years	1.9
<b>Secondary employment</b>	
no	77.4
yes	22.6

Table 1. Baseline characteristics of the study population.

%	Burnout		
	Low	Moderate	High
<b>Gender</b>			
Female	33.6	61.2	5.2
Male	36.7	60.0	3.3
<b>Age</b>			
18-25 years	31.7	61.0	7.3
26-35 years	32.8	64.1	3.1
36-45 years	47.7	49.2	3.1
46-55 years	29.8	66.0	4.2
56-62 years	30.0	65.0	5.0
above 62 years	26.7	66.7	6.6
<b>Marital status</b>			
single	39.3	55.7	4.9
relationship	41.8	56.7	1.5
married	28.3	65.2	6.5
divorced	37.9	58.6	3.4
<b>Number of children</b>			
have no child	44.2	51.6	4.2
1 child	32.9	65.7	1.4
2 children	19.0	72.4	8.6
3 or more children	38.5	57.7	3.8
<b>Years spent with work</b>			
1-12 months	22.6	71.0	6.5
1-5 years	33.9	60.7	5.4
6-10 years	35.8	58.5	5.7
11-20 years	47.5	52.5	0.0
21-30 years	25.0	68.8	6.3
31-40 years	28.6	64.3	7.1
above 40 years	40.0	60.0	0.0
<b>Secondary employment</b>			
no	38.4	58.6	3.0
yes	22.2	68.5	9.3

Table 2. Association of burnout and demographic data.

Young people (under 25) and those over 62 are most affected by severe burnout (2% points higher than average, 7.3% of new entrants and 6.6% of those in retirement,  $p < 0.05$ ). We have not experienced severe burnout among those working for 11-20 years, as well as

working for more than 40 years, (ie. at the beginning there is a higher and then decreasing trend of burnout, and we can also observe higher values before retirement) (Table 2).

Analyzing the demographic data of burnout, it can be concluded that medium and high rates of emotional exhaustion are significantly more common among those having at least 2 children (1.7 times higher than the mean ( $p = 0.009$ )) and among newcomers (69.7% vs. 52.0%,  $p = 0.011$ ) Age also has an effect on emotional exhaustion: under 25 years (10.9% vs. 3.6%  $p = 0.019$ ) and those above 62 have significantly higher rates of severe burnout (5.9% vs. 3.6%,  $p = 0.013$ ) (Table 2).

Medium and high rates of depersonalization were more common among women (76.3% vs. 55.7%,  $p = 0.006$ ). A risk factor in this dimension was having many children (3 or more) (14.3% vs. 9.6% with those with fewer children,  $p = 0.046$ ) (Table 2).

Medium and high rates of personal accomplishment affect 18-35 year olds to a greater extent (70.9% vs 54.2% in the 36-55 age group,  $p = 0.035$ ). Almost twice as many (12.5%) of pre-retirement workers have high burnout in this dimension compared to those aged 36-55 (5.7%) (Table 2).

*Burnout and depression, dysfunctional attitudes:* 13.0% of respondents have no, 48.3% have mild, 29.0% have moderate depression, and 9.7% have severe mood disorders. A significant risk factor for depression is the number of years spent in the field, on average 80.0% of those working in the social sector for more than 40 years belong to the group of mild to moderate depression ( $p = 0.025$ ), those who have worked in the field for more than 30 years 88.8% were affected by major depression. Workers over the age of 62 were 2.6 times (38.1%) more severely affected than the average. There is a significant association between the severity of depression and burnout. While no severe burnout was observed among those with mild depression, 10.9% of those with major depression had severe burnout ( $p < 0.001$ ). 40.9% of those with mild burnout also had mild mood disorder, while 58.3% of those with severe burnout were severely depressed ( $p < 0.001$ ) (Table 3). It should be mentioned that a positive relationship between dysfunctional attitudes and burnout was confirmed (correlation coefficient  $r = 0.316$ ,  $p < 0.001$ ).

*Burnout and social support, coping strategies:* In general, 64.5% of respondents feel happy and balanced about their privacy. 74.6% of the respondents have a good social relationship with their co-workers and their workplace manager, 35.1% can count on the help of their colleagues in their daily work, and 22.5% feel professional appreciation. The

proportion of participants in regular education is 47.2%. 32.2% of those who completed the questionnaire feel secure about their job, and 18.2% consider their future to be hopeless.

%	Depression		
	absent/mild	moderate	severe
<b>Gender</b>			
Female	57.1	31.9	11.0
Male	68.8	23.9	7.3
<b>Age</b>			
18-25 years	27.7	42.6	29.7
26-35 years	27.3	46.7	26.0
36-45 years	33.4	58.3	8.3
46-55 years	20.8	50.9	28.3
56-62 years	28.0	52.0	20.0
above 62 years	6.2	62.8	25.0
<b>Marital status</b>			
single	30.0	44.3	25.7
relationship	30.0	52.5	17.5
married	24.0	54.8	21.2
divorced	21.9	53.1	25.0
<b>Number of children</b>			
have no child	31.9	51.3	16.8
1 child	22.6	46.4	31.0
2 children	22.2	54.0	23.8
3 or more children	27.6	58.6	13.8
<b>Years spent with work</b>			
1-12 months	11.8	32.4	55.8
1-5 years	21.3	54.5	24.2
6-10 years	34.4	50.0	15.6
11-20 years	40.3	52.2	7.5
21-30 years	21.6	54.1	24.3
31-40 years	11.8	58.8	29.4
above 40 years	0.0	80.0	20.0
<b>Secondary employment</b>			
no	27.0	52.7	20.4
yes	25.4	46.0	28.6

Table 3. Association of depression and baseline characteristics.

64.8% of social workers affected by burnout would change careers, compared to 61.4% of those not affected by burnout. Regarding remuneration, 78.6% of those who completed the questionnaire had an unfavorable opinion. There was a positive relationship between the level of burnout and professional esteem ( $p < 0.001$ ), income ( $p < 0.001$ ), and some collegial support ( $p = 0.016$ ). Performance impairment and depersonalization are most affected by the assessment of the income situation ( $p < 0.001$ ) and the degree of professional esteem ( $p < 0.001$ ).

*Multivariate analysis:* In a multivariate analysis, female gender (OR: 5,857), age (OR: 4,126), years at work (OR: 2,721), family with many children (OR: 2,861), and lack of social support (OR: 2, 81) proved to be independent risk factors for burnout ( $p < 0.05$  in all cases).

### 4.3. Discussion

Our work is the first to deal with the complex background of the burnout of social workers in Hungary. Previously, no similar article was published based on our literature research and knowledge, only a small study from Transylvania is available, but a total of 34 elderly caregivers and social workers were surveyed (40).

Based on our results, a significant proportion of the social workers included in the study struggled with burnout, as 60% suffer from moderate, while about 5% suffer from severe burnout. The rate of depersonalization is particularly high, with severe depersonalization affecting up to 10% of workers, with a clear declining commitment to carers and other people in general (40). The data described above also stand out in an international comparison, about 15% of social workers suffer predominantly mild burnout, moderate or severe burnout occurs at a much lower rate compared to the data in our sample based on publications published so far (41,42).

According to Hungarian data, about half of healthcare workers suffer from some degree of burnout, but social work-related jobs are among the first occupations at risk (43). The burnout rate of the study population is much higher comparing to previous results (11,12,40,44-46).

It should be mentioned that although the burnout rate of social workers working in child protection is higher than the average based on the available literature data, the rate of

burnout and severe depression is also outstanding in our study in an international comparison. The above-mentioned Transylvanian article also found a much lower degree of burnout, with the absence of severe burnout among the included participants (40).

Surprisingly, young people starting their careers (under 25) and those over 62 are most affected by severe burnout in our study population (2% points higher than average, 7.3% of new entrants and 6.6% of those before retirement). Burnout rates are rising among college and university students, as showed by recently published meta analysis (47). Burnout can occur not only during the years spent with work, but also at school which can have a negative effect on subsequent work.

In addition to age, marital status (3 children vs. those with less children) and females proved to be risk factors for burnout in both uni- and multivariate analysis. Starting a career and being relative inexperienced, having lack of routine, and their association with burnout have been described previously (49). Although the protective role of the family has already been demonstrated, our results suggest that those living in families with many children are still at higher risk of burnout compared to their peers (50). This may be explained by the fact that the vast majority of the study population were women, who, in addition to work, are also responsible for the majority of child-rearing, so that they can easily be emotionally exhausted (51).

Our study demonstrated a strong association between burnout and dysfunctional attitudes. The DAS measures the - not necessarily pathological - workplace attitudes in this case, which tend to make a person unhappy, cause stress that can also become crippling, and can lead to severe anxiety, thereby causing burnout. That is, there are certain patterns of behavior (perfectionism, etc.) carrying a higher risk of burnout.

It should be emphasized that only about 2/3 of the study workers feel that their private lives are balanced, which may also play a role in burnout, as the protective role of a secure family background is known (50). The vast majority of them have a good relationship at work, but only a third can count on the help of their colleagues, and they feel even less professional appreciation. The vast majority of them would be dissatisfied with their remuneration and about 2/3 of them would change careers. There was a significant correlation between the level of burnout and professional esteem, income, and workplace support. Social support (or lack thereof) proved to be an independent risk factor for burnout in a multivariate analysis. Workplace atmosphere, lack of support at work, proved to be a predictive factor of

burnout in previous studies in healthcare jobs, but its predictive role has not been previously described for social workers (47,52,53).

Although there are controversial literature data, recent studies suggest that anxiety and depression are clearly different conditions from burnout (54). Burnout leads to psychiatric complications in the long run (anxiety, sleep disturbance, depression, etc.) and is also strongly associated with adverse cardiovascular outcome (12). Prevention and treatment of depression are of paramount importance, with the World Health Organization (WHO) saying that by 2030, depression will be the leading disease due to constant performance pressure and overwork, and the resulting suicide will be one of the leading causes of death ( 55). The importance of the topic is highlighted by the high incidence of major depression in the study group.

It should be mentioned that the costs of work-related stress in Hungary are estimated at around HUF 440 billion per year, which can reach EUR 136 billion in the European Union (56).

In summary, our study was the first to attempt to explore the complex background of burnout among social workers. Based on our results, a significant proportion of social workers suffer from moderate burnout, 5% suffer from severe burnout, and a significant proportion also suffer from severe depression. Burnout has influential (workplace attitudes, social support) and uncontrollable factors (age, gender, family) that should be considered in any prevention or interventional strategies. We need to emphasize the importance of creating the right work atmosphere, which clearly has a preventive role.

It should be mentioned that our study also has limitations. First, the sample is not representative, so our conclusions do not apply to all social workers or the social sphere in general, only to the studied population. It is also not known what percentage of the surveyed social workers work in the same workplace (institution) and how this modifies the evaluation of results, which presumably influences our conclusions, given that work atmosphere and lack of workplace support are one of the most significant predictors of burnout.

## **5. ASSOCIATION OF BURNOUT AND NEUROPATHIC LOW BACK PAIN**

### **5.1. Introduction**

Chronic pain is a devastating disease, one of the leading causes of disability, which can affect 10–20% of the population. Neuropathic pain, which originates from injury or malfunction to the peripheral or central nervous system resulting in maladaptive changes in neurons along the nociceptive pathway can be detected about 30% of chronic pain patients (23).

Lower back and neck pain are the leading causes of disability in the jobholder population based on recent data (23). Lower back pain is a complex, heterogeneous condition, where both nociceptive and neuropathic pain mechanisms may be involved, and the rate of neuropathic component can as high as 55% (23).

Similar to burnout, emotional aspects also play an important role in the development of neuropathic pain. Impaired familial and social interactions have been shown to be associated with both burnout and neuropathic pain.

Despite of the possible association of chronic pain syndromes and burnout, based on our knowledge and literature search, no study focused on the association between neuropathic low back pain and burnout.

The aim of our prospective cross-sectional study was (a.) to detect the prevalence and risk factors of neuropathic pain, (b.) to examine the role of risk factors of burnout on neuropathic pain and (c.) to assess the connection between burnout and neuropathic pain among human service workers including educational, healthcare or social area.

## 5.2. Methods

This questionnaire based cross-sectional study was carried out between April 2019 and March 2020, patients were recruited from three cities (cities of Komló, Pécs and Kecskemét). The study was approved by the Ethical Committee of the University of Pécs (reference number: PTE/96773-2/2018).

Paper based questionnaires were posted to teachers in the educational region of Kecskemét, Pécs and Komló (77 schools), to the social workers of Ágota Foundation (1 major site in Kecskemét and 37 minor sites in Central Hungary) and to the healthcare workers employed in the hospitals of Komló, Kecskemét and Pécs (3 sites).

Inclusion criteria were working with human services as a healthcare worker, social worker or teacher, being between 18 and 65 years of age and being employed at the time of the study apart from the type of employment (public servant, subcontractor etc.).

Exclusion criteria were being under 18 or over 65 years of age, having disability, having severe uncontrolled disease, being on permanent leave or refusing to participate in the study.

Demographic criteria included age, gender, marital status, number of children, type of work, years spent with work, work schedule, legal relation, secondary employment.

Included diseases were diabetes, hypertension, ischemic heart disease, generalized pain (pain involving more than one area of the body) and depression.

Low back pain was assessed by the painDETECT questionnaire, which is a simple, patient-based, easy-to-use screening questionnaire developed by Freynhagen and his co-workers in cooperation with the German Research Network on Neuropathic Pain. It can determine the prevalence of neuropathic pain components both in individual low back pain patients and in heterogeneous cohorts of such patients (57). We used the following cut-off values as suggested by the authors: 0–12 neuropathic pain is unlikely, 13–18 probable neuropathic pain, 19–38 neuropathic pain is very likely.

Burnout was measured with the Maslach Burnout Inventory (MBI), which is an introspective psychological inventory consisting of 22 items pertaining to three dimensions of

burnout: emotional exhaustion, depersonalization, and personal accomplishment. Details can be seen under Chapter 4.2.

Depression was measured by the Beck Depression Inventory which is a 21-question multiple-choice self-report inventory, one of the most widely used psychometric tests for measuring the severity of depression. Details can be seen under Chapter 4.2.

The Dysfunctional Attitude Scale (DAS) is a 40-item instrument that is designed to identify and measure cognitive distortions, particularly distortions that may relate to or cause depression. Details can be seen under Chapter 4.2.

Statistical analysis: Data were evaluated as means  $\pm$  SD (standard deviation) the chi-square test, distribution ratios and the Pearson's Rank-Order Correlation. Data were analyzed using descriptive statistics, linear regression, correlation, multivariate analysis of variance, and factor analysis. Analysis of variance (ANOVA) was used in neuropathic low back pain analysis. Logistic regression analysis was used to determine the significance of the included parameters as independent risk factors in the development of neuropathic low back pain. For all odds ratios, an exact confidence interval (CI) of 95% was constructed in our study. Logistic regression analyses were performed using the statistical package of SPSS 11.0 (SPSS, Chicago, IL, USA).

### **5.3. Results**

Overall, 1500 questionnaires were successfully delivered and 1141 responses received (response rate of 76%). Three hundred social workers, 399 teachers, 339 paramedics, 35 doctors and 68 medical attendants have completed our survey.

643 males (56.4%) and 498 females (43.6%) participated in our study. About one third of the examined workers was between 36–45 years of age (31.5%). 764 people (67%) were married or lived in a relationship. The number of childless workers was 65 (5.7%). 150 participants (13.1%) had secondary employment. The vast majority (44.2%) of our study population has been working for 11–30 years. Baseline data can be seen in Table 4.

Two hundred seventy-eight (24.4%) participants had hypertension, and sixty-six (5.8%) were diabetic. Ischemic heart disease can be detected in 161 (14.1%) workers. Two

hundred twenty (19.3%) participants suffered from generalized pain (pain involving more than one area of the body). Thirty-nine (3.4%) persons had a history of depression (Table 5).

Low back pain occurred in 630 workers (55.2%): 264 (23.1%) had neuropathic low back pain (final score above 19 points), 366 workers (32.1%) had probable neuropathic pain (final score 13–18 points) and 511 (44.8%) workers had nociceptive low back pain (final score: 0–12 points) (Table 6).

The prevalence of significant burnout among the study population was 81.4%. The mean burnout score was 57.6 (SD = 16.2); 212 workers had mild (18.6%), 884 had moderate (77.5%) and 45 had severe (3.9%) burnout (Table 5).

(N=1141)	%
<b>Gender</b>	
Female	43.6 (498/1141)
Male	56.4 (643/1141)
<b>Age</b>	
18-25 years	8.0 (91/1141)
26-35 years	15.0 (171/1141)
36-45 years	31.5 (359/1141)
46-55 years	28.9 (330/1141)
56-62 years	12.9 (148/1141)
more than 62 years	3.7 (42/1141)
<b>Marital status</b>	
single	20.1 (230/1141)
relationship	19.2 (219/1141)
married	47.8 (545/1141)
divorced / widow	12.9 (147/1141)
<b>Number of children</b>	
have no child	5.7 (65/1141)
1 child	32.6 (372/1141)
2 children	28.5 (325/1141)
more than 3 children	33.2 (379/1141)
<b>Type of work</b>	
medical clerk	2.2 (25/1141)
assistant	10.4 (119/1141)
nurse	11.8 (135/1141)
doctor	3.1 (35/1141)
other health care worker	5.2 (60/1141)
swabber	2.7 (30/1141)
economical – technical workers	3.3 (38/1141)
social worker	26.3 (300/1141)
teacher	35.0 (399/1141)
<b>Years spent with work</b>	

1-12 months	7.1 (81/1141)
1-5 years	14.8 (169/1141)
6-10 years	14.5 (165/1141)
11-20 years	22.2 (253/1141)
21-30 years	22.0 (251/1141)
31-40 years	16.6 (190/1141)
more than 40 years	2.8 (32/1141)

Table 4. Baseline characteristics of the study population.

ANOVA analysis showed that neuropathic low back pain was associated with age over 62 ( $p = 0.035$ ), having children  $\geq 2$  ( $p = 0.005$ ), being a social worker ( $p = 0.03$ ), and having a secondary employment ( $p = 0.014$ ) (Table 6).

(N=1141)	%
<b>Comorbidity</b>	
diabetes	5.8 (66/1141)
hypertension	24.4 (278/1141)
ischemic heart disease	14.1 (161/1141)
generalized pain	19.3 (220/1141)
history depression	3.4 (39/1141)
<b>Dysfunctional attitudes</b>	
normal	28.9 (330/1141)
mild	57.7 (658/1141)
moderate	11.8 (135/1141)
severe	1.6 (18/1141)
<b>Current depression</b>	
normal	39.8 (454/1141)
mild	48.3 (551/1141)
moderate	9.2 (105/1141)
severe	2.7 (31/1141)
<b>Burnout</b>	
mild	18.6 (212/1141)

moderate	77.5 (884/1141)
severe	3.9 (45/1141)

Table 5. Comorbidity, dysfunctional attitudes, depression and burnout in the study population.

	<b>Nociceptive pain N=511</b>	<b>Unclear pain N=366</b>	<b>Neuropathic pain N=264</b>
<b>Gender</b>			
Female	43.2 (221/511)	28.9 (106/366)	64.8 (171/264)
Male	56.8 (290/511)	71.1 (260/366)	35.2 (93/264)
<b>Age</b>			
18-25 years	7.8 (40/511)	7.7 (28/366)	8.7 (23/264)
26-35 years	15.6 (80/511)	15.3 (56/366)	13.3 (35/264)
36-45 years	30.9 (158/511)	30.4 (111/366)	34.1 (90/264)
46-55 years	28.0 (143/511)	31.7 (116/366)	26.5 (70/264)
56-62 years	14.1 (72/511)	11.8 (43/366)	12.5 (33/264)
more than 62 years	3.6 (18/511)	3.1 (11/366)	<b>4.9 (13/264)*</b>
<b>Marital status</b>			
single	11.1 (115/511)	18.0 (66/366)	18.6 (49/264)
relationship	18.0 (92/511)	20.5 (75/366)	19.7 (52/264)
married	46.8 (239/511)	49.7 (182/366)	46.9 (124/264)
divorced / widow	24.1 (65/511)	11.8 (43/366)	14.8 (39/264)
<b>Number of children</b>			
have no child	11.2 (57/511)	1.9 (7/366)	0.4 (1/264)
1 child	34.1 (174/511)	35.0 (128/366)	26.8 (71/264)
2 children	27.9 (143/511)	26.0 (95/366)	<b>33.0 (87/264)*</b>
more than 3 children	26.8 (137/511)	37.1 (136/366)	<b>39.8 (105/264)*</b>
<b>Type of work</b>			
medical clerk	3.5 (18/511)	0.8 (3/366)	1.5 (4/264)
assistant	17.6 (90/511)	3.8 (14/366)	5.7 (15/264)
nurse	13.1 (67/511)	10.9 (40/366)	10.6 (28/264)
doctor	6.1 (31/511)	1.1 (4/366)	0.0 (0/264)
other health care worker	9.6 (49/511)	1.9 (7/366)	1.5 (4/264)
swabber	3.3 (17/511)	1.6 (6/366)	2.7 (7/264)
economical – technical workers	5.1 (26/511)	2.5 (9/366)	1.2 (3/264)
social worker	12.5 (64/511)	29.2 (107/366)	<b>48.8 (129/264)*</b>
pedagogue	29.2 (149/511)	48.2 (176/366)	28.0 (74/264)
<b>Years spent with work</b>			
1-12 months	9.0 (46/511)	5.7 (21/366)	5.3 (14/264)
1-5 years	15.9 (81/511)	13.9 (51/366)	14.0 (37/264)
6-10 years	15.7 (80/511)	13.4 (49/366)	13.6 (36/264)
11-20 years	18.2 (93/511)	26.8 (98/366)	23.5 (62/264)

21-30 years	22.5 (115/511)	20.2 (74/366)	23.5 (62/264)
31-40 years	16.2 (83/511)	16.7 3(61/366)	17.4 (46/264)
more than 40 years	2.5 (13/511)	3.3 (12/366)	2.7 (7/264)
<b>Secondary employment</b>			
No	87.3 (446/511)	88.8 (325/366)	83.3 (220/264)
Yes	12.7 (65/511)	11.2 (41/366)	16.7 (44/264)*

Table 6: Demographic factors associated with neuropathic low back pain, \*p<0.05

Neuropathic low back pain was also associated with hypertension (p = 0.006), diabetes (% , p < 0.001), history of depression (p = 0.014) and generalized pain (p = 0.044) based on ANOVA analysis (Table 7).

	<b>Nociceptive pain N=511</b>	<b>Unclear pain N=366</b>	<b>Neuropathic pain N=264</b>
<b>Depression</b>			
normal	40.5 (207/511)	42.3 (155/366)	34.8 (92/264)
mild	50.7 (259/511)	49.7 (182/366)	41.7 (110/264)
moderate	6.8 (35/511)	6.0 (22/366)	<b>18.2 (48/264)*</b>
severe	1.8 (10/1511)	2.0 (7/366)	<b>5.3 (14/264)*</b>
<b>Dysfunctional attitudes</b>			
normal	45.6 (235/511)	20.5 (75/366)	7.6 (20/264)
mild	45.4 (232/511)	69.1 (253/366)	65.5 (173/264)
moderate	8.0 (41/511)	9.0 (33/366)	<b>23.1 (61/264)*</b>
severe	1.0 (36/511)	0.5 (5/366)	<b>3.8 (10/264)*</b>
<b>Burnout</b>			
normal	20.2 (103/511)	21.6 (79/366)	11.4 (30/264)
moderate	78.3 (400/511)	75.5 (276/366)	78.8 (208/264)
severe	1.6 (8/511)	3.0 (11/366)	<b>9.8 (26/264)</b>
<b>Comorbidity</b>			
diabetes	34.8 (23/66)	15 (22.7/66)	<b>42.4 (28/66)*</b>
hypertension	22.7 (63/278)	25.2 (70/278)	<b>52.1 (145/278)*</b>
ischemic heart disease	34.2 (55/161)	27.4 (44/161)	38.4 (62/161)
generalized pain	31.4 (69/220)	28.6 (63/220)	<b>40.0 (88/220)*</b>
depression	28.2 (11/39)	30.8 (12/39)	<b>41.0 (16/39)*</b>

Table 7. Association of neuropathic low back pain, depression, dysfunctional attitudes, burnout and coorbidities.

Moderate and severe depression as well as dysfunctional attitudes were also associated with neuropathic low back pain ( $p < 0.05$  in all cases) (Table 7). The presence of depression and dysfunctional attitudes were also significantly associated with neuropathic low back pain ( $R = 0.38$ ,  $p = 0.004$  and  $R = 0.327$ ,  $p < 0.001$ , respectively).

Severe burnout was also significantly associated with neuropathic low back pain ( $p = 0.012$ ) (Table 7). There was a weak but significant association between the presence of any burnout and neuropathic low back pain ( $R = 0.169$ ,  $p < 0.001$ ).

In a multivariate analysis including of all factors (demographic criteria, burnout, depression, dysfunctional attitudes, comorbidity, etc.) neuropathic low back pain was associated with age  $> 62$  ( $OR = 3.981$ ,  $p = 0.01$ ), number of children  $\geq 2$  ( $OR = 2.638$ ,  $p = 0.003$ ), job type (being social worker) ( $OR = 6.654$ ,  $p < 0.001$ ), burnout ( $OR = 2.577$ ,  $p < 0.001$ ), current depression ( $OR = 2.397$ ,  $p < 0.001$ ), and suffering from generalized pain ( $OR = 4.076$ ,  $p < 0.001$ ).

## **5.4. Discussion**

This is the first study showing the association of burnout and neuropathic low back pain in a large cohort of workers.

The rate of low back pain was more than 50% in our population which is slightly above the estimated rates comparing to a previous study from Hungary (58). One in five low back pain patients suffered from neuropathic pain and the rate of mixed pain (containing both nociceptive and neuropathic components) was similar. This is in concordance with previous findings, the rate of neuropathic low back pain varied from 16% to 55% (26).

In our survey neuropathic pain was associated with age, there was a 3.98-fold increase over 62, and living in a larger family (having children  $\geq 2$ ) also has a 2.6-fold increase in developing neuropathic low back pain. Job type (being a social worker) and secondary employment were also strongly associated with this condition in a univariate analysis; being a social worker has a six-fold increase of risk alone. In a Canadian study neuropathic pain was associated with low income, unemployment, smoking, and being unmarried, which are slightly similar to our findings (59). Social workers usually have lower income compared to other participants of the study, and having secondary employment also reflects being involved

circumstances. Interestingly, age, gender, marital status, and difficult working conditions also were independent risk factors of burnout based on a recent meta-analysis (60).

We also found significant association among neuropathic low back pain, depression, diabetes and hypertension. Hypertension and cardiovascular diseases have been previously documented as being associated with neuropathic pain (59,61,62). Diabetes is the most important risk factor of developing neuropathic pain, and this type of pain is also strongly associated with mood disorders (63). However, a multivariate analysis could not confirm their role as significant contributors.

Dysfunctional attitudes are usually associated with depression; however, they are strongly related to burnout (64). Psychological, psychobehavioral and psychosocial factors also play relevant role in pain perception; therefore, dysfunctional attitudes, depression, burnout and neuropathic pain may share a common root as there is a strong association among them in our study (65).

We also found a four-fold increase in the risk of developing neuropathic low back pain among those suffering from generalized pain, which underlines the involvement of pain perception pathways.

Based on our results, neuropathic low back pain shared similar risk factors and consequences with burnout. Burnout was also a significant risk factor of neuropathic low back pain, workers suffering from burnout has an approximately 2.5-fold risk to suffer from neuropathic low back pain based on our results. The association can be bidirectional because burnout is mainly due to chronic occupational stress and work overload can result in the activation of the autonomic nervous system (ANS) and the hypothalamic-pituitary-adrenal (HPA) axis (which results in overactivation of vital functions such as blood pressure or heart rate), and this can be associated with low-grade inflammation, blood coagulation changes, depression of the immune system, sleep disorders, and adoption of poor health behaviors, such as overweight, smoking, excessive alcohol consumption and lack of physical activity. This sympathetic hyperactivity and biochemical changes may play a role in the development of neuropathic pain also (65-68).

Secondly, neuropathic pain, which is caused by a lesion or malfunction of the somatosensory system is associated with imbalances between excitatory and inhibitory somatosensory signaling, alterations in ion channels and variability of pain processing

pathways. Imaging studies have confirmed altered activity of afferent and descending pain pathways, as well as atrophy of different pain perception regions of the brain, which can result in sympathetic overload leading to cardiovascular diseases and psychiatric symptoms. It is supported by a Danish multicenter study, in which neuropathic pain was associated with depression and unfavorable cardiovascular outcome (69).

In summary, this is the first study showing the association of burnout and neuropathic low back pain, which is the most common cause of disability. Based on our results, neuropathic low back pain and burnout share similar risk factors and consequences, which raises the possibility of similar pathophysiology. We do not have a proper explanation to this phenomenon, but the activation of sympathicoadrenal system leading to catecholamine overload can probably be responsible for this association.

Finally, our article has some limitations. Although it was a prospective cross-sectional study in nature including more than 1000 workers, it was not representative of burnout and neuropathic pain neither in the general nor in the human services population. As it was a paper-based survey, physical examination was not carried out (such as screening for neuropathic pain in pending cases for example with DN4). We had no detailed medical information about the previous diseases and medication of the included workers as well as about the duration of low back pain and its treatment modalities. History of neuropathic low back pain was also not recorded. The above-mentioned limitations may influence our findings. Finally, follow-ups were not carried out.

## **6. SUMMARY OF NEW RESULTS**

Our study is the first comparing the effect different parameters on burnout among social workers in Hungary. The vast majority of them suffered from moderate and a small, but a significant proportion from severe burnout. Our work draws attention to the modifiable and unmodifiable risk factors of burnout in this population, which may help in the development of preventive strategies.

We have also conducted the first study showing the association of burnout and neuropathic low back pain, which is the most common cause of disability. Based on our results, neuropathic low back pain and burnout share similar risk factors and consequences, which raises the possibility of similar pathophysiology. We do not have a proper explanation to this phenomenon, but the activation of sympathoadrenal system leading to catecholamine overload can probably be responsible for this association.

## **7. PUBLICATIONS RELATED TO THE THESIS**

### **8.1. Thesis-related publications**

1. Mák K, Kapus K, Tóth G, Hesszenberger D, Pohl M, Pusch G, Fejes É, Fehér G, Tibold A. Neuropathic Low Back Pain and Burnout among Hungarian Workers. *International Journal of Environmental Research and Public Health*. 2021; 18(5):2693. IF: 2,849

2. Mák K, Fejes É, Pohl M, Kolonics G, Tóth G, Zádori I, Nemeskéri Z, Hesszenberger D, Feher G, Tibold A. A kiégés előfordulása szociális munkások körében. *Orv Hetil*. 2020; 161(44): 1894–1900. IF:: 0,497

3. Mák K, Fehér G, Gombos K, Pusch G, Koltai K, Bank G, Kósa G, Varjasi G, Tibold A. A munkaképesség elbírásának lehetőségei: irodalmi áttekintés. *LAM* 2019;29(8–9):381–388.

### **8.2. Other publications**

1. Fehér G, Nemeskéri Z, Pusch G, Zádori I, Bank G, Gurdán Z, Mészáros J, Mák K, Tibold A, Komoly S. Krónikus orofacialis fájdalmak. *Orv Hetil*. 2019;160(27):1047-1056. IF: 0,497

2. Feher G, Pohl M, Bank G, Mak K, Tibold A, Pusch G. Management of chronic pain: Still a challenge for clinicians (editorial). *Ed J Neurol*. 2019;6:100013N06GF2019.

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