ORIGINAL RESEARCH

A Cross-Sectional Study of Musculoskeletal Discomfort and Burnout Syndrome in Physicians and Nurses at a University Hospital in Turkey

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Abstract

Background

Musculoskeletal discomfort (MSD) and burnout syndrome (BS) represent frequently occurring issues among physicians and nurses. Psychosocial conditions having a critical role in BS may be a factor in MSD.

Objective

This study aimed to evaluate MSDs and BS, socio-demographics (gender, marital status, education, profession, sleep), work-related characteristics (working year, resting period, working hours, number of shifts) associated with MSDs/BS, and the relationship between MSDs and BS in physicians and nurses.

Methods

The study was cross-sectional and was conducted on 217 physicians and nurses at Trakya University Health Centre for Medical Research and Practice (Hospital) from December 2019 to February 2020 using a pre-designed questionnaire for demographics, Copenhagen Burnout Inventory and Cornell Musculoskeletal Discomfort Questionnaire. SPSS v.24.0 software and statistical techniques were used to analyse the data.

Results

59% of the participants were physically strained and the average score for BS was 50.33. An association was found between MSDs/BS, and demographic/work-related characteristics (gender, marital status, education, profession, sleep, working year, resting period, working hour, number of shifts). The most common MSDs was in the upper and lower back, left/right lower leg, and left/right leg. The Pearson correlation test showed a statistically significant relationship between MSDs (neck, left/right shoulder, upper back, left upper arm, lower back, left/right forearm, right wrist, left/right lower leg, left/right foot) and BS.

Conclusion

This study concludes that the existence of MSD and BS and the significant association of different demographics with MSD/BS among physicians and nurses needs to be adequately addressed. The interaction of MSD with BS suggests the need for more interdisciplinary research. Protective measures should focus on the most exposed parts of the body.

Keywords: Occupational health and safety, musculoskeletal discomfort, burnout syndrome, physicians and nurses

Introduction

Healthcare services are workspaces that can reveal numerous risks to the health and safety of workers[1]. Patient perceptions and expectations about staff quality and service increase physical and psychosocial challenges for physicians and nurses. Musculoskeletal discomfort accounts for about half of all occupational health problems and usually includes physical pain and damage to tendons, muscles, nerves, tendonitis and the carpal tunnel[2]. The risk factors for musculoskeletal disorders are associated with physical and psychosocial characteristics described as ergonomic risk factors in terms of patient handling for nurses and awkward postures for nurses and doctors. Ergonomic risk factors may cause physical and psychological adverse effects[2,3]. Therefore, musculoskeletal and psychological disorders may co-exist. Employees of hospitals and health care institutions are exposed to many risks of musculoskeletal discomfort (MSD)[3]. The hospital environment is a work environment that includes many ergonomic exposures and risks of MSDs[4]. Some studies on hospital staff have revealed that decreased control and overburden and high physical and emotional demands are associated with an increase in MSDs due to physical, back, and neck pain[5,6,7]. However, psychosocial risks are one of the occupational risks faced by most workers in the last three decades[8,9,10,11]. In the healthcare environment, intense workload, stress, the need to provide emotional support, care for severely and terminally ill patients, disruption of sleep patterns, and a high number of working shifts (continuous night) are significant stressors for healthcare professionals[12]. MSDs are caused by physical, personal and psychological factors[13]. Because of physical and psychological work demands in the healthcare environment, we hypothesized that MSDs could be found primarily in areas of the body related to the back and lower limbs of physicians and nurses. There is growing evidence of a significant relationship between MSDs and stress, related to both directions[13,14].

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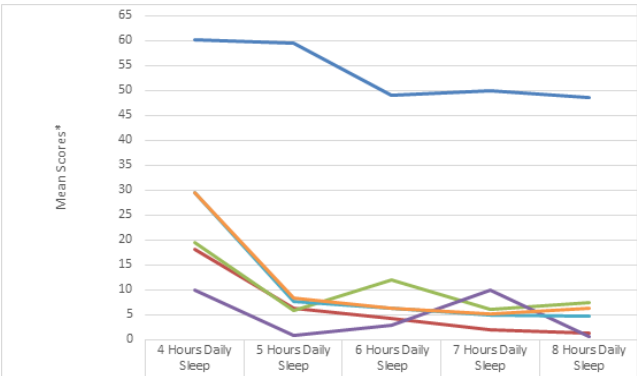

	4 Hours Daily Sleep	5 Hours Daily Sleep	6 Hours Daily Sleep	7 Hours Daily Sleep	8 Hours Daily Sleep
Burnout (WRB)	60.16	59.52	49.03	49.95	48.53
Neck	18.15	6.38	4.35	2.01	1.29
Lower Back	19.54	5.79	11.97	6.04	7.35
Left Upper Leg	10	0.85	2.81	9.92	0.59
Left Foot	29.38	7.67	6.21	4.99	4.71
Right Foot	29.38	8.38	6.32	5.08	6.35

Figure 1. Comparison of sleeping hours with Musculoskeletal discomfort and Burnout

Table 1. Identifying characteristics (demographics, work-related characteristics)

Demograpich and work-related variables		n	%
Gender	Male	84	38.7
	Female	133	61.3
Marital Status	Married	138	63.6
	Single	79	36.4
Level of Education	Highschool	10	4.6
	Associate Degree	21	9.7
	Bachelor Degree	117	53.9
	Master Degree	61	28.1
	Doctorate	8	3.7
Profession	Physician	78	35.9
	Nurse	139	64.1
Working Years of Profession	1-4	83	38.2
	5-9	64	29.5
	10-14	38	17.5
	15-19	22	10.1
	20 and above	10	4.6
Working Hours per Week	0-40	73	33.6
	41-50	92	42.4
	51-60	25	11.5
	60 and above	27	12.4
Rest Periods at Work (minute-daily)	0	39	18.0
	0-20	47	21.7
	20-40	72	33.2
	40-60	27	12.4
	60 and above	32	14.7
Number of Shifts (continious night) per Month	1-2	29	13.4
	3-4	44	20.3
	5-6	45	20.7
	7-8	51	23.5
	8 above	48	22.1
Hours of Sleep per Day	4	13	6.0
	5	39	18.0
	6	81	37.3
	7	67	30.9
	8 and above	17	7.8
Physical strain in performing profession	Yes	128	59.0
	May be	49	22.6
	No	40	18.4
Physical pain and fatigue/exhaustion effects on service and care quality	Yes	136	62.7
	May be	42	19.4
	No	39	18.0
Restore to individual comfort measures (such as orthopaedic slippers/sport shoes, back supports etc.)	Yes	175	80.6
	No	42	19.4
Physical complaints are of professional origin	Yes	119	54.8
	No	98	45.2

During the COVID-19 pandemic, HCWs faced anxiety, fear, depression, burnout and PTSD (post-traumatic stress disorder). This is relevant for the high turnover intention among HCWs and overburdened healthcare systems[15,16]. Psychosocial factors are extremely important and, in fact, they can have consequences like burnout syndrome, which is prevalent among health care professionals, especially physicians and nurses[13,17,18].

Burnout syndrome is characterized by high emotional exhaustion and depersonalization and low personal accomplishment[19]. The burnout syndrome has a profound impact on mental health outcomes[20]. Therefore, an understanding of burnout and the implementation of corresponding measures are of great importance to maintain the health of physicians and nurses[21].

This study was based on the fact that physicians and nurses live in difficult conditions in the hospital work environment and react with psychological and physical consequences

Table 2. Descriptive statistics of Musculoskeletal discomfort and Burnout

Musculoskeletal discomfort	Mean	SD.	Min.	Max.
Neck	4.58	8.870	0.0	60.0
Shoulder (right)	4.60	9.484	0.0	60.0
Shoulder (left)	2.37	6.952	0.0	60.0
Upper Back	9.19	16.938	0.0	90.0
Upper Arm (right)	1.29	6.867	0.0	90.0
Upper Arm (left)	0.73	3.471	0.0	40.0
Lower Back	9.11	17.561	0.0	90.0
Forearm (right)	0.63	1.682	0.0	7.0
Forearm (left)	0.41	1.672	0.0	20.0
Wrist (right)	2.31	6.463	0.0	40.0
Wrist (left)	1.14	4.744	0.0	40.0
Hip	3.20	12.749	0.0	90.0
Upper Leg (right)	3.41	11.108	0.0	90.0
Upper Leg (left)	4.91	17.048	0.0	90.0
Knee (right)	3.75	10.259	0.0	90.0
Knee (left)	5.19	15.902	0.0	90.0
Lower Leg (right)	8.63	21.138	0.0	90.0
Lower Leg (left)	8.30	21.181	0.0	90.0
Foot (right)	7.69	14.804	0.0	90.0
Foot (left)	7.37	14.793	0.0	90.0
Burnout	50.33	18.184	14.5	96.1
Personal Related Burnout	49.71	21.333	4.2	100.0
Work Related Burnout	51.83	18.065	10.7	89.3
Client Related Burnout	49.21	20.568	8.3	100.0

Table 3. Comparison of identifying characteristics with MSD and BS

Variables	Gender and Marital status & MSD/BS						Education level and Profession & MSD/BS						Sleep & MSD/BS					
	Gender			Marital			Graduate			Profession			Sleeping Hours per Day					
	M.	F.	p	Mr.	Sin.	p	HS / AD	BD	MD/ DC	p	Phy.	Nr.	p	4	5	6	7	8	p
Neck	3.81	5.07	0.310	5.20	3.49	0.173	4.52	4.53	4.70	0.991	4.79	4.46	0.791	18.15	6.38	4.35	2.01	1.29	0.000*
Shoulder R.	1.25	6.71	0.000	5.75	2.59	0.005*	6.56	5.65	1.93	0.016	2.84	5.58	0.023*	6.54	5.54	5.20	4.07	0.18	0.273
Shoulder L.	0.99	3.24	0.006	2.49	2.16	0.739	3.35	2.87	1.09	0.167	0.66	3.33	0.001*	1.92	2.74	3.73	1.16	0.18	0.134
Upper Back	5.56	11.49	0.005	11.05	5.94	0.012*	13.97	9.42	6.67	0.134	9.86	8.82	0.693	17.23	9.95	8.76	9.32	2.88	0.247
Upper Arm R.	0.75	1.64	0.356	1.54	0.85	0.478	0.53	1.83	0.72	0.454	1.85	0.98	0.375	1.77	3.94	0.69	0.61	0.44	0.115
Upper Arm L.	0.46	0.91	0.356	0.75	0.70	0.923	1.48	0.61	0.60	0.431	0.62	0.80	0.710	1.77	0.50	0.97	0.48	0.35	0.689
Lower Back	5.35	11.48	0.006	9.38	8.63	0.765	17.45	8.02	7.20	0.015	8.10	9.67	0.527	19.54	5.79	11.97	6.04	7.15	0.033*
Forearm R.	0.61	0.64	0.892	0.74	0.44	0.146	1.56	0.39	0.61	0.002	0.65	0.61	0.859	0.62	0.65	0.95	0.20	0.71	0.118
Forearm L.	0.43	0.39	0.885	0.43	0.36	0.755	1.13	0.33	0.22	0.031	0.18	0.54	0.057	0.62	0.59	0.52	0.20	0.09	0.613
Wist R.	1.36	2.90	0.069	2.38	2.17	0.816	7.35	1.90	0.73	0.000	2.29	2.32	0.976	1.65	2.99	2.81	1.66	1.35	0.721
Wrist L.	0.51	1.54	0.066	1.13	1.16	0.971	2.23	1.38	0.25	0.112	0.75	1.36	0.362	1.65	0.27	1.48	1.42	0.09	0.572
Hip	1.29	4.41	0.040	3.48	2.71	0.668	2.94	2.30	4.84	0.422	1.44	4.19	0.067	8.08	1.60	3.77	3.29	0.09	0.452
Upper Leg R.	3.01	3.66	0.676	2.75	4.56	0.340	1.29	4.77	2.06	0.142	2.98	3.65	0.671	10.00	1.71	2.86	4.51	0.59	0.113
Upper Leg L.	3.21	5.98	0.201	5.18	4.43	0.755	1.06	7.21	2.73	0.088	4.67	5.04	0.878	10.00	0.85	2.81	9.92	0.59	0.020*
Knee R.	2.40	4.60	0.130	4.11	3.13	0.499	7.74	4.49	0.70	0.003	2.51	4.45	0.183	8.46	6.79	1.99	3.46	2.71	0.065
Knee L.	2.56	6.86	0.031	6.41	3.07	0.096	7.06	6.56	2.04	0.136	4.74	5.45	0.756	8.46	7.23	1.62	8.40	2.44	0.073
Lower Leg R.	6.27	10.12	0.192	7.81	10.06	0.451	7.29	10.51	6.04	0.353	5.71	10.27	0.110	13.92	8.46	6.54	11.97	1.76	0.280
Lower Leg L.	6.24	9.60	0.257	7.30	10.04	0.362	6.97	9.50	6.86	0.665	5.72	9.74	0.159	13.92	7.50	6.27	11.79	1.76	0.272
Foot R.	6.51	8.44	0.351	7.01	8.88	0.421	11.21	8.16	5.32	0.162	8.33	7.34	0.638	29.38	8.38	6.32	5.08	6.35	0.000*
Foot L.	6.35	8.01	0.420	6.53	8.83	0.321	10.98	7.62	5.32	0.202	8.28	6.86	0.499	29.38	7.67	6.21	4.99	4.71	0.000*
Burnout	52.52	48.95	0.159	47.83	54.71	0.007*	49.70	48.68	53.41	0.226	52.68	49.02	0.186	57.09	57.96	47.84	47.60	50.31	0.018*
PRB	53.17	47.53	0.057	47.10	54.27	0.023*	51.61	46.33	54.59	0.033	54.22	47.18	0.027*	58.97	60.26	47.17	44.78	50.00	0.002*
WRB	52.64	51.32	0.601	48.94	56.87	0.002*	52.88	51.86	51.29	0.921	52.84	51.26	0.564	60.16	59.52	49.03	49.95	48.53	0.010*
CRB	51.74	47.62	0.176	47.25	52.64	0.063	44.09	47.33	54.71	0.019	50.96	48.23	0.385	51.60	53.85	47.12	47.70	52.70	0.430

*L: Left. R: Right. M.:Male. F.:Female. Mr.:Married. Sg:Single. HS: High School. AD: BD:Bachelor Degree. MD:Master Degree. DC: Doctorate Degree. Proff: profession. Phy:Physician. Nr:Nurse. PRB: Personal Related Burnout. WRB:Work Related Burnout. CRB:Client Related Burnout. *:p<0.05 (significance) is highlighted. MSD: Musculoskeletal discomfort. BS: Burnout Syndrome*

such as burnout and MSDs.

These negative health outcomes may have a specific relationship with socio-demographic and work-related characteristics, which are theoretically supported by the occupational stress and health outcomes model[22,23] and the conceptual model of work-related psychological response to stressors[24].

To the best of our knowledge, there are not many studies on this topic in physicians and nurses and none, especially in

Table 4. Comparison of work-related characteristics with MSD and BS

Variables	Working Year & MSD/BS					Working Hour & MSD/BS					Rest Periods (min) & MSD/BS						Number of Shifts & MSD/BS					
	1-4	5-9	10-14	15 abv	*p*	0-40	41-50	51-60	60 abv	*p*	0	0-20	20-40	40-60	60 abv	*p*	1-2	3-4	5-6	7-8	8 abv	*p*
Neck	4.35	3.65	6.38	4.91	0.501	2.77	5.28	2.96	8.59	0.018	6.78	4.18	4.86	3.85	2.47	0.337	3.64	4.55	3.30	6.63	4.21	0.400
Shoulder R.	2.36	7.20	4.55	5.25	0.021	3.81	5.85	4.18	2.83	0.378	3.00	4.33	6.62	4.44	2.52	0.202	5.66	4.11	2.69	4.78	5.99	0.504
Shoulder L.	1.93	2.04	3.95	2.31	0.491	1.79	3.07	1.40	2.48	0.588	2.36	1.39	2.01	5.13	2.31	0.252	1.43	4.05	0.31	2.31	3.42	0.084
Upper Back	6.07	16.60	6.95	5.16	0.000	9.93	9.47	7.44	7.89	0.900	9.28	8.71	14.50	4.11	2.14	0.004	15.29	8.49	3.03	13.22	7.66	0.010
Upper Arm R.	1.04	0.48	0.83	4.13	0.084	2.43	1.05	0.26	0.00	0.304	3.31	0.45	1.26	1.26	0.19	0.299	0.79	1.70	0.68	1.10	2.00	0.877
Upper Arm L.	1.00	0.09	1.80	0.05	0.056	0.55	1.16	0.48	0.00	0.409	1.69	0.64	0.49	0.81	0.19	0.384	0.47	0.48	0.64	1.58	0.31	0.386
Lower Back	7.33	9.18	12.49	9.56	0.518	9.99	9.49	5.30	8.94	0.707	14.40	7.14	10.52	6.37	4.67	0.120	13.07	9.32	7.17	6.41	11.20	0.420
Forearm R.	0.62	0.76	0.91	0.05	0.154	0.68	0.77	0.48	0.13	0.350	0.38	0.61	0.51	0.76	0.38	0.157	1.60	0.68	0.27	0.52	0.44	0.012
Forearm L.	0.40	0.23	1.01	0.05	0.066	0.20	0.72	0.18	0.13	0.138	0.90	0.26	0.28	0.38	0.38	0.383	0.40	0.27	0.24	0.79	0.28	0.449
Wist R.	2.34	3.37	1.79	0.72	0.274	3.12	2.43	1.14	0.74	0.309	4.47	1.33	1.90	4.24	0.38	0.025	2.62	0.97	2.46	1.95	3.58	0.407
Wrist L.	1.42	0.36	2.25	0.67	0.220	1.16	1.40	0.60	0.74	0.855	2.04	0.49	1.15	2.02	0.23	0.555	0.16	0.69	0.41	1.93	1.05	0.523
Hip	1.73	1.45	7.26	5.67	0.060	2.25	4.74	2.16	1.46	0.493	5.96	3.29	3.89	0.35	0.56	0.314	0.43	5.59	4.90	0.64	3.81	0.208
Upper Leg R.	3.86	1.49	4.21	5.14	0.391	3.82	3.81	4.14	0.26	0.478	3.73	1.87	5.05	4.85	0.38	0.255	2.81	2.59	4.03	4.86	2.40	0.787
Upper Leg L.	3.77	7.56	3.50	4.20	0.529	2.86	8.19	3.84	0.26	0.086	3.91	1.72	9.57	4.85	0.38	0.050	1.12	2.54	4.11	12.21	2.32	0.011
Knee R.	3.40	4.20	5.17	2.06	0.615	3.55	4.84	4.40	0.00	0.202	6.77	1.80	5.22	2.84	0.47	0.037	3.07	1.72	2.98	3.34	7.20	0.105
Knee L.	3.29	10.19	4.34	1.16	0.021	2.42	8.59	6.34	0.06	0.024	6.77	1.88	9.68	2.37	0.42	0.017	0.90	1.47	3.32	10.03	7.82	0.023
Lower Leg R.	8.77	10.72	5.59	7.70	0.691	5.93	12.83	5.58	4.43	0.092	10.65	3.44	13.93	4.85	5.00	0.048	2.72	8.06	6.01	14.80	8.58	0.120
Lower Leg L.	8.65	10.52	5.07	6.80	0.624	4.97	12.76	5.84	4.37	0.066	10.58	3.27	13.11	4.74	5.00	0.079	0.45	7.85	6.40	14.68	8.46	0.060
Foot R.	8.50	7.22	8.39	5.72	0.811	5.14	7.24	8.62	15.28	0.023	15.18	5.73	5.13	7.15	7.67	0.010	2.34	6.93	5.04	6.81	15.04	0.001
Foot L.	8.53	6.40	8.03	5.50	0.715	5.32	6.29	8.62	15.39	0.018	15.00	4.70	4.69	8.00	7.40	0.006	3.14	6.77	4.28	6.39	14.40	0.003
Burnout	53.69	47.22	52.32	45.48	0.058	46.38	51.12	55.79	53.31	0.085	45.51	48.96	52.12	52.97	51.97	0.341	50.54	47.40	41.96	54.62	56.20	0.001
PRB	56.07	46.61	49.67	39.45	0.001	45.95	49.64	54.00	56.17	0.123	50.64	47.52	49.42	49.54	52.60	0.884	51.29	45.74	42.22	51.72	57.29	0.007
WRB	53.79	50.45	52.91	48.21	0.431	48.24	53.26	57.43	51.46	0.117	45.79	49.39	55.01	55.95	52.12	0.063	50.99	47.81	43.81	58.19	56.77	0.000
CRB	51.20	44.08	54.28	48.31	0.067	44.63	50.09	55.67	52.62	0.071	40.06	49.91	51.45	52.93	51.17	0.042	49.28	48.58	39.54	53.35	54.43	0.004

*L: Left. R: Right. Abv: above. PRB: Personal Related Burnout. WRB:Work Related Burnout. CRB:Client Related Burnout.. *:p<0.05 (significance) is highlighted. MSD: Musculoskeletal discomfort. BS: Burnout Syndrome.*

Table 5. Comparison of the perceptions of physicians and nurses with MSD / BS

Variables	Physical strain in performing profession & MSD/BS				Physical complaints are of professional origin & MSD/BS			Physical pain and fatigue / exhaustion effects on service and care quality & MSD/BS				Restore to individual comfort measures & MSD/BS		
	Yes	May be	No	*p*	Yes	No	*p*	Yes	May be	No	*p*	Yes	No	*p*
Neck	7.00	1.53	0.58	0.000	6.44	2.32	0.000	5.55	5.15	0.59	0.007	4.63	4.38	0.871
Shoulder R.	6.97	2.02	0.16	0.000	7.63	0.91	0.000	6.43	1.85	1.17	0.001	4.87	3.48	0.302
Shoulder L.	3.92	0.21	0.08	0.000	3.96	0.44	0.000	3.58	0.54	0.13	0.003	2.52	1.77	0.535
Upper Back	13.73	2.96	2.30	0.000	15.05	2.09	0.000	12.79	4.98	1.18	0.000	9.78	6.74	0.297
Upper Arm R.	2.02	0.43	0.04	0.171	1.82	0.65	0.178	1.89	0.11	0.49	0.246	1.38	0.94	0.712
Upper Arm L.	1.15	0.24	0.00	0.101	0.95	0.46	0.302	0.95	0.11	0.64	0.382	0.74	0.71	0.970
Lower Back	12.36	6.39	2.01	0.002	14.18	2.95	0.000	12.63	3.92	2.40	0.000	10.61	2.86	0.000
Forearm R.	0.89	0.43	0.04	0.013	0.94	0.24	0.001	0.87	0.18	0.27	0.022	0.50	1.17	0.075
Forearm L.	0.54	0.37	0.04	0.250	0.58	0.20	0.071	0.56	0.18	0.12	0.208	0.39	0.49	0.730
Wist R.	2.77	2.70	0.35	0.105	3.28	1.13	0.011	3.13	0.61	1.26	0.045	2.64	0.90	0.018
Wrist L.	1.73	0.48	0.09	0.087	1.41	0.82	0.366	1.54	0.36	0.59	0.266	1.29	0.55	0.366
Hip	4.53	2.35	0.00	0.127	5.41	0.52	0.002	4.79	0.04	1.08	0.055	3.11	3.58	0.829
Upper Leg R.	5.27	1.15	0.24	0.011	5.70	0.63	0.000	4.21	1.81	2.35	0.382	4.07	0.67	0.001
Upper Leg L.	7.80	1.17	0.24	0.010	8.52	0.53	0.000	7.14	0.37	2.01	0.039	5.97	0.49	0.000
Knee R.	4.23	4.84	0.89	0.139	6.32	0.63	0.000	5.03	2.24	0.92	0.049	4.31	1.40	0.003
Knee L.	6.97	4.28	0.63	0.079	8.73	0.90	0.000	7.96	0.27	0.85	0.004	6.12	1.33	0.001
Lower Leg R.	12.44	4.26	1.80	0.005	14.35	1.68	0.000	11.83	3.46	3.04	0.015	10.25	1.89	0.000
Lower Leg L.	12.02	3.88	1.80	0.007	13.76	1.66	0.000	11.76	2.00	3.03	0.007	9.83	1.92	0.000
Foot R.	9.89	6.24	2.43	0.015	9.88	5.04	0.011	8.99	6.44	4.53	0.210	9.07	1.95	0.000
Foot L.	9.36	6.34	2.25	0.025	9.32	5.00	0.024	8.64	5.80	4.60	0.242	8.65	2.02	0.000
Burnout	56.53	44.17	38.06	0.000	53.13	46.94	0.012	51.70	46.46	49.73	0.258	47.74	61.15	0.001
PRB	56.22	41.92	38.44	0.000	52.70	46.09	0.023	50.25	45.04	52.88	0.228	46.88	61.51	0.001
WRB	58.20	46.43	38.04	0.000	54.41	48.69	0.020	53.94	50.34	46.06	0.046	49.63	60.97	0.003
CRB	54.88	43.79	37.71	0.000	52.07	45.75	0.024	50.55	43.35	50.85	0.120	46.38	61.01	0.001

*L: Left. R: Right. Abv: above. PRB: Personal Related Burnout. WRB:Work Related Burnout. CRB:Client Related Burnout.. *:p<0.05 (significance) is highlighted. MSD: Musculoskeletal discomfort. BS: Burnout Syndrome.*

Turkey, have been studied using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) and the Copenhagen Burnout Inventory (CBI). The study differs from other studies on the scale of researching MSD with burnout sub-dimensions such as personal burnout, work-related burnout and client-related burnout in physicians and nurses.

Objective

The objective of this study was to assess musculoskeletal discomfort, burnout syndrome, socio-demographic characteristics (gender, marital status, education, profession, sleep), and occupational related characteristics (working year, resting period, working hour, number of shifts) of physicians and nurses. More specifically, this study also examined the association of socio-demographic and occupational characteristics with MSD and BS and the relationship between burnout and musculoskeletal discomfort.

Methods

Study design

In this observational study, data were collected using a pre-developed questionnaire on socio-demographic and work-related characteristics, the Copenhagen Burnout Inventory and the Cornell Musculoskeletal Discomfort Questionnaire.

Population and sample

A cross-sectional study involving 217 subjects was conducted at Trakya University Health Centre for Medical Research and Practice (hospital), Republic of Turkey, from 15 December 2019 to 02 February 2020. A random sample of nurses and physicians at the hospital was recruited voluntarily and anonymously to participate in the study by giving written consent.

The physicians and nurses working in the departments for one year and more were included in the study. The study did not include nursing students or interns. The inclusion criteria ensured sample homogeneity and the random sample assisted in minimizing selection bias and confounding. A health professional with expertise in the area was consulted on the study's design and data collection.The sample size for correlation tests of scales was determined using G-power 3.9.1 Software. The minimum number of participants required for the study design was 193 with a 95% confidence interval and 80% power (n= 193, α=0.05, 1-β=0.80).

Data collection tools

The Demographic Information Form: The questionnaire designed by the researchers was used to collect data on socio-demographic characteristics (gender, age, marital status, educational degree, profession, year of study, working hours per week, rest period, hours of shift per month, and daily sleeping hours), and work-related characteristics (physical discomfort with performing the profession, the effect of physical discomfort and fatigue on service quality, and resorting to individual measures). The reliability of the questionnaire (Cronbach's a) was found to be 0.781.

The Copenhagen Burnout Inventory (CBI): It was used to measure burnout and consisted of three subscales: personal-related burnout (PRB), composed of 6 items; work-related burnout (WRB) consisting of 7 items; and client-related burnout (CRB), composed of 6 items with exhaustion/tiredness expressions 25. The validity and reliability of the Turkish version of the CBI were made by Bakoğlu et al. (2009), and the total subscale reliability (Cronbach's a) was 0.92 26. The subscales in CBI include expressions of exhaustion and fatigue in separate questions for subscales of PRB, WRB, and CRB. A Five-point Likert-type scale is used in the CBI for the study (Scoring for items related to subscales varied as; Always:

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100, Often: 75, Sometimes: 50, Seldom: 25, Never/almost never: 0 and also; To a very high degree, To a high degree, Somewhat, To a low degree, To a very low degree). The total score on the scale is the average of the scores on the items.

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ): It was used to examine MSD for standing male or female workers for 20 regions in the body, including the neck, shoulders, upper arms, upper back, lower back, forearms, wrists, hip, upper legs, knee, lower legs, feet. It consists of 3 sections for MSD, including frequency [never (0), 1-2 times last week (1.5), 3-4 times (3.5) last week, once every day (5) and several times every day (10)], discomfort [slightly (1), moderately (2) and very uncomfortable (3)] and interference with work [not at all (1), slightly (2) and substantially interfered (3)]

The CMDQ is for research screening purposes, and its scores can be analyzed by multiplying scores of the frequency (0, 1.5, 3.5, 5, 10), the discomfort (1, 2, 3) and the interference (1, 2, 3) 27. The validity and reliability of the Turkish version of the CMDQ were made by Erdinç et al. (2011), and the total reliability (Cronbach's a) was 0.876 28. A pilot study was conducted with a small group in a hospital unit to observe the feasibility and difficulties of the research. The data collection tools of the Demographic Information Form, CMDQ and CBI were issued to the pilot group (a total of 20 physicians and nurses). The researchers observed the ease of use, time requirements, and valid data in data collection tools for the study purposes. The questionnaires were applied on paper and filled by the physicians and nurses during working hours. The data was collected in the participants' free time at work (to reduce subject bias) by the blinded and pre-trained interviewers (to prevent interviewer bias). A blinded statistician analyzed the data. They were requested not to give information on questionaries to avoid the possibility of information bias.

Data analysis

The SPSS v.24.0 software was used for analyzing the data. The categorical variables were presented as relative (%) and absolute (n) frequencies and continuous variables as means (±standard deviation). Shapiro-Wilk test assessed the continuous variables' normality. The independent-sample t-test was used in case of no difference between the two groups. In case of a difference between more than two groups, a one-way analysis of variance (ANOVA) was utilized. "One-way analysis of variance" (ANOVA) results were checked firstly with the Levene test for variance homogeneity and then with the "multiple comparison test" (the Bonferroni and the Tamhane's T2) to control from which group or groups the difference originated. The Pearson correlation analysis was used to examine the relationship between the scales and the Cronbach's alpha value for the scale's reliability. A P-value of <0.05 was considered statistically significant.

Table 6. Correlation of respondents' burnout and Musculoskeletal discomfort

Musculoskeletal discomfort	Burnout		Personal Related Burnout		Work Related Burnout		Client Related Burnout	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Neck	**0.361**	**0.000**	**0.361**	**0.000**	**0.376**	**0.000**	**0.252**	**0.000**
Shoulder R.	**0.250**	**0.000**	**0.246**	**0.000**	**0.240**	**0.000**	**0.199**	**0.003**
Shoulder L.	**0.178**	**0.009**	**0.183**	**0.007**	**0.159**	**0.019**	**0.146**	**0.032**
Upper Back	**0.168**	**0.013**	**0.171**	**0.011**	**0.219**	**0.001**	0.068	0.318
Upper Arm R.	0.003	0.970	0.007	0.913	0.006	0.926	-0.007	0.917
Upper Arm L.	**0.151**	**0.027**	**0.163**	**0.016**	**0.165**	**0.015**	0.083	0.221
Lower Back	**0.197**	**0.003**	**0.216**	**0.001**	**0.200**	**0.003**	0.124	0.069
Forearm R.	**0.140**	**0.039**	**0.159**	**0.019**	**0.173**	**0.011**	0.050	0.461
Forearm L.	**0.169**	**0.013**	**0.174**	**0.010**	**0.204**	**0.003**	0.083	0.223
Wist R.	0.084	0.218	**0.137**	**0.044**	0.090	0.189	0.002	0.982
Wrist L.	0.122	0.072	0.122	0.073	0.127	0.061	0.085	0.212
Hip	0.085	0.211	0.076	0.264	0.056	0.412	0.103	0.132
Upper Leg R.	0.076	0.263	0.037	0.592	0.094	0.168	0.079	0.245
Upper Leg L.	0.071	0.297	0.012	0.859	0.112	0.101	0.072	0.290
Knee R.	0.101	0.138	0.133	0.051	0.109	0.111	0.034	0.621
Knee L.	0.109	0.110	0.106	0.119	0.131	0.054	0.060	0.378
Lower Leg R.	**0.181**	**0.008**	0.132	0.053	**0.227**	**0.001**	**0.137**	**0.044**
Lower Leg L.	**0.180**	**0.008**	0.130	0.055	**0.230**	**0.001**	**0.135**	**0.048**
Foot R.	**0.211**	**0.002**	**0.239**	**0.000**	**0.212**	**0.002**	0.127	0.061
Foot L.	**0.206**	**0.002**	**0.235**	**0.000**	**0.210**	**0.002**	0.118	0.082

*L: Left. R: Right. r: Pearson correlation coefficient. *:p<0.05 (significance) is bold.*

Ethical Considerations

The research permission for ethics review and approval was granted by Istanbul Aydın University Ethical Committee (30 Sept 2019, Nu: 2019/14). The institutional permission was received from the Trakya University (09 Dec 2019, Nu: 13930723-045.99) for conducting the study. All participants provided informed consent and were informed about voluntary participation and the research topic.

Results

A total of 223 healthcare professionals consisting of physicians and nurses were volunteer subjects for the study, and six questionnaires were excluded from the study due to incorrect completion and missing data.

Identifying Characteristics

The study included a sample of 217; nurses (64.1%) and physicians (35.9%), and the average age was 30.82 years. Most of the participants were female (61.3%), married (63.6%) and had a bachelor's degree (53.9%). 38.2 % had 1-4 years of work experience, 42 % worked for 41-50 hours per week, 20.6 % had 5-6 extra hours for work per month (shifts-continuous nights), and 33.2 % rested 20-40 minutes per day. 18 % of them had no rest minutes in the daily working time. Physicians and nurses were asked to indicate the amount of sleep they typically get within a day. 37.3 % of them sleep 6 hours a day.

Physicians and nurses reported most frequently "physical strain in performing profession" (59%), followed by "having physical complaints/pain due to profession" (54.8%) and "taking individual measures for physical complaints" (80.6%). 62.7% expressed that "physical pain and fatigue/exhaustion that they experienced affects service and care quality", which contributes to the quality of service negatively [Table 1].

Musculoskeletal Discomfort and Burnout Syndrome

The most frequently reported pain was upper back (9.19 ± 16.93), lower back (9.11 ± 17.56), right lower leg (8.63 ± 21.13), left lower leg (8.30 ± 21.18), right foot (7.69 ± 14.80) and left foot (7.37 ± 14.79). The mean score for burnout was 50.33 ± 18.18, and the mean scores for the subscales of burnout were respectively; personal-related burnout (49.71±21.33), work-related burnout (51.83 ± 18.06) and client-related burnout (49.21±20.56) [Table 2].

Comparison of identifying characteristics with MSD and BS

A statistically significant association was found between sociodemographic characteristics and MSD / BS. We found that MSD scores for the left and right shoulders were significantly associated with gender, and the female gender had higher MSD scores ($p<0.05$). Although burnout scores were higher for males than females, burnout was not significantly associated with gender ($p> 0.05$). While married physicians and nurses had higher MSD scores for the upper back and right shoulder, single ones had higher burnout, PRB, and WRB scores.

The study participants with a high school degree/associate degree had high MSD scores for the right shoulder, lower back, forearms, and right knee, and the ones with master's degrees had more PRB and CRB. While nurses had higher MSD scores for right and left shoulders, physicians had

higher scores in PRB ($p<0.05$). The participants who slept 4 or 5 hours daily had higher MSD scores in the neck, lower back, upper leg left, foot left, foot right and BS scores (with PRB and WRB). [Table 3].

The comparison of sleeping hours with MSD and BS is presented in [Figure 1].

Physicians and nurses who worked for 5-9 years had higher MSD scores in the right shoulder, upper back, left knee, and those who worked for 1-4 years had higher PRB. The participants who rested for 60 minutes daily during working hours had the least pain scores for MSD in the upper back, right-hand wrist, upper left leg, knees and foots, and CRB. The participants having more than 60 hours per week had the highest neck and right foot scores but no association with burnout. Having over 8 hours of shift (continuous night) per month was the highest score of MSD in the right and left foot and burnout, PRB, and WRB subscales. [Table 4].

The physicians and nurses who reported "physical strain in performing profession", "physical complaints", "restore to individual comfort measures", and "physical pain and fatigue/exhaustion effects on service and care quality" [Table 1] had significantly higher scores ($p<0.05$) for MSD and BS [Table 5].

There was a significant positive relationship between MSD and burnout ($p<0.05$). The Pearson correlation is shown in Table 6 for the relationship between MSD obtained from the CMDQ and burnout, including the PRB, WRB and CRB subscales obtained from the CBI [Table 6].

Discussion

When the CMDQ was used to investigate MSDs in physicians and nurses, the areas of the body where participants reported the most pain were the upper back, lower back, right lower leg, left lower leg, right foot and left foot. Previous research indicates that the lower back, upper back, neck, and foot are the most commonly experienced pain areas for MSD in various groups[29,30,31,32,33]. Unlike previous research, discomfort in the neck was not one of the most common complaints in our study. In addition, higher reported pains by physicians and nurses in the right and the left lower legs were also different from the studies. Omidi et al. (2017) pointed out that the highest incidence was in the lower back and neck[29]. Due to the nature of the work of healthcare professionals, back and neck disorders result from sudden movements and bends that require abnormal postures, especially during patient movement[34,35].

The participants' highest levels of burnout sub-dimension were WRB, followed by PRB, and CRB in the study. Previous research found that nearly half of the participants had at least moderate burnout syndrome[36,37,38,39,40] and WRB was the most common BS, which is consistent with our findings.

Several variables of sociodemographics were associated with MSD and burnout in physicians and nurses ($p<0.05$) [Table 3, Table 4]. The available research suggests that the prevalence of pain and discomfort may be correlated with factors such as age, gender, and work experience[29]. Some sociodemographic factors may have an impact on MSD[35], and female gender, young age, marital status, working conditions, low job satisfaction, night shift work, weekly increasing working hours, increased patients per person, clinical experience and advancing age could increase burnout[39,41,42,43]. Our findings suggest that certain job characteristics, such as working hours, rest periods, and the number of shifts, may influence MSD and BS in physicians and nurses [Table 4].

The female gender had significantly higher MSD scores in the right shoulder, left shoulder, upper back, lower back, hip, and left knee ($p<0.05$), but no statistical significance between burnout and gender in the present study. The female gender was associated with MSD in the shoulder, back, and neck areas, according to Yılmaz and Özkan (2008)[44]. Chirico et al. (2021) reported that characteristics like age, gender, occupation, marital status and work experience are all associated with burnout. They suggested personal coping mechanisms like exercise, sound sleeping patterns, and peer interaction[21].

Burnout and gender have no relationship, according to Alqahtani et al. (2020)[45]. Lapa et al. (2018), on the other hand, discovered that the female gender, younger physicians, and a relatively new profession all had higher levels of burnout in physicians[36]. Although it was stated that marital status could influence pain[44], Kupcewicz and Jówik (2020) found no significant relationship between marital status and burnout with sub-dimensions in nurses[37]. In the current study, married physicians and nurses reported significantly more upper back and right shoulder pain ($p<0.05$), while singles reported significantly higher burnout, PRB, and WRB ($p<0.05$). Burnout may be influenced by one's level of education, and it was noted that musculoskeletal pain increases with lower levels of education. That situation was attributed to individuals with low education levels being more exposed as a result of not taking advantage of educational opportunities and their inability to manage pain[37,46].

Our research backed up these findings by showing that participants with a high school diploma or an associate's degree experienced the highest MSD pain averages in the waist, right shoulder, right and left forearms, and right knee. Additionally, the study revealed that MS/PhD graduates had the highest PRB and CRB subscale scores ($p<0.05$).

While nurses had higher MSD scores in the right and left shoulders, physicians had significantly higher PRB ($p<0.05$) [Table 3]. According to Caesar et al. (2020)[41], general surgeons have higher rates of burnout, and Shanafelt et al. (2010) suggested that young health care workers who work more than 60 hours per week, including surgeons, may also be at risk of burnout[47]. Biksegn et al. (2016) detected that nurses had the highest rates of burnout[39]; still, in our study, the physicians had significantly more personal-related burnout. Metregiste et al. (2020) discovered that paramedic healthcare workers experienced more burnout than physicians, owing to their lack of education and increased exposure to severely traumatized patients[40].

Physicians and nurses are physically challenged with accessing medical supplies, equipment and tools, placed on inappropriate reach, resulting in strains in the spine and shoulders[33]. In our study, nurses had significantly higher MSD scores than physicians in both the right and left shoulder ($p<0.05$). Lifting and carrying patients and pulling movements cause pain due to MSD[33]. According to Kjellberg et al. (2003)'s research, low back and shoulder pain get worse as people age. They attributed this to a lack of training in body mechanics and a decline in natural movement ability[48].

In this study, physicians and nurses who had worked for 5 to 9 years had higher rates of MSDs in the right shoulder, back and left knee. Working 60 hours a week or more was associated with more MSDs in the neck and right foot. The PRB was higher in those who had worked for 1-4 years ($p<0.05$), and no relationship was found between burnout and weekly working hours. Some studies found no relationship

between working years and MSD-related pain and BS 45,49, while others discovered a decrease in burnout with increasing age[50], a higher prevalence of pain in those who have worked for more than ten years[51], and more burnout in young physicians 36 [Table 4].

The results showed that people who rested for 60 minutes per day had the lowest MSD pain (in the upper back, left upper leg, right wrist, right and left knees, right lower leg, and right and left foot), as well as the lowest CRB, while people who worked for eight-night shifts per month had the highest MSD (in the right and left foot) and BS ($p < 0.05$) [Table 4]. Working long hours on a daily basis can cause pain in the right wrist, shoulder, and neck, as well as contribute to burnout[50]. 12-hour shift work, organizational and individual factors may all contribute to fatigue, which can have a negative physiological and behavioral impact[51].

The adverse effects of the shift-working system on the psychological and physical health of physicians and nurses and high fatigue negatively affect medical errors, injuries, physical and mental work performances. Due to the harmful effects of shift working over the years, appropriate working hours are critical for health management to reduce many problems affecting employees' health[52,53,54,55]. Periodic review of each shift schedule, and provision of support from experienced physician and nurses in each department may be helpful to improve the psychological well-being of physicians and nurses[21].

In the study, both MSD and BS tend to decrease with increasing sleeping hours; physicians and nurses who sleep for 4 hours per day reported the most pain for MSDs (neck, waist, left upper leg, left and right foot) and average BS (PRB and WRB) [Table 4]. The irregular sleep habits caused by occupation and shift work have a negative impact on the quality of life of healthcare professionals[56,57]. Furthermore, the pain caused by MSD worsens their fatigue, disrupts their sleep patterns, and increases their depression[58]. Therefore, the study's findings lead us to the conclusion that the sleep pattern will have a positive impact on the MSD and BS statuses of physicians and nurses.

Participants in the study with higher MSD and BS scores reported physical strain/complaints and were restored to take individual measures, and the quality of service was affected by these complaints [Table 5]. Burnout can indicate outcomes such as cardiovascular disease, diabetes (type-2), coronary heart, MSD pain, fatigue, headache, gastrointestinal and respiratory problems[59]. The literature indicates, supporting our study, that physical pain, MSD, and BS experienced by physicians and nurses affect job performance, productivity, and quality of service[29,39,40,50,55,60]. Chirico et al. (2019) reported that employing spiritual practices could boost employees' personal resources. They also stated that doing so may influence motivation by reducing the negative effects of job demands on job strain, including burnout, as reported in the Job-demand resource model[61,62,63].

Multivariate interaction theory states that musculoskeletal injury is an interactive process involving genetic, morphological, psychosocial and biomechanical factors. Within each of these categories, there are numerous variables that can contribute to the onset of musculoskeletal injury 64. In our study, BS with subdimensions (PRB, WRB, CRB) was positively associated with musculoskeletal pain (low to moderate), suggesting that MSDs (neck, right shoulder, left shoulder, upper back, left upper arm, lower back, right and left forearm, right wrist, right and left lower leg, right and left foot) and burnout may co-occur in physicians and nurses [Table 6].

The literature shows that burnout can be associated with pain, most commonly in the shoulder, back, neck, waist and other regions, contributing to the development of MSD pain[65,66,45,50,67]. However, there is a lack of clarity about what the relationship between these conditions might be 68. In contrast to previous studies, our study examined the relationship between MSD and personal work and client-related burnout subdimensions. Work demands and stimuli affect MSD directly or indirectly through BS, but the relationship between work stimuli, BS and MSD is quite complicated. There is therefore a need for further studies to explore the impact of psychosocial, organisational, physical and environmental risk factors on MSD and BS[50,65,69,70].

According to Karasek's 'work demand control' model, job demand is a factor that reflects the number of tasks. It is also a source of stress, such as workload and problem-solving demands. When physicians and nurses have higher job demands, i.e. when they face difficulties, job control can act as a buffer for employees, making them less vulnerable to work-related stress[71,72].

Controlling the source of stress at work requires an organisational approach. Work-related stress risk factors should be prioritised by health and safety management, and national authorities should support occupational health services' actions to combat burnout through specific legislation[21]. Occupational health services (OHS) should manage psychosocial risks and promote the mental well-being of workers. OHS are multidisciplinary teams consisting of occupational health physicians, nurses, organisational/mental health specialists, occupational psychologists, ergonomists, epidemiologists and health educators[15].

Limitations of the study

Based on a cross-sectional design with a limited group, the study considered physicians and nurses in all clinics and did not evaluate each clinic separately. Cross-sectional studies have a high chance of bias for reverse causality. The study required statistical relations and observational results with a limited sample group, which increases the risk of reverse causality bias. The research was planned with three university hospitals, but institutional permission was granted by one. During the sample collection, there was a global COVID-19 pandemic outbreak, and some organizational preparations were made in Turkey's healthcare system. Therefore, it became hard to reach the physicians and nurses towards the study's end, which affected the sampling number. The data of this study relates only responses of study participants. However, researchers were able to collect data for the minimum required sample size of physicians and nurses, which strengthen our results' validity.

Another limitation is that the findings represent an observational study of a particular university hospital and, therefore, cannot be generalized to other hospitals. Nevertheless, it may be helpful for nursing and physician staff in different hospital settings to use the findings in their assessment and management of the risk of MSDs and Burnout, since all institutions offering healthcare services should be aware of the occupational health risks for workers. In the future, the research may be improved on physicians and nurses who work in the same clinic in multiple hospitals.

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Conclusion

Musculoskeletal discomfort (MSD) and burnout are the most common problems among physicians and nurses, who are critical to the delivery of quality healthcare. Although the level of pain experienced due to MSD is low, it is associated with daily work and repetitive movements indicate the ergonomic inconvenience of the work environment.

Our findings on MSD and BS suggest that special attention needs to be paid to physicians and nurses with MSD/BS problems. It is therefore recommended that protective measures focus on the most exposed and reported MSDs in the upper and lower back, left and right lower leg, left and right leg.

The association between some demographic/work-related characteristics and MSD/BN may vary with body regions and burnout subscales, which need to be addressed appropriately. The interaction of MSD with burnout suggests the need for more interdisciplinary research. Physicians and nurses provide direct care or treatment to their patients and know which approaches work well and which need to be adapted. Their concerns are therefore at the heart of the healthcare system. Clinical interviews can be conducted for more in-depth and further studies, which will allow burnout factors to be investigated in more detail.

Consequently, knowledge of the variation in MSD and BS due to different factors and the relationship between MSD and BS is crucial if we are to understand the influencing factors from an occupational health perspective. Further research in clinical settings to identify increasing factors for MSDs and BS will help to ensure that these factors are taken into account in occupational health and safety planning to mitigate risks to the health of physicians and nurses, and may even indirectly influence the quality of care. In addition, new research can be designed to determine the effects of interventions to reduce these factors of MSD and BS.

References

1.Ulutasdemir, N., Cirpan, M., Copur, E. O., & Tanir, F. (2015). Occupational risks of health professionals in Turkey as an emerging economy. Ann Glob Health, 81(4), 522-529. https://doi.org/10.1016/j.aogh.2015.08.019

2.Shariat, A. (2018). Occupational physical and emotional fitness. Work, 59(3), 463-467. doi: 10.3233/WOR-182696. PMID: 29630587.

3.Kim, IJ. (2017) Ergonomic Explorations for the Safety and Health Improvement in Hospital and Healthcare Professions. J Ergonomics 7: e167. https://doi.org/10.4172/2165-7556.1000e167

4.Hignett, S., Carayon, P., Buckle, P., & Catchpole, K. (2013). State of science: human factors and ergonomics in healthcare. Ergonomics, 56(10), 1491-1503. https://doi.org/10.1080/00140139.2013.822932

5.Boyer, J., Galizzi, M., Cifuentes, M., d'Errico, A., Gore, R., Punnett, L., & Slatin, C. (2009). Ergonomic and socioeconomic risk factors for hospital workers' compensation injury claims. Am. J. Ind. Med., 52(7), 551-562. https://doi.org/10.1002/ajim.20702

6.Chirico F, Crescenzo P, Sacco A, Riccò M, Ripa S, Nucera G, Magnavita N. Prevalence of burnout syndrome among Italian volunteers of the Red Cross: a cross-sectional study. Ind Health. 2021;59(2):117-127. doi: 10.2486/indhealth.2020-0246.

7.Chirico F. Adjustment Disorder as an Occupational Disease: Our Experience in Italy. Int J Occup Environ Med. 2016 Jan;7(1):52-7. doi: 10.15171/ijoem.2016.716. PMID: 26772598; PMCID: PMC6816519

8.Hughes, P. W., & Ferrett, E. (2005). Introduction to health and safety in construction. Oxford: Elsevier Butterworth-Heinemann. p.305

9.Borritz, M., Bültmann, U., Rugulies, R., Christensen, K. B., Villadsen, E., & Kristensen, T. S. (2005). Psychosocial work characteristics as predictors for burnout: findings from 3-year follow up of the PUMA Study. Int J Occup Environ Med, 47(10), 1015-1025. https://doi.org/10.1097/01.jom.0000175155.50789.98

10.Magnavita N, Chirico F. New and emerging risk factors in Occupational Health. Applied Sciences. 2020;10(4):8906. Doi: 10.3390/app10248906

11.Chirico F. The assessment of psychosocial risk: only "work-related stress" or something else? Med Lav. 2015 Jan 9;106(1):65-6. https://mattioli1885journals.com/index.php/lamedicinadellavoro/article/view/3861

12.Tummers, G. E., Landeweerd, J. A., & Van Merode, G. G. (2002). Work organization, work characteristics, and their psychological effects on nurses in the Netherlands. Int J Stress Manag, 9(3), 183-206. https://doi.org/10.1023/A:1015519815319

13.Patrick Neumann, W., Steege, L. M., Jun, G. T., & Wiklund, M. (2018). Ergonomics and Human Factors in Healthcare System Design–An Introduction to This Special Issue. https://doi.org/10.1080/24725838.2018.1560927

14.Chirico F, Zaffina S, Di Prinzio RR, Giorgi G, Ferrari G, Capitanelli I, Sacco A, Szarpak L, Nucera G, Afolabi A, Ilesanmi OS. Working from home in the context of COVID-19: A systematic review of physical and mental health effects of teleworkers. J Health Soc Sci. 2021;6(3):319-332. Doi: 10.19204/2021/wrkn8.

15.Chirico, F., & Leiter, M. (2022). Tackling stress, burnout, suicide and preventing the "great resignation" phenomenon among healthcare workers (during and after the COVID-19 pandemic) for maintaining the sustainability of healthcare systems and reaching the 2030 sustainable development goals. Journal of Health and Social Sciences, 9-13. Doi:10.19204/2022/TCKL1

16.Chirico F, Afolabi AA, Ilesanmi OS, Nucera G, Ferrari G, Szarpak L, Yildirim M, Magnavita N. Workplace violence against healthcare workers during the COVID-19 pandemic: A systematic review. J Health Soc Sci. 2022;7(1):14-35. Doi:10.19204/2022/WRKP2.

17.Vandenbroeck, S. V., Moerenhout, E. M., Sercu, M. S., De Man, H. D. M., De Witte, H. D. W., Vanbelle, E. V., & Godderis, L. G. (2013). Burnout, a substantial problem in hospital physicians. A multicentre study on its prevalence, determinants and consequences in 37 Belgian Hospitals. Occup Environ Med, 70 (Suppl 1), A127-A128. http://dx.doi.org/10.1136/oemed-2013-101717.373

18.Magnavita, N., Chirico, F., & Sacco, A. (2021). COVID-19: from hospitals to courts. The Lancet, 397(10284), 1542. . Doi: 10.1016/s0140-6736(21)00472-4

19.Chirico F, Nucera G, Leiter M. Measuring burnout syndrome requires reliable and standardized measures. Hong Kong J Emerg Med. 2022 May. Doi: 10.1177/10249079221096920.

20.Chirico, F., & Magnavita, N. (2020). Burnout syndrome and meta-analyses: Need for evidence-based research in occupational health. comments on prevalence of burnout in medical and surgical residents: A meta-analysis. int. j. environ. res. public. health. 2019, 16, https://doi.org/10.3390/ijerph17030741.

21.Chirico, F., Afolabi, A. A., Ilesanmi, O. S., Nucera, G., Ferrari, G., Sacco, A., ... & Leiter, M. (2021). Prevalence, risk factors and prevention of burnout syndrome among healthcare workers: an umbrella review of systematic reviews and meta-analyses. Journal of Health and Social Sciences, 6(4), 465-491. Doi:10.19204/2021/prvl3.2

22.Althaus, V., Kop, J.-.L., Grosjean, V., 2013. Work, stress and health: from theoretical models to a meta-model: critical Review of theoretical models linking work environment, stress and health: towards a meta-model. Trav. Hum. 81–103. Doi:10.2307/41969976

23.Baker, E., Israel, B., Schurman, S., 1996. Role of control and support in occupational stress: an integrated model. Soc. Sci. Med. 43 (7), 1145–1159. Doi:10.1016/0277-9536(96)00064-0.

24.Havaei, F., Astivia, O. L. O., & MacPhee, M. (2020). The impact of workplace violence on medical-surgical nurses' health outcome: A moderated mediation model of work environment conditions and burnout using secondary data. International journal of nursing studies, 109, 103666. Doi: 10.1016/j.ijnurstu.2020.103666

25.Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The Copenhagen Burnout Inventory: A new tool for the assessment of burnout. Work Stress, 19(3), 192-207. https://doi.org/10.1080/02678370500297720

26.Bakoğlu R. D, Taştan İ. B, Yiğit İ, Yıldız S. (2009). Tükenmişliği ölçmede alternatif bir araç: Kopenhag tükenmişlik envanterinin Marmara Üniversitesi Akademik personeli üzerine uyarlaması. Yönetim Dergisi: İstanbul Üniversitesi İşletme Fakültesi İşletme İktisadı Enstitüsü, 20(63), 77 - 98. https://search.trdizin.gov.tr/tr/yayin/detay/95359/

27.Hedge, A. Morimoto, S. Mccrobie D (1999) Effects of keyboard tray geometry on upper body posture and comfort. Ergonomics 42(10): 1333-1349. https://doi.org/10.1080/001401399184983

28.Erdinc, O., Hot, K., & Ozkaya, M. (2011). Turkish version of the Cornell Musculoskeletal Discomfort Questionnaire: cross-cultural adaptation and validation. Work, 39(3), 251-260. https://doi.org/10.3233/WOR-2011-1173

29.Omidi, M., Jalilian, M., Kazemi, M., Kamalvandi, M., Jamshidzad, M., & Kurd, N. (2017). Using of Cornell measuring tool (Cornell musculoskeletal discomfort questionnaires) for assessment of the musculoskeletal disorders prevalence among Ilam teaching hospitals nurses: Cross-sectional study in 2016. Ann Trop Med Public Health, 10(6), 1729. https://doi.org/10.4103/ATMPH.ATMPH_619_17

30.Gul, A., Purisa, S., Kahraman, B., & Ustundag, H. (2014). Evaluation of musculoskeletal pain among nurses. J. Health Sci Prof, 1(1), 1-10. https://doi.org/10.17681/hsp.77225

31.Gholami, T., Heidari Pahlavian, A., Akbarzadeh, M., Motamedzade, M., Heidari Moghadam, R., & Khani Jeihooni, A. (2016). Effects of nursing burnout syndrome on musculoskeletal disorders. Int. j. musculoskelet. pain prev., 1(1), 35-39. Doi: 10.7508/ijmpp.2016.01.006

32.Cürcani M. & Tan M. 2009. Occupational Risk Factors and Health Problems Faced by Nurses that Working Dialysis Unit and Nephrology Service. TAF Preventive Medicine Bulletin, 8(4): 339 – 344. https://app.trdizin.gov.tr/publication/paper/detail/T1RZM056RXg

33.Güler, T, Yıldız, T, Önler, E, Yıldız, B , Gülcivan, G. (2015). The effect of hospitals' ergonomic conditions on the nurses' professional musculoskeletal system disorders. Int Anatolia Academic Online J Sci, 3(1), 0-0. https://dergipark.org.tr/tr/pub/iaaojf/issue/32117/356059

34.Askaripoor T, Kermani A, Jandaghi J, Farivar F. (2013). Survey of musculoskeletal disorders and ergonomic risk factors among dentists and providing control measures in Semnan. J Health: 4(3): 241-248 http://healthjournal.arums.ac.ir/article-1-41-en.html

35.Harber, P., Billet, E., Gutowski, M., SooHoo, K., Lew, M., & Roman, A. (1985). Occupational low-back pain in hospital nurses. J Occup Med, 27(7), 518-524. https://pubmed.ncbi.nlm.nih.gov/3162009/

36.Lapa, T., Carvalho, S., Viana, J., Ferreira, P. L., Pinto-Gouveia, J., & Belo-Cabete, A. (2018). Development and Evaluation of a Global Burnout Index Derived from the Use of the Copenhagen Burnout Inventory in Portuguese Physicians. Acta medica portuguesa, 31(10), 534-541. https://doi.org/10.20344/amp.10407

37.Kupcewicz, E., & Jóźwik, M. (2020). Association of burnout syndrome and global self-esteem among Polish nurses. Arch. Med. Sci., 16(1), 135. https://doi.org/10.5114/aoms.2019.88626

38.Fischer, L., Dadaczynski, K., & Rathmann, K. (2020). Psychosocial working conditions and symptoms of burnout in somatic and psychiatric nursing. PFLEGE, 33(2), 93-104. https://doi.org/10.1024/1012-5302/a000720

39.Biksegn, A., Kenfe, T., Matiwos, S., & Eshetu, G. (2016). Burnout status at work among health care professionals in a Tertiary hospital. Ethiop J Health Sci, 26(2), https://doi.org/10.4314/ejhs.v26i2.3

40.Metregiste, D., Boucaud-Maitre, D., Aubert, L., Noubou, L., & Jehel, L. (2020). Explanatory factors of post-traumatic distress and burnout among hospital staff 6 months after Hurricane Irma in Saint-Martin and Saint-Barthelemy. PLoS one, 15(3). https://doi.org/10.1371/journal.pone.0229246

41.Caesar, B., Barakat, A., Bernard, C., & Butler, D. (2020). Evaluation of physician burnout at a major trauma centre using the Copenhagen burnout inventory: cross-sectional observational study. Ir J Med Sci, (1971-), 1-6. https://doi.org/10.1007/s11845-020-02223-5

42. Rossouw, L., Seedat, S., Emsley, R. A., Suliman, S., & Hagemeister, D. (2013). The prevalence of burnout and depression in medical doctors working in the Cape Town Metropolitan Municipality community healthcare clinics and district hospitals of the Provincial Government of the Western Cape: a cross-sectional study. S Afr Fam Pract, 55(6), 567-573. https://hdl.handle.net/10520/EJC146807

43.Kara K. Ballenger-Browning, Schmitz, K. J., Rothacker, J. A., Hammer, P. S., Webb-Murphy, J. A., & Johnson, D. C. (2011). Predictors of burnout among military mental health providers. Military medicine, 176(3), 253–260. https://doi.org/10.7205/milmed-d-10-00269

44.Yılmaz, E., & Özkan, S. (2008). Determination of the Prevalence of Low Back Pain Among Nurses Working in Hospitals. Turk J Phys Med Rehabil, 54(1). https://hdl.handle.net/20.500.12462/5181

45.Alqahtani, N. H., Abdulaziz, A. A., Hendi, O. M., & Mahfouz, M. E. M. (2020). Prevalence of burnout syndrome among students of health care colleges and its correlation to musculoskeletal disorders in Saudi Arabia. Int. j. preventive medicine, 11. https://doi.org/10.4103/ijpvm.IJPVM_295_19

46.Çil Akıncı, A., Dereli, E., & Sert, H. (2014). Low back pain among nurses working in Kirklareli and the associated factors. Acıbadem University Health Sci J, 5:1. https://dergipark.org.tr/en/pub/acusaglik/issue/61302/914365

47.Shanafelt, T. D., Balch, C. M., Bechamps, G., Russell, T., Dyrbye, L., Satele, D., ... & Freischlag, J. (2010). Burnout and medical errors among American surgeons. Ann Surg., 251(6), 995-1000. https://doi.org/10.1097/SLA.0b013e3181bfdab3

48.Kjellberg, K., Lagerström, M., & Hagberg, M. (2003). Work technique of nurses in patient transfer tasks and associations with personal factors. Scand J Work Environ Health, 29(6), 468-477. http://www.jstor.org/stable/40967325

49. Feng, C. K., Chen, M. L., & Mao, I. F. (2007). Prevalence of and risk factors for different measures of low back pain among female nursing aides in Taiwanese nursing homes. BMC Musculoskeletal Disord, 8(1), 52. https://doi.org/10.1186/1471-2474-8-52

50.Zhang, X., Schall Jr, M. C., Sesek, R., Gallagher, S., & Michel, J. (2017). Burnout and its association with musculoskeletal pain among primary care providers. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 61, No. 1, pp. 1010-1014). Sage CA: Los Angeles, CA: SAGE Publications. https://doi.org/10.1177/1541931213601735

51.Chen, J., Davis, K. G., Daraiseh, N. M., Pan, W., & Davis, L. S. (2014). Fatigue and recovery in 12-hour dayshift hospital nurses. J Nurs Manag, 22(5), 593-603. https://doi.org/10.1111/jonm.12062

52.He, C. (2013). Physical and Psychosocial Demands on Shift Work in Nursing Homes (Doctoral dissertation, University of Cincinnati). http://rave.ohiolink.edu/etdc/view?acc_num=ucin1378393703

53.Samaha, E., Lal, S., Samaha, N., & Wyndham, J. (2007). Psychological, lifestyle and coping contributors to chronic fatigue in shift-worker nurses. J Adv Nurs., 59(3), 221-232. https://doi.org/10.1111/j.1365-2648.2007.04338.x

54.Stimpfel, A. W., Sloane, D. M., & Aiken, L. H. (2012). The longer the shifts for hospital nurses, the higher the levels of burnout and patient

dissatisfaction. Health Aff., 31(11), 2501-2509. https://doi.org/10.1377/hlthaff.2011.1377

55.Rahman, H. A., Abdul-Mumin, K., & Naing, L. (2017). Psychosocial factors, musculoskeletal disorders and work-related fatigue amongst nurses in Brunei: structural equation model approach. Int Emerg Nurs., 34, 17-22. https://doi.org/10.1016/j.ienj.2017.04.001

56.Shao, M. F., Chou, Y. C., Yeh, M. Y., & Tzeng, W. C. (2010). Sleep quality and quality of life in female shift-working nurses. J Adv Nurs., 66(7), 1565-1572. https://doi.org/10.1111/j.1365-2648.2010.05300.x

57.Ohida, T., Kamal, A. M. M., Sone, T., Ishii, T., Uchiyama, M., Minowa, M., & Nozaki, S. (2001). Night-shift work related problems in young female nurses in Japan. J. Occup. Health, 43(3), 150-156. https://doi.org/10.1539/joh.43.150

58.Strine, T. W., Hootman, J. M., Chapman, D. P., Okoro, C. A., & Balluz, L. (2005). Health-related quality of life, health risk behaviors, and disability among adults with pain-related activity difficulty. Am J Public Health, 95(11), 2042-2048. https://doi.org/10.2105/AJPH.2005.066225

59.Salvagioni, D. A. J., Melanda, F. N., Mesas, A. E., González, A. D., Gabani, F. L., & de Andrade, S. M. (2017). Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. PloS one. https://doi.org/10.1371/journal.pone.0185781

60.Souza, A. C., & Alexandre, N. M. (2012). Musculoskeletal symptoms, work ability, and disability among nursing personnel. Workplace Health Saf, 60(8), 353-360. https://doi.org/10.1177/216507991206000805

61.Chirico, F., & Magnavita, N. (2019). The spiritual dimension of health for more spirituality at workplace. Indian Journal of Occupational and Environmental Medicine, 23(2). Doi:10.4103/ijoem.IJOEM_209_18

62.Chirico, F., Sharma, M., Zaffina, S., & Magnavita, N. (2020). Spirituality and prayer on teacher stress and burnout in an Italian cohort: A pilot, before-after controlled study. Frontiers in Psychology, 10, 2933. https://doi.org/10.3389/fpsyg.2019.02933

63.Demerouti, E., Bakker, A. B., Nachreiner, F., and Schaufeli, W. B. (2001). The job demands-resources model of burnout. J. Appl. Psychol. 86, 499–512. Doi:10.1037/0021-9010.86.3.499

64.Shrawan Kumar (2001): Theories of musculoskeletal injury causation, Ergonomics, 44:1, 17-47. http://dx.doi.org/10.1080/00140130120716

65.Gholami, T., Pahlavian, A. H., Akbarzadeh, M., Motamedzade, M., & Moghaddam, R. H. (2016). The role of burnout syndrome as a mediator for the effect of psychosocial risk factors on the intensity of musculoskeletal disorders: a structural equation modeling approach. Int J Occup Saf Ergon, 22(2), 283-290. https://doi.org/10.1080/10803548.2016.1147876

66.Mirmohammadi T, Mohsenabadi M, Gholizadeh S, Etemadinejad S, Yazdani J, et al. (2019) Investigating the Relationship between Musculoskeletal Disorders and Burnout Syndrome among Ems Personnel in Mazandaran Province Hospitals. J Ergon Res 2:1.

67.Armon, G., Melamed, S., Shirom, A., & Shapira, I. (2010). Elevated burnout predicts the onset of musculoskeletal pain among apparently healthy employees. J Occup Health Psychol, 15(4), 399. https://doi.org/10.1037/a0020726

68.Melamed, S. (2009). Burnout and risk of regional musculoskeletal pain-a prospective study of apparently healthy employed adults. Stress Health, 25(4), 313-321. https://doi.org/10.1002/smi.1265

69.Honkonen, T., Ahola, K., Pertovaara, M., Isometsä, E., Kalimo, R., Nykyri, E., Aromaa, A., & Lönnqvist, J. (2006). The association between burnout and physical illness in the general population-results from the Finnish Health 2000 Study. J Psychosom Res, 61(1), 59-66. https://doi.org/10.1016/j.jpsychores.2005.10.002

70.Parent-Thirion, A., Biletta, I., Cabrita, J., Llave, O. V., Vermeylen, G., Wilczynska, A., & Wilkens, M. (2017). 6th European Working Conditions Survey: 2017 Update. Publications Office of the European Union. https://doi.org/10.1080/07420528.2019.1698591

71.Alkadash, T. M., Jun Bo, S., Besher, B., Almaamari, Q., & Mohsen Al-Absy, M. S. (2020). Conceptual Framework on Job Burnout of the Employees and its Correlative Factors in China During Covid-19. Doi: 10.34218/IJM.11.10.2020.020

72.Karasek Jr, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. Administrative science quarterly, 285-308. http://dx.doi.org/10.2307/2392498