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EFFECTS OF THE COVID-19 CRISIS ON WORK-LIFE BALANCE, MENTAL HEALTH, AND PERCEIVED HEALTH STATUS AMONG HUNGARIAN DEFENSE EMPLOYEES: A CROSS-SECTIONAL STUDY

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Abstract. The COVID-19 pandemic impacted profoundly on the mental and physical health of defense personnel, due to their involvement in the enforcement of COVID-19 measures and confined work environments. This cross-sectional study assessed the effects of the pandemic on work-life balance, mental health, and perceived health status among Hungarian defense employees. Data was collected from 300 employees of a Hungarian defense company using an online questionnaire that included demographics, work-related observations, mental health scales (DASS), and perceived health status (SF-12). Data was analyzed using descriptive and inferential statistics. The results indicated that work type, flexibility, and workload remained stable before, during, and after the pandemic. Compensation satisfaction ($p = 0.025$) showed a slight increase post-COVID-19, while organizational support did not significantly change ($p > 0.05$). Work-life balance significantly decreased during the pandemic ($p = 0.012$), and the mental health indicators stress ($p = 0.005$), anxiety ($p < 0.001$), and depression ($p < 0.001$) increased significantly. Reliability analysis (Cronbach's alpha) demonstrated good internal consistency across the scales. These findings underscore the significant negative impact of the COVID-19 pandemic on the mental health of defense employees, reinforcing the need for sustained support mechanisms to promote both physical and mental well-being in this workforce.

Keywords: work-life balance, mental health, COVID-19 pandemic, defense employees, stress and anxiety, Hungarian military.

JEL Classification: I18, H75.

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1. Introduction

In December 2019, clusters of patients with pneumonia were first reported in Wuhan, Hubei Province in China (Zhu et al., 2020). The World Health Organization (WHO) officially reported the first case of a SARS-CoV2 infection on December 31st, 2019. Infections spread rapidly throughout the world and COVID-19 was declared a pandemic on March 11th, 2020. The pandemic has since significantly disrupted daily life, economies, and public health systems worldwide (Klementová et al., 2023; Lincényi & Mindár, 2022; Mikołajczak et al., 2022). The effects extended beyond physical health and had an impact on mental health, work-life balance,

and overall well-being (Kupcova et al., 2023). The WHO reported a substantial increase in anxiety, depression, and stress-related disorders as a consequence of the COVID-19 pandemic (World Health Organization [WHO], 2020).

Employees working in military defense positions across nations and continents were particularly affected and experienced unique challenges because of the nature of their work and the extra burdens imposed on them due to the pandemic (Bond et al., 2024; Griffith et al., 2023; Mahar et al., 2022; Mariani et al., 2024; Matthias et al., 2022; Ndiaye et al., 2024; Payne et al., 2020; Purcell et al., 2021; Valladares-Garrido et al., 2022a, 2022b, 2023).

Some military members were isolated from their families due to deployments or quarantine measures, leading to feelings of loneliness and isolation (Nair & Banerjee, 2021). Social distancing and restrictions on gatherings impacted the ability to connect with peers and support networks. The pandemic disrupted established routines, including training schedules and work environments, leading to uncertainty and stress. Access to mental health services was disrupted or limited in some areas, affecting those who relied on these services for support (Guo et al., 2020). Let's also not forget that the epidemic, like other issues, had an impact on securitization, an issue we did not want to deal with in this study (Besenyő, 2019; Ivančík & Andrassy, 2023).

The COVID-19 pandemic has significantly disrupted work-life balance across various sectors, with military personnel facing unique challenges in maintaining this equilibrium. Military service members, traditionally subject to rigid schedules and extended deployments, experienced increased stress during the pandemic as they adapted to new safety protocols, remote work, and fluctuating operational demands. The pandemic exacerbated stress for military families due to the uncertainty of deployments, isolation from loved ones, and the strain of balancing military responsibilities with family needs (Nair & Banerjee, 2021). Moreover, the shift to remote training and virtual communication, although essential, added additional layers of complexity to work-life balance, as military personnel struggled to navigate the blending of professional duties with home life.

Moreover, military support played a crucial role in bolstering civilian health systems and responding to public health crises in several key ways. For instance, military personnel was deployed to help overwhelmed civilian healthcare facilities, providing much-needed manpower and expertise during critical times (Acacio et al., 2023). This support has been instrumental in alleviating the strain on healthcare workers and ensuring that patient care standards are maintained.

In addition to direct assistance in medical settings, the military was actively involved in the logistics of healthcare by transporting essential medical supplies. This included the swift and efficient delivery of vaccines, medications, and other crucial materials, ensuring that they reach their destinations promptly and effectively (Kalkman, 2021). This logistical capability is vital during emergencies when the timely distribution of supplies can significantly impact health outcomes.

Furthermore, military support extended to public health initiatives such as vaccination campaigns. Service members played a key role in administering vaccines and organizing vaccination sites, thereby enhancing the reach and efficacy of these efforts (Lopez, 2021). Their involvement was pivotal in accelerating the pace of vaccination, contributing to the broader goal of achieving herd immunity and controlling the spread of infectious diseases.

More than five years have passed since the first reported case of COVID-19 in China, and two years since the pandemic status was officially ended by the WHO. Nonetheless, the pandemic had a profound and lasting impact on people and businesses across sectors. The

analysis and understanding of this impact is of importance to alleviate COVID-19-related consequences and to be prepared for future pandemics. In that sense, post-pandemic studies are being conducted to assess the long-term consequences of COVID-19 in general and on the workforce in different sectors in particular. One aspect to be studied in this context is the impact on the mental health of workers. Recent reviews examined the consequence of the pandemic for mental healthcare professionals. The review highlighted increased workloads, burnout, and mental health challenges among these workers, emphasizing the need for ongoing support (Crocker et al., 2023; Rossi et al., 2023). Others have focused on the increase in remote work during COVID-19 and the challenges of transitioning back to presence at the workplace (Nowrouzi-Kia et al., 2024; Silver, 2023). Moreover, socioeconomic impacts have been observed for the workforce, with reports highlighting increases in unemployment rates due to the pandemic and increased psychological stress because of it (Katole, 2023; Nandi & Chauhan, 2022). It is apparent that COVID-19 had a continuous impact on all aspects of life, including work life, the economy, and mental health.

Relevant previous publications on the effect of the COVID-19 pandemic are first summarized in a literature review. The Methods section that follows describes the research design, data collection, and analysis procedures. The Results section presents key findings on work-life balance, mental health, and perceived health status among Hungarian defense employees. The Discussion compares these results with previous research, and the Conclusion summarizes key insights, limitations, and implications for future studies and practical applications.

2. Literature review

The increased and continuous engagement of military personnel during the COVID-19 pandemic has taken a toll on their physical and mental health. Studies have emphasized an increase in the prevalence anxiety, depression, and stress due to COVID-19 amongst military personnel (Baker et al., 2023; Cronk, 2020; Guo et al., 2020; Gupta et al., 2020; Hill et al., 2023; Kotoulas et al., 2023; Lee et al., 2022; Li et al., 2023; Na et al., 2022; Spiller et al., 2023; Sudom & Lee, 2022).

Pomer et al. (2024) evaluated the effect of the pandemic on the US Military Health System response by reviewing 16 internal Department of Defense (DoD) reports. The finding clearly indicated delayed care which led to diminishing health in the military personnel (Pomer et al., 2024). In the same context, the prevalence of COVID-19 among defense employees as documented in databases from 2019 to 2021 and its effect on their mental well-being was investigated in a systematic review by Sahlabadi et al. (Sahlabadi et al., 2022). The results of the review revealed that COVID-19 significantly impacted the mental health and well-being of military personnel, with notable variations in prevalence among different branches. Although the disease was widespread in the armed forces, it was less common among Navy personnel. Contributing factors to the spread included inadequate training and poor nutritional status. The pandemic led to increased rates of depression and anxiety, particularly among physicians and veterans. Factors such as sleep quality, occupation, and age influenced mental health outcomes. Guo et al. (2020) examined the mental health of 642 employees of a military hospital during the COVID-19 pandemic and observed a higher rate of anxiety and depression. Potential risk factors for increased anxiety were fear of being infected themselves or transmitting the infection to their families. The study also advocated that military personnel should receive suitable care to maintain their mental health during particularly stressful periods (Guo et al., 2020). In this regard, a case report by Yehuda et al. (2020) summarized the case of a

young soldier who was involuntarily committed to a psychiatric hospital due to the severity of his mental health as a result of COVID-19.

Quartana et al. assessed the prevalence of COVID-19 concerns, information needs, demographic disparities, and the connection between these concerns and mental health outcomes among U.S. Army soldiers (Quartana et al., 2023). Surveys involved active duty and reservist soldiers from three regions: Northwest U.S., Europe, and the Asia-Pacific. Major concerns included restrictions on time with friends and family, social activities, and changing COVID-19 regulations. Common information needs involved stress management, travel, self-protection, and mission readiness. COVID-19 concerns remained consistent across both phases and were linked to a higher risk of mental health issues. These findings suggest a need for targeted support and monitoring of specific demographic groups to address mental health challenges in the Army.

Adler et al. explored the impact of leadership behaviors related to COVID-19 on U.S. Army soldiers' mental health and adherence to public health guidelines (Adler et al., 2022). An anonymous survey was conducted among 7,829 soldiers from December 2020 to January 2021. Soldiers rated their immediate supervisors' COVID-19-specific leadership behaviors, with outcomes focused on mental health (depression and anxiety) and compliance with health guidelines. After adjusting for various factors like rank and general leadership, results showed that strong COVID-19 leadership behaviors were associated with lower rates of depression and anxiety, and higher adherence to public health measures. The findings suggest that training supervisors to adopt health-promoting behaviors can enhance soldier well-being and public health compliance, particularly in high-risk occupations.

Goodman and Martinez (2024) assessed the impact of the COVID-19 pandemic on U.S. Air Force in terms of experienced workplace, fitness, and lifestyle changes that likely added stress to their already demanding roles, affecting their emotional, social, and physical well-being (Goodman & Martinez, 2024). 1,488 cyber personnel completed an online occupational health survey, which measured burnout, psychological distress, work strain, and health behaviors.

Qualitative analysis revealed 32 negative and 13 positive themes. Most respondents (68.5%) reported negative impacts, such as reduced face-to-face interactions and loss of personal activities, which were linked to increased psychological distress and work strain. Recommendations for future pandemic responses emphasize addressing these challenges to support psychological health.

Hill et al. (2023) analysed data from 3,078 U.S. military employees during the COVID-19 pandemic in terms of their mental health and wellbeing. They concluded that the percentage of employees with Generalized Anxiety Disorder (GAD) increased significantly (from 7.1% to 9.4%), mainly in veterans aged between 45 and 64 (Hill et al., 2023). In the same study it was also concluded that while major depressive disorder and posttraumatic stress disorder rates were stable, there was a 13.2% increase in psychiatric disorders. Furthermore, loneliness and pandemic-related concerns were found to be linked to increased levels of distress, while extended social networks and secure attachments were linked to reduced distress.

Similar observations were made in European military systems. Gómez-Galán et al. (2020) investigated burnout levels among Spain's State Security Forces and Armed Forces during the COVID-19 pandemic. Utilizing the Maslach Burnout Inventory (MBI), the study assessed burnout through its subscales and overall score. Findings reveal significant burnout, with 28.5% of participants showing high levels across all MBI subscales: emotional exhaustion (53.8%), depersonalization (58.0%), and lack of personal accomplishment (46.3%) (Gómez-Galán et al., 2020).

Gracia-Lanchares et al. (2024) aimed to evaluate the psychological effects of the COVID-19 crisis on police and armed forces personnel. An online survey with 242 participants was conducted to measure posttraumatic stress symptoms (PTSS), burnout, emotional suppression, and various labor and sociodemographic factors (Gracia-Lanchares et al., 2024). Results indicated that one-third of the participants experienced severe PTSS, which was associated with specific stressors such as frequent patrolling, high levels of contact with the public, fear of infection, perceived severity of the pandemic, living with vulnerable individuals, undergoing COVID-19 testing, increased workload, exposure to assaults, limited vacation time, and separation from loved ones. PTSS was also found to be correlated with burnout and emotional suppression. Additionally, about three-quarters of the participants reported not receiving any support from their workplace. The findings highlight the urgent need for targeted interventions to improve the personal, social, and work conditions for these professionals.

The Irish Defense Forces responded to the COVID-19 crisis by deploying personnel to assist civil authorities with medical, logistical, and operational support. A study by Mitchell et al. examined mental health and resilience among DF members, comparing those deployed on pandemic-related duties with non-deployed personnel (Mitchell et al., 2023). Data from 231 Defense Force members was analyzed using various mental health and resilience scales. No significant differences were found between deployed and not deployed groups in terms of psychological distress or self-rated mental health before and during COVID-19. However, depression was linked to lower resilience, while experiencing multiple traumatic events was associated with higher resilience. The study highlights the need to improve psychological support access for Defense Forces personnel and military populations.

In mid- and low-income economies, the COVID-19 pandemic had even more detrimental consequences. The economic downturn caused by COVID-19 led to the worst recession Africa had faced in half a century, which in turn intensified frustrations with governmental responses and capabilities (Chin & Kirkpatrick, 2023). This economic strain has disproportionately affected poorer countries, where military forces faced increasing pressure to act decisively against deteriorating security situations, particularly in the Sahel region, where Islamist insurgencies are rampant. The military in several African nations has become increasingly involved in political affairs, often justifying coups as necessary actions to restore stability and address security threats. For instance, in countries like Mali and Burkina Faso, military leaders capitalized on public discontent regarding ineffective governance in the face of insurgencies. The military's role has shifted from a focus on external threats to internal power struggles exacerbated by the pandemic. The military often entrenched itself in power, leading to a cycle of coups that further destabilized the democratic process. In essence, the COVID-19 pandemic has not only intensified existing vulnerabilities within African states but has also altered the military's role, making it a pivotal player in the political landscape amid a backdrop of economic and social upheaval (Chin & Kirkpatrick, 2023).

These results underscore the urgent need for preventive and therapeutic interventions to mitigate stress and anxiety among these workers, particularly in light of potential future pandemic challenges.

The pandemic also triggered concerns about increased suicide rates among active-duty soldiers due to stress and lack of mental support during and after the COVID-19 waves (Li et al., 2023; Na et al., 2022; Schaughency et al., 2021; Valladares-Garrido et al., 2022).

The COVID-19 pandemic also significantly impacted on the families of armed forces members. To assess this impact, the Behavioral Health Advisory Team surveyed over 20,000

soldiers from three major Army bases in the northwestern U.S., South Korea, and Germany (Gomez et al., 2023). The analysis revealed that factors such as gender, rank, financial hardship, work disruptions due to childcare, and family coping difficulties (including those of soldiers, spouses, and children) were strongly associated with higher risks of depression and anxiety. These results highlight the parallels between Army families and civilians during the pandemic. Army leaders can use these insights to improve support systems and ensure that soldiers and their families are accessing necessary services, while adapting military resources to better address their needs during crises and beyond.

Spouses of military personnel, often serving as primary caregivers, face increased stress, potentially leading to mental health struggles and burnout. A study by Hansen et al. examined the mental health and well-being of 365 spouses of Canadian Armed Forces Veterans between July 2020 and February 2021 (Hansen et al., 2023). Findings showed elevated rates of depression, anxiety, alcohol use disorder, and PTSD among spouses, with many attributing their symptoms to the pandemic. Those exposed to COVID-19 had notably worse mental health outcomes. Over 56% of participants used telehealth, with more than 70% expressing a willingness to continue post-pandemic.

In Eastern Europe, the COVID-19 pandemic has had profound implications on various sectors. In Romania, the military was mobilized to enforce public health measures, which included the imposition of lockdowns. This militarization of the state response to the pandemic was evident as military vehicles patrolled the streets to ensure compliance with emergency regulations (Poenaru, 2021). This involvement of the military signified a shift from traditional defense roles to active participation in domestic governance, particularly in public health enforcement. Moreover, the pandemic exacerbated existing challenges within the Romanian health system, which is historically underfunded and understaffed (Dascalu, 2020). The healthcare sector's struggles were mirrored in military hospitals, which also faced resource shortages and management issues. The military was tasked with not only defending the nation but also addressing the urgent needs of a healthcare system that was ill-prepared for the pandemic. This dual role placed additional strain on military resources and personnel, as they had to adapt to new responsibilities while maintaining their traditional military functions. The pandemic further led to a perception of the military as an essential component of the national response to crises, which may have lasting implications for its role in Romanian society. The increase in military visibility and involvement in civilian matters could reshape public perceptions and expectations regarding the military's function in non-traditional contexts, such as public health emergencies (Poenaru, 2021).

In Serbia, the Serbian Armed Forces actively participated in efforts to counter the pandemic by supporting civil authorities with planning, logistics, and medical personnel (Knežević, 2022). However, the pandemic led to delays and cancellations of training exercises and troop deployments, creating additional security challenges. The National Security Strategy of Serbia recognized pandemics as a security challenge, emphasizing the need to pay special attention to the prevention and suppression of infectious diseases.

In Austria, where military personnel was involved in the enforcement of COVID-19-related restrictions and interventions, a 100% surge in legal complaints by soldiers was noted due to issues with training and service operations, infrastructure, personnel matters, supply issues, and disciplinary and complaint-related matters that had been experienced by personnel (Austrian Parliament, 2021). Soldiers were increasingly deployed for assistance and support tasks for civilian institutions. The increase in complaints was particularly related to restrictions on leave to reduce infection risks. Additionally, soldiers deployed in assistance tasks,

who performed similar duties to their voluntary combat-exercising counterparts, expressed dissatisfaction with the lower pay for assistance tasks.

In April 2020, a survey among Slovenian military families assessed their ability to balance work, childcare, and home schooling during the pandemic lockdown (Vuga Beršnak et al., 2023). The military's increased workload during this period significantly affected civilian female spouses, who bore the brunt of unpaid domestic work and childcare responsibilities. The study revealed that larger families and those with primary school children faced the most difficulties, while dual-serving military families reported feeling more successful in managing these challenges. Key factors influencing work-life balance included support measures on macro and micro social levels, family structure, and the number and age of children. The lack of extended family support and the closure of educational institutions negatively impacted families' ability to navigate their responsibilities. Overall, the findings highlighted that civilian spouses paid the highest price, reinforcing traditional gender roles in family dynamics during the crisis.

The COVID-19 outbreak in Hungary witnessed multiple waves that had a significant impact on public health as well as healthcare systems. The pandemic caused lockdowns, travel limits, and vaccination drives. Hungary faced severe outbreaks, during the second and third waves in late 2020 and early 2021 respectively, driven by the Alpha and Delta variants. The fourth wave of COVID-19 in this country, by the Delta variant, resulted in 454,018 cases and 9,824 deaths from mid-2021 to early 2022. Despite the use of SARS-CoV2 vaccines, the Delta variant caused a sharp increase in cases till mid-2021 (European Centre for Disease Prevention and Control [ECDC], 2021; WHO, 2021).

The research revealed that Hungarian defense personnel experienced increased stress and anxiety during the COVID-19 pandemic, aligning with a study conducted in Germany where military personnel also noted heightened mental health challenges (Müller & Schmidt, 2021). Nevertheless, the German military swiftly implemented mental health interventions like telehealth services and resilience training programs, which successfully alleviated long-term psychological effects. In contrast, Hungarian defense forces could improve by adopting similar strategies to support their personnel during and after critical situations.

In contrast to the Hungarian military, which had limited support mechanisms, Norway's armed forces swiftly adjusted to the pandemic by implementing work-life balance policies, including flexible work schedules and improved family support services (Johansen & Eriksen, 2022). These initiatives played a role in reducing reported levels of burnout and stress among Norwegian personnel. Subsequent studies should investigate how these military support models from Northern Europe can be customized to the Hungarian context to promote mental health and well-being.

Italian military personnel benefited from access to specialized mental health resources and structured debriefing sessions during the pandemic, resulting in a notable decrease in anxiety and depression rates (Rossi et al., 2021), unlike the Hungarian defense sector. Implementing comparable programs, particularly emphasizing debriefing and counseling services, could help the Hungarian military address the enduring impacts of COVID-19 on their personnel.

Similar to other countries, these multiple waves of COVID-19 had a severe impact on day-to-day life of employees across all economic branches in Hungary. There is currently a lack of studies investigating how Hungarian defense personnel was affected by the pandemic. Therefore, this study aimed to investigate the effects of COVID-19 on work-life balance, mental health, and perceived health status of Hungarian defense employees using a cross-sectional online survey.

3. Methods

3.1. Conceptual framework

The conceptual framework of this study explores the impact of the COVID-19 pandemic on the work-life balance, mental health, and perceived health status of Hungarian defense employees (Figure 1). The pandemic has disrupted traditional military schedules, leading to heightened stress due to remote work, isolation from family, and uncertainty regarding deployments. As military personnel face challenges in maintaining a balance between work and personal life, it is expected that these disruptions have negatively impacted their overall well-being. Specifically, the pandemic is hypothesized to reduce work-life balance by complicating the separation of professional duties from home life, which may, in turn, contribute to worsening mental health outcomes, such as increased anxiety, depression, and stress. This, in turn, may lead to poorer perceptions of physical and mental health among defense employees.

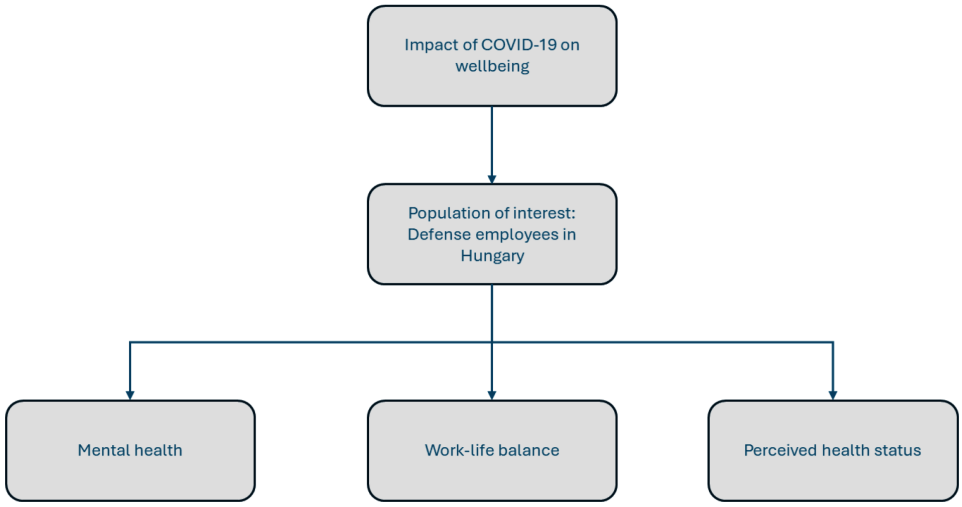

Figure 1. Conceptual framework for the present study

The framework also considers the role of mediating and moderating factors. The availability of social support, coping strategies, and access to mental health resources may influence the relationship between work-life balance and mental health. Additionally, personal resilience, previous mental health conditions, and exposure to frontline operations during the pandemic may moderate how these variables interact. External factors such as government policies, changes in military protocols, and societal responses to the pandemic also shape how defense employees experience these challenges.

Overall, the framework posits that COVID-19's disruptions to work-life balance are a significant driver of deteriorating mental health and perceived health status, with external and individual factors playing key roles in these outcomes. This conceptual approach provides a foundation for understanding the complexities faced by military personnel during the pandemic in Hungary and can inform future studies and policies aimed at improving their well-being.

3.2. Study design and data collection

A cross-sectional online survey was used in this study to assess the effects of the COVID-19 pandemic on mental health, work-life balance, and perceived health status among Hungarian defense employees. Data was collected using an online questionnaire specifically designed for this study. The questionnaire included 6 sections like demographic information, health practices and preparedness measures, workplace adaptations and response strategies questionnaire, work life balance (WLB), Depression Anxiety Stress Scale (DASS Scale), Perceived Health Status (SF-12 health survey)- Pre-COVID, During-COVID and Post-COVID.

3.3. Participants

Participants were Hungarian defense employees who were employed during the COVID-19 pandemic were recruited for the study. This included military personnel, administrative staff, and other support workers. Are. The Researched Company was Ministry of Defense Hungary Electronics, Logistics and Asset Management Ltd. Participants were enlisted over internal communication channels like emails within the Hungarian defense sector. An invitation to participate and a link for online survey, was distributed. The survey was accessible for three to four weeks. Reminders were sent weekly for increase in participation. A minimum sample size of 564 participants were taken to ensure adequate statistical power for detecting effects with a confidence level of 95%.

The inclusion criteria were:

- People who can read and write Hungarian;
- People employed in the Hungarian defense sector during the COVID-19 pandemic;
- People who give consent to participate in the study.

The exclusion criteria were:

- Individuals not employed in the Hungarian defense sector;
- Individuals who are non-Hungarian speakers;
- Those who do not consent to participate.

3.4. Ethical considerations

Informed consent was obtained before participants can access the survey. Ethical approval for the study was obtained from institutional review board. Participants were provided with a data sheet specifying the aim of the study and assurance of confidentiality.

3.5. Data analysis and limitations

Descriptive statistics was employed to provide an outline of the demographic characteristics of the sample and the distribution of responses for work-life balance, mental health, and perceived health status. Means, standard deviations, frequencies, and percentages were calculated for all variables. One way ANOVA was carried out to examine the relationships between variables.

4. Results

4.1. Demographic characteristics

Demographic data on Hungarian Defense employees participating in the study are shown in Table 1. Most of participants i.e. 66.5% were male, with 33.5% females. The largest and smallest age group were 41–50 years (34.2%), and 18–30 years (9.6%) respectively. Participants of age 51–60 years made up 28.2%, and 61 years and above made up 11.2%. As far as education was concerned, 42.9% had a postgraduate degree, and 42.7% had done school. Relatively smaller percentage of people held professional qualification (9.4%) or undergraduate degree (5.0%). Most of the participants surveyed had >6 years' experience followed by 1–3 years, 4–6 years, and <1 year.

Table 1. Sociodemographic and other characteristics of employees of a Hungarian defense company (n = 564)

Variables	Categories	Numbers	%
Gender	Male	375	66.5
	Female	189	33.5
Age (in years)	18–30	54	9.6
	31–40	95	16.8
	41–50	193	34.2
	51–60	159	28.2
	>=61	63	11.2
Educational qualification	Completed school	241	42.7
	Undergraduate	28	5.0
	Postgraduate	242	42.9
	Professional	53	9.4
Experience in the defense sector	<1 year	43	7.6
	1–3 years	97	17.2
	4–6 years	88	15.6
	More than 6 years	336	59.6

4.2. Work-related observations

The nature of work, work flexibility, and workload of Hungarian Defense employees perceived steadily across the pre, during, and post COVID-19 periods (Table 2, Figure 2). The data reflects changes across several work-related and mental health variables over three time periods: Pre, During, and Post. Overall, findings suggest stability in work-related perceptions, with some minor fluctuations, and a temporary increase in mental health symptoms during the pandemic, followed by partial recovery.

For nature of work, scores remained high and stable, with only minor fluctuations over time (mean approximately 3.9 to 4.0), indicating consistency in how participants perceived the nature of their work. Work flexibility, however, showed a slight decline from Pre-COVID-19 (mean 3.84) to Post-COVID-19 (mean 3.74), suggesting a modest decrease in perceived flexibility over time. Workload scores stayed consistent across all periods, with a low average (around 2.05 to 2.06), indicating stable workload perceptions.

Compensation showed a slight increase in the Post-COVID-19 period (mean 3.25) compared to the Pre-COVID-19 period and during the pandemic (mean around 3.12), which may reflect improvements in satisfaction with pay or adjustments made to compensation over time. In terms of organizational support, scores were generally low across all periods (mean around 2.3 to 2.5) but showed a slight increase from Pre- (2.35) to Post-COVID-19 (2.46), suggesting a small improvement in perceived support from the organization. For personal life, satisfaction dropped slightly during the pandemic (mean 3.16) and partially recovered Post-COVID-19 (3.24), indicating that employees' personal life satisfaction was most impacted during the pandemic

The mental health indicators – stress, anxiety, and depression – followed a similar pattern (Figure 3). All three measures increased from Pre-COVID-19 during the pandemic and then decreased slightly in the post-pandemic phase, yet remained above Pre-COVID-19 levels. Specifically, stress rose from 0.70 Pre-COVID-19 to 0.85 during the pandemic, before dropping slightly to 0.77 Post-COVID-19. Anxiety levels were initially low (0.30 Pre-COVID-19) but increased to 0.48 during the pandemic, followed by a slight decrease to 0.43 Post-COVID-19. Depression showed a similar trend, rising from 0.42 Pre-COVID-19 to 0.59 during COVID-19 and then slightly decreasing to 0.51 Post-COVID-19.

In summary, work-related measures showed relatively stable or minor improvements over time, particularly in compensation and organizational support. Conversely, mental health indicators reflected a temporary rise in symptoms during the middle phase, with only a partial return to baseline levels afterward, indicating lingering effects on employee mental health.

Table 2. Descriptive Statistics for the study variables

		Mean	SD	Max	Min
Nature of work	Pre	3.94	0.83	5.00	1.00
	During	3.90	0.81	5.00	1.00
	Post	3.98	0.79	5.00	1.00
Work Flexibility	Pre	3.84	0.80	5.00	1.00
	During	3.79	0.70	5.00	1.00
	Post	3.74	0.66	5.00	1.00
Workload	Pre	2.05	0.95	5.00	1.00
	During	2.06	0.94	5.00	1.00
	Post	2.06	0.97	5.00	1.00
Compensation	Pre	3.12	0.99	5.00	1.00
	During	3.11	0.98	5.00	1.00
	Post	3.25	0.96	5.00	1.00
Organizational Support	Pre	2.35	0.95	5.00	1.00
	During	2.33	0.96	5.00	1.00
	Post	2.46	0.97	5.00	1.00
Personal Life	Pre	3.30	0.89	5.00	1.00
	During	3.16	0.79	5.00	1.00
	Post	3.24	0.76	5.00	1.00
Stress	Pre	0.70	0.74	2.83	0.00
	During	0.85	0.80	3.00	0.00
	Post	0.77	0.79	3.00	0.00

End of Table 2

		Mean	SD	Max	Min
Anxiety	Pre	0.30	0.67	3.00	0.00
	During	0.48	0.74	3.00	0.00
	Post	0.43	0.70	3.00	0.00
Depression	Pre	0.42	0.66	3.00	0.00
	During	0.59	0.71	3.00	0.00
	Post	0.51	0.70	3.00	0.00

Note: SD- Standard Deviation, Max-Maximum, Min-Minimum.

Figure 2. Mean score of study variables between Pre, During and Post COVID-19

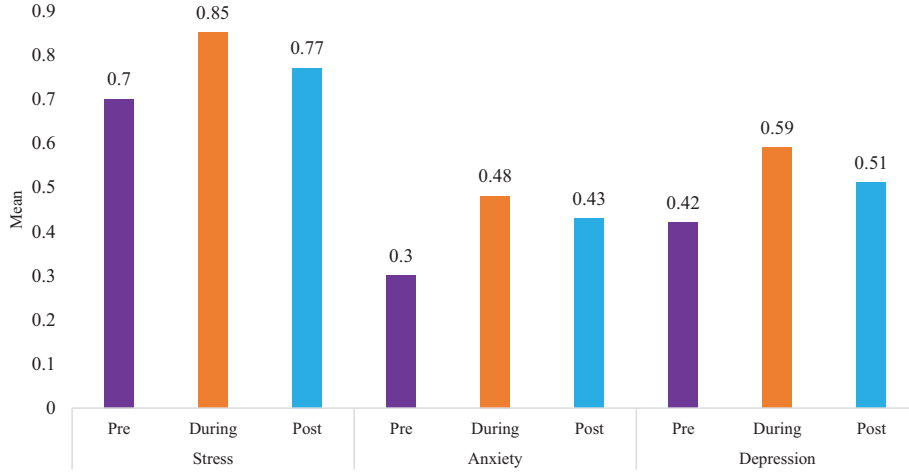

Figure 3. Mean scores of stress, anxiety and depression between Pre, During and Post COVID-19

4.3. Reliability analysis

Cronbach's alpha values for the scales used in the study are depicted in Table 3. Alpha values above 0.8 indicated good internal consistency, and moderate values i.e. between 0.6 and 0.8 suggested some variability in perceptions among employees (Table 3). These findings supported the reliability of the measurement tools used in the study for assessing the impact of the COVID-19 crisis on employee well-being and work-related experiences.

Table 3. Reliability analysis

	Number of items	Cronbach's alpha
Nature of work	6	0.838
Work Flexibility	4	0.611
Workload	4	0.753
Compensation	5	0.827
Organizational Support	3	0.715
Personal Life	4	0.627
Work Life Balance (WLB)-Overall	26	0.869
Stress	6	0.891
Anxiety	2	0.781
Depression	9	0.938
DASS scale (Overall)	17	0.947

4.4. Inferential statistics

Result obtained from one-way ANOVA indicated significant changes in mean work-life balance and DASS scores across the pre, during, and post COVID-19 periods (Table 4). Compensation satisfaction was found to be significantly increased post-COVID ($p = 0.025^*$). Work-life balance perceptions were decreased during COVID and partially reverted subsequently ($p = 0.012^{**}$). There

Table 4. Difference in mean Work life balance and DASS scale between Pre, during and Post COVID using One-way ANOVA

	COVID-Pre (n = 564)	COVID- During (n = 564)	COVID-Post (n = 564)	p-value
	Mean±SD			
Nature of work	3.94±0.83	3.90±0.81	3.98±0.79	0.244
Work Flexibility	3.84±0.80	3.79±0.70	3.74±0.66	0.085
Workload	2.05±0.95	2.06±0.94	2.06±0.97	0.954
Compensation	3.12±0.99	3.11±0.98	3.25±0.96	0.025*
Organizational Support	2.35±0.95	2.33±0.96	2.46±0.97	0.072
Personal Life	3.30±0.89	3.16±0.79	3.24±0.76	0.012**
Stress	0.70±0.74	0.85±0.80	0.77±0.78	0.005**
Anxiety	0.30±0.67	0.48±0.74	0.43±0.70	0.000**
Depression	0.42±0.66	0.59±0.71	0.51±0.70	0.000**

Note: **p < 0.01, *p < 0.05.

was significant increase in stress levels during COVID which decreased slightly post-COVID (p = 0.005**). Similarly, both anxiety and depression levels significantly increased during the pandemic, with anxiety level slight decreased and depression partly recovered post-COVID (both p = 0.000**). Other variables like the nature of work, work flexibility, workload, and organizational support, were not found to be statistically significant (p > 0.05).

The Tukey HSD test was employed to assess the statistical significance of differences between the Pre, During, and Post periods across various dependent variables (Table 5).

Table 5. Multiple Comparisons using Tukey HSD

Dependent Variable	(I) Index1	(J) Index1	Mean Difference (I-J)	Std. Error	p-value
Nature of work	Pre	During	.03812	.04839	.711
		Post	–.04314	.04839	.646
	During	Pre	–.03812	.04839	.711
		Post	–.08126	.04839	.213
	Post	Pre	.04314	.04839	.646
		During	.08126	.04839	.213
Work Flexibility	Pre	During	.04699	.04307	.520
		Post	.09574	.04307	.068
	During	Pre	–.04699	.04307	.520
		Post	.04876	.04307	.494
	Post	Pre	–.09574	.04307	.068
		During	–.04876	.04307	.494
Workload	Pre	During	–.01507	.05666	.962
		Post	–.01507	.05666	.962
	During	Pre	.01507	.05666	.962
		Post	.00000	.05666	1.000
	Post	Pre	.01507	.05666	.962
		During	.00000	.05666	1.000
Compensation	Pre	During	.00709	.05821	.992
		Post	–.13333	.05821	.057
	During	Pre	–.00709	.05821	.992
		Post	–.14043*	.05821	.042
	Post	Pre	.13333	.05821	.057
		During	.14043*	.05821	.042
Organizational Support	Pre	During	.01891	.05704	.941
		Post	–.10284	.05704	.169
	During	Pre	–.01891	.05704	.941
		Post	–.12175	.05704	.083
	Post	Pre	.10284	.05704	.169
		During	.12175	.05704	.083
Personal Life	Pre	During	.14495*	.04865	.008
		Post	.06250	.04865	.404

End of Table 5

Dependent Variable	(I) Index1	(J) Index1	Mean Difference (I-J)	Std. Error	p-value
	During	Pre	–.14495*	.04865	.008
		Post	–.08245	.04865	.207
	Post	Pre	–.06250	.04865	.404
		During	.08245	.04865	.207
Stress	Pre	During	–.15100*	.04626	.003
		Post	–.07122	.04626	.273
	During	Pre	.15100*	.04626	.003
		Post	.07979	.04626	.196
	Post	Pre	.07122	.04626	.273
		During	–.07979	.04626	.196
Anxiety	Pre	During	–.18528*	.04181	.000
		Post	–.13652*	.04181	.003
	During	Pre	.18528*	.04181	.000
		Post	.04876	.04181	.474
	Post	Pre	.13652*	.04181	.003
		During	–.04876	.04181	.474
Depression	Pre	During	–.16982*	.04106	.000
		Post	–.08708	.04106	.086
	During	Pre	.16982*	.04106	.000
		Post	.08274	.04106	.109
	Post	Pre	.08708	.04106	.086
		During	-.08274	.04106	.109

Note: *p < 0.05.

Analysis of the nature of work revealed no significant differences across periods, with all p-values > 0.05, suggesting that perceptions regarding the nature of work remained stable throughout the periods. Similarly, work flexibility showed no statistically significant differences, with all p-values > 0.05, indicating a consistent perception of flexibility over time.

For workload, the analysis also indicated no significant changes across periods, pointing to a stable perception of workload throughout the Pre, During, and Post periods. In contrast, compensation exhibited a significant difference between the During and Post periods (mean difference = 0.14043, p = 0.042), reflecting a slight improvement in perceptions of compensation.

Regarding organizational support, no significant differences were observed across any of the time periods, which suggests steady perceptions of organizational support over time. Personal life, however, displayed a significant difference between the Pre and During periods (mean difference = 0.14495, p = 0.008), indicating a temporary decline in personal life satisfaction during the pandemic. This measure showed a partial recovery in the Post period.

For stress, there was a statistically significant increase from the Pre to the During period (mean difference = .15100, p = .003), yet this increase was not significant when comparing Pre to Post or During to Post, suggesting that stress levels rose temporarily but partially normalized after the pandemic. Anxiety followed a similar pattern, with significant increases

from the Pre to the During period (mean difference = 0.18528, $p < 0.001$) and from the Pre to the Post period (mean difference = 0.13652, $p = 0.003$). These findings imply a lasting impact on anxiety levels, even though a reduction occurred in the Post period compared to the During period.

Lastly, depression showed a significant increase from the Pre to the During period (mean difference = 0.16982, $p < 0.001$); however, this difference was not statistically significant from the Pre to the Post period ($p = 0.086$), indicating a temporary rise in depressive symptoms during the pandemic that mostly receded afterward.

In summary, the analysis shows that while perceptions of work-related factors (nature of work, work flexibility, workload, and organizational support) remained stable over time, compensation showed a slight improvement after the pandemic. Personal life satisfaction temporarily declined during the pandemic but showed a partial recovery afterward. Mental health indicators – particularly stress, anxiety, and depression – experienced significant increases during the pandemic, with only partial reductions in the Post period, suggesting a lasting but slightly reduced impact on these measures.

5. Discussion

The results of this study projected the effects of the COVID-19 pandemic on Hungarian military employees with respect to their work-life balance, mental health, and perceived health status. The demographic data revealed that most of the participants were males aged between 41 and 50, who have completed school or held postgraduate degrees. This demographic profile agrees with the profile of other defense organizations (Cronk, 2020). The noted constancy in work flexibility and workload suggested that work-related stress imposed on military employees remained the same during and after the pandemic periods compared to the situation before the pandemic. This finding was unexpected, as previous studies have reported an increase in work-related stress due to the COVID-19 pandemic (Kotoulas et al., 2023; Ndiaye et al., 2024; Spiller et al., 2023). These differences could be related to the obligatory nature of their work, being used to recurring duties and the fulfilment of orders independent of the type of duty to be completed. Nonetheless it remains unclear why employees of the Hungarian military did not experience any obvious difference in stress levels during the pandemic.

The observed increase in satisfaction with compensation and organizational support after the pandemic demonstrates that measures were likely implemented to support employees during these challenging times, and it is assumed that this implementation was initiated because they experienced higher workloads and mental load. In this context, a significant increase in mental health issues, including stress, anxiety, and depression during the pandemic was reported by the military employees, from which they at least partially recovered after the pandemic ended. The self-reported increase in depression and anxiety is in line with the findings of previous studies that were conducted in North America, South America, and other European countries (Hill et al., 2023; Kotoulas et al., 2023; Ndiaye et al., 2024; Spiller et al., 2023; Sudom & Lee, 2022; Valladares-Garrido et al., 2022).

The elevated stress, depression and anxiety levels during COVID-19 compared to the pre- and post-phases can likely be attributed to the fear of infection of themselves and their family members, as well as on changes in the type of work and tasks to be completed during a time of numerous restrictions, isolation, and lack of mental support, as has been reported in previous studies (Guo et al., 2020; Valladares-Garrido et al., 2023).

This study reveals a significant increase in mental health issues, including stress, anxiety, and depression, among Hungarian defense personnel during the COVID-19 pandemic. These findings align with research from other European countries, such as Germany and Norway, where military personnel experienced similar psychological impacts during the pandemic (Johansen & Eriksen, 2022; Müller & Schmidt, 2021). However, unlike in Hungary, the German military implemented rapid mental health interventions like telehealth services and resilience training programs, which were effective in reducing long-term psychological impacts. Similarly, Norway's defense forces introduced flexible work schedules and enhanced family support services, contributing to lower burnout and stress levels among their personnel. The study also highlights the need for Hungary to adopt more robust support mechanisms. In contrast to countries like Italy, where the military provided specialized mental health resources and structured debriefing sessions that significantly reduced anxiety and depression rates (Rossi et al., 2021). Hungarian defense employees had limited access to such interventions. Drawing on these European examples, the Hungarian military should consider implementing similar support programs, including mental health screening, telehealth services, and structured counseling sessions, to address both immediate and long-term psychological effects of crises.

From a theoretical perspective, the findings can be understood through the lens of the Job Demands-Resources (JD-R) model, which suggests that increased job demands during the pandemic, coupled with insufficient resources, contributed to negative mental health outcomes among Hungarian defense personnel (Bakker & Demerouti, 2007; Siegrist, 1996). To mitigate these outcomes, it is crucial to enhance job resources, such as organizational support and mental health services, to balance the demands placed on military employees.

Comprehensive support networks for military employees have been implemented in other countries, particularly in Scandinavian countries. For example, proactive mental health screening and ongoing wellness programs are routinely included in the benefits of military personnel in Sweden (Lindström & Olsson, 2022). The Hungarian military could potentially also benefit from such measures, and they might reduce the long-term psychological impacts of pandemics and other crises on military employees. Whether such measures can be implemented in Hungary in practice and to what extend must be the focus of future studies. The literature review obviates differences in mental health outcomes between Hungary and countries such as the United Kingdom which have established extensive mental health support structures for military personnel (Walker & Turner, 2021).

The limitations of this study include the cross-sectional design and the subjective nature of the responses due to the questionnaire design. Nonetheless, this study offers an important contribution to the evaluation of mental effects of the COVID-19 pandemic on Hungarian military workers. The findings also revealed that providing mental health and organizational support could be helpful in reducing the impact of COVID-19 on military personnel in Hungary and globally. The internal consistency of the scales employed was validated by the reliability analysis, which supported the study's conclusions. The one-way ANOVA revealed substantial changes in both work-life balance and DASS ratings, indicating the pandemic's devastating impact on these dimensions.

6. Conclusions

In conclusion, this present study assessed the effects of COVID-19 on Hungarian military employees, focusing on demography, mental stress, and organizational support. The findings highlight the impact of the pandemic on the mental health and wellbeing of military

employees and point toward a critical need for continuous mental health care and organizational support to improve their overall well-being. The deterioration of work-life balance, which was partially restored after the pandemic, indicates the difficulties in maintaining a balance between personal and professional obligations during COVID-19. The results of this study and findings of previous studies highlight the need for continuous support for military employees beyond phases of immediate stress and workload. While in this study the mental issues faced during the pandemic decreased after the pandemic ended, they did not entirely reach the pre-pandemic levels, which suggests that military personnel needs a recovery period after times of increased pressure and challenges.

Although Hungary's defense personnel encountered significant mental health challenges during the pandemic, proactive interventions in other European countries provide a potential for improvement. Emulating the targeted mental health initiatives and work-life balance programs observed in Germany, Norway, and Italy could potentially enhance the resilience and well-being of Hungarian military employees. A key message to be taken away from the present literature review is the pressing need for cross-national collaboration to allow for an effective support across European countries. Future research should focus on cross-national military mental health initiatives that can provide a framework for countries with fewer resources, such as Hungary, to establish support systems for times of crisis.

Future studies should also focus on evaluating the effectiveness of these interventions in the Hungarian context, fostering cross-national collaboration to develop comprehensive support systems for defense personnel in Eastern Europe. This study emphasizes the necessity for further investigation in Eastern European countries such as Poland and Romania, where similar stressors among defense personnel might exist but have not been thoroughly studied. By conducting comparative research within Eastern European military forces, we can identify common challenges and develop effective interventions tailored to the unique cultural and operational contexts of this region.

Author contributions

Evelin Trembeczki: Conceived and designed the experiments, performed the experiments, analyzed and interpreted the data, and wrote the paper. Manuela Tvaronavičienė: Contributed to the design and implementation of the research. Besenyő János PhD: Contributed to the design and implementation of the research. István Kobolka PhD: Conceived and designed the experiments; contributed reagents, materials, analysis tools, or data.

Disclosure statement

The authors declare no competing interests.

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