Various factors contributing to burnout among paramedics: a multivariate approach

A mentősök kiégés-szindrómájához hozzájáruló különböző tényezők szerepe többváltozós megközelítésben

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ABSTRACT

Background

Burnout is still one of the leading mental health problems among paramedics. Even though numerous studies have examined factors related to the degree of burnout, little research has been done to examine the exact pattern in which these variables contribute to its degree.

Methods

In our study 727 Hungarian paramedics were enrolled. Participants completed the 21-item Burnout Measurement and the 8-item version of the Psychosomatic Symptom Scale. Using numerous demographic data Partial Least Squares regression analysis was applied to examine multivariate associations between demographic data and behavioral measures. Variable Importance in Projection (VIP) scores were computed to identify features contributing most strongly to the Partial Least Squares components.

Results

The Partial Least Squares regression revealed that that age (VIP score: 1.029), gender (VIP score: 1.21), job description (VIP score: 1.258) and level of education (VIP score: 1.225) contributed the most to the rate of burnout. However, physical-, emotional- and mental-exhaustion aspects of the burnout showed varying patterns of significant contributors. Regarding psychosomatic symptoms age (VIP score: 1.562) and gender (VIP score: 1.739) were the most significant contributors to symptom severity.

Conclusion

Our results indicate that the various demographic and work related factors contribute considerably and diversely to the degree of burnout and psychosomatic symptoms of paramedics. Our findings may help to understand the multifaceted nature of burnout and thus help to identify intervention and screening points that will make it easier and more effective to identify paramedics who need help before burnout develops.

Keywords: *burnout, psychosomatic symptoms, paramedics, multivariate approach.*

Abbreviations: *Burnout Measure (BM), Psychosomatic Symptom Scale (PSS), Partial Least Squares regression (PLS), Variable Importance in Projection (VIP).*

ÖSSZEFOGLALÁS

Háttér

A kiégés az egyik legfőbb mentális egészségügyi probléma a mentősök körében. Bár számos tanulmány vizsgálta a kiégés mértékével kapcsolatos tényezőket, kevés kutatás foglalkozott azzal, hogy ezek a változók pontosan milyen mintázatban járulnak hozzá a kiégés mértékéhez.

Módszerek

Kutatásunkban 727 mentős vett részt. A résztvevők kitöltötték a 21 tételes Kiégés Kérdőívet és a 8 tételes Pszichoszomatikus Tünet Skála kérdőívet. Parciális legkisebb négyzetek regressziót alkalmaztunk a demográfiai adatok és a viselkedési mutatók közötti többváltozós összefüggések vizsgálatára. A parciális legkisebb négyzetek komponenseihez leginkább hozzájáruló faktorok azonosítása érdekében kiszámítottuk a Változók Fontossága a Projekcióban (VIP) pontszámokat.

Eredmények

A parciális legkisebb négyzetek regressziója kimutatta, hogy az életkor (VIP pontszám: 1.029), a nem (VIP pontszám: 1.21), a munkaköri leírás (VIP pontszám: 1.258) és az iskolai végzettség (VIP pontszám: 1.225) járult hozzá leginkább a kiégés mértékéhez. A kiégés fizikai, érzelmi és mentális kimerültségi aspektusai azonban eltérő mintázatot mutattak a velük összefüggést mutató változók tekintetében. A pszichoszomatikus tünetek tekintetében az életkor (VIP pontszám: 1.562) és a nem (VIP pontszám: 1.739) járultak hozzé leginkább a tünetek súlyosságához.

Következtetés

Eredményeink azt mutatják, hogy a különböző demográfiai és munkával kapcsolatos tényezők jelentősen és sokféleképpen hozzájárulnak a mentősök kiégésének mértékéhez és pszichoszomatikus tüneteihez. Megállapításaink segíthetnek megérteni a kiégés sokrétű természetét, és így hozzájárulhatnak azoknak a beavatkozási és szűrési pontoknak a meghatározásához, amelyek megkönnyítik és hatékonyabbá teszik a kiégés kialakulása előtt segítségre szoruló mentősök azonosítását.

Kulcsszavak: kiégés, pszichoszomatikus tünetek, mentősök, többváltozós megközelítés.

Rövidítések: Kiégés Kérdőív (BM), Pszichoszomatikus Tünet Skála (PSS), Parciális Legkisebb Négyzetek regresszió (PLS), Változók Fontossága a Projekcióban (VIP).

INTRODUCTION

Burnout syndrome is a complex occupational phenomenon resulting from prolonged work stress, affecting mental, psychological, and physical health, as well as job performance (Aronsson et al., 2017; Woo et al., 2020). Although not classified as a medical condition, it is recognized by the WHO in the ICD-11. Burnout has significant public health and economic costs, with healthcare professionals particularly at risk (Bria et al., 2012). Reported prevalence varies widely, approximately 16–56% of paramedics are affected (Reardon et al., 2020). The definition of burnout remains debated, but it is generally described by three core dimensions: emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (PA). EE involves fatigue, loss of energy, and emotional depletion; DP reflects detachment, irritability, and indifference toward work or clients; and low PA is linked to negative self-esteem, reduced productivity, and decreased coping skills. Burnout differs from depression in that its symptoms are mainly work-related and often improve when stressors are removed, though it can progress into depression with broader psychological and physiological consequences (Bianchi et al., 2017; Edú-valsania et al., 2022; Khammissa et al., 2022). Assessment tools include the Burnout Measure (BM) (Malakh-Pines, 1981), widely used in Hungary among healthcare workers (Tamás et al., 2017, 2018). The BM evaluates burnout across emotional, physical, and mental exhaustion through 21 items (Enzmann et al., 1998).

Research on Hungarian healthcare workers shows that burnout varies by profession, gender, and work conditions. Nurses often report higher emotional exhaustion and depersonalization, while physicians score higher on personal accomplishment (Kovács et al., 2010). Female physicians tend to experience more emotional exhaustion, whereas depersonalization is more frequent in males; age is generally protective, correlating with lower exhaustion and higher accomplishment (Ádám et al., 2008; Adam et al., 2018; Győrffy & Girasek, 2015). Intensive care and emergency unit staff are especially vulnerable, with longer work hours, years of service, and job dissatisfaction strongly linked to higher burnout levels (Hompoth et al., 2018; Palfi et al., 2008; Piko, 2006; Sipos et al., 2019, 2020, 2023; Stankovic et al., 2019). Although less studied, paramedics face comparable or higher risks. Contributing factors include older age, exposure to threats, long shifts, multiple jobs, work-related stress, and dissatisfaction with the work environment (Adriaenssens et al., 2015; Alacacioglu et al., 2009; Alenazi et al., 2016; Braun et al., 2021; Molina-Praena et al., 2018). Some studies highlight gender effects (e.g., higher burnout among female paramedics), while others do not

find consistent differences. Importantly, tasks involving major accidents or rescue operations appear to increase vulnerability. Overall, evidence points to workload, job demands, and organizational factors as key contributors to burnout across healthcare professions, with paramedics emerging as one of the most at-risk groups. Although several factors have been linked to the severity of burnout syndrome, less is known about how these factors interact to produce distinct patterns leading to burnout.

METHODS

Instruments

The Burnout Measure (BM): The level of burnout was assessed using the questionnaire developed by Pines and Aronson (Malakh-Pines, 1981). The questionnaire focuses on items identified in previous research on burnout syndrome. Each item was scored on a seven-point Likert scale (1=never, 2=once or twice, 3=rarely, 4=sometimes, 5=often, 6=usually 7=always), rating symptoms that have occurred in the past 12 months. Answers were then categorized the following way: between 1-2 points state of constant euphoria; between 2-3 points no intervention needed; between 3-4 points need for change; above 4 points requires intervention. However, calculating burnout score (after recoding the positively phrased items), emotional (items 2, 5, 8, 12, 14, 17,21), mental (items 3, 6, 9, 11, 15, 18, 19), and physical exhaustion (items 1, 4, 7, 10, 13, 16, 20) rates were calculated using the listed items in the brackets (*Pines et al. (1981), Enzmann et al.(1998)*).

Psychosomatic Symptom Scale (PSS): The somatic background of burnout was assessed using a Hungarian-validated version of the Psychosomatic Symptom Scale. Each symptom is scored on a scale from 0 to 3 (0=never, 1=rarely, 2=occasionally, and 3=often). According to the original validation in a standard sample, from a total of 21 points, women scored an average of 6.1 points and men 5.0 points *(Pik et al., 1997)*.

Sociodemographic characteristics

The following factors were asked of the study participants: gender, age, work years, status within the paramedic workforce, highest level of education (primary education, high school education or university), marital status, shifts, side jobs.

Statistical analysis

We applied partial least squares (PLS) regression to examine how different sociodemographic and work related factors contribute to the degree of burnout (total burnout score, emotional exhaustion, physical exhaustion and mental exhaustion) and to the degree of psychosomatic symptoms in paramedics. In this framework, the outcome variables are represented by an $n \times q$ matrix Y, and the predictors by an $n \times p$ matrix X, with n being the number of subjects. PLS iteratively extracts latent variables from both X and Y in a way that maximizes the covariance between them. This procedure reduces the dimensionality of the predictor space by constructing weighted linear combinations of the X variables that form orthogonal components optimized for predicting Y.Formally, the decomposition is expressed as:

$$X=TP^{T}+E,\ Y=UQ^{T}+F,$$

where T ($n \times r$) and U ($n \times r$) are the score matrices, P ($p \times r$) and Q ($q \times r$) are the loading matrices, E and F are the residual terms, and r is the number of latent variables. The method ensures that the covariance between the score matrices T and U is maximized. To assess statistical significance, permutation testing was performed on the singular values of the decomposition. Specifically, the rows of the dependent variable matrix were randomly permuted 5,000 times, and the singular values recalculated to generate a null distribution. Variable contributions were summarized using Variable Importance in the Projection (VIP) scores. Since the mean of the squared VIP scores equals 1, variables with VIP values greater than 1 were considered to be of high importance (Abdi & Williams, 2013; Wold et al., 1993).

RESULTS

Sample characteristics

The questionnaire was completed by a total N=727 respondents. A total of 637 men and 90 women remained in the sample. Age mean of the total sample was 40.02 years, 40.77 years for men and 34.69 years for women. Most of the respondents (62,17%) had completed secondary school education. The BI has a median of 2.33 points, with 2.33 points for men and 2.35 points for women. The sample was homogeneous in this respect, with no significant difference according to the Mann-Whitney test performed (Z=-1.292, U=26255.0, p=.196). For PSS, the average score was 9.04, 8.88 for men and 1.14 for women. These scores were significantly higher than the mean scores of the originally validated test. In addition, the

correlation between the burnout index and the psychosomatic index was found to be strong (rho=.735; p<.0001) (*For sample characteristics, see Table 1.).*

	N	Minimum	Maximum	Mean (Median)	SD	Test of normality *(p)*
Age	727	19.00	64.00	40.02 (40.00)	10.22	<.0001
Years of Work	727	0.15	45.00	14.77 (12.00)	11.10	<.0001
BM Index	727	1.00	7.00	2.70 (2.33)	1.20	<.0001
PSS Index	727	0.00	24.00	9.04 (9.00)	4.90	<.0001

		Sex		**Education**		
		Male	Female	Primary education	Secondary education	Higher education
	N	637	90	28	452	247
	Percentage (%)	85.88	14.12	3.85	62.17	33.98

		Marital State				
		Single	In a relationship	Married	Divorced	Widow
	N	88	234	438	53	2
	Percentage (%)	10,8	28,7	53,7	6,5	0,2

		Job Title			
		Emergency physician	Paramedic officer	Emergency nurse	Ambulance driver
	N	40	173	343	171
	Percentage (%)	5,5	23,8	47,2	23,5

Table 1.: Descriptive statistics of the sample. Results show that the main characteristics do not meet the criteria of normal distribution.

PLS analysis

In the first PLS analysis, the dependent variables were the total burnout score, the rate of emotional, mental and physical exhaustion. As the second latent variable interpreted only a small part of the variance of the dependent measure (<5%) and the permutation test indicated a non-significant latent variable, only the first latent variable was evaluated. The permutation test showed that the first latent variable was significant ($p < 0.001$) and responsible for 34.6% of the variation of the dependent variable. The *X* loadings and the corresponding VIP scores in regard of the total burnout score indicated that job description (VIP score: 1.258), level of education (VIP score: 1.225), gender (VIP score: 1.21) and age (VIP score: 1.029) were the significant contributors in ascending order (Figure 1, left upper corner). In regards of the physical exhaustion level of education (VIP score: 1.327), gender (VIP score: 1.308) and job description (VIP score: 1.28) were the significant contributors in ascending order (Figure 1, right upper corner). However, age (VIP score: 1.37), side job (VIP score: 1.261) and level of education (VIP score: 1.246) contributed the most to the level of mental exhaustion in ascending order (Figure 1, left bottom corner). Finally, contributors of emotional exhaustion were age (VIP score: 1.57), job description (VIP score: 1.213) and gender (VIP score: 1.092) in ascending order (Figure 1, right bottom corner).

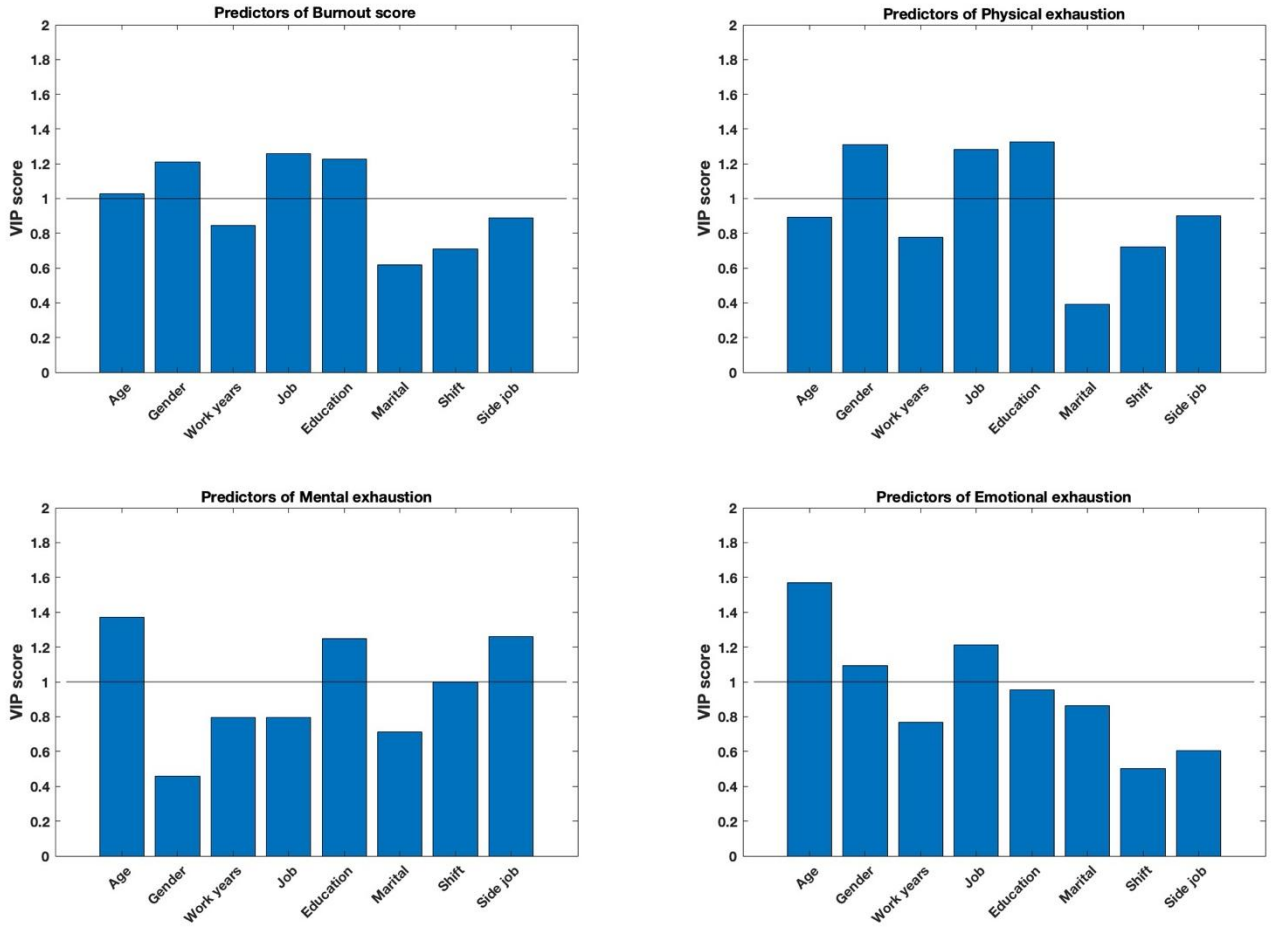

Figure 1.: VIP scores of PLS regression to determine contributors to burnout score and the different aspects of burnout.

In the second PLS analysis, the dependent variable was the psychosomatic symptom scale score. As in the first PLS, the second latent variable interpreted only a small part of the variance of the dependent measure (<5%) and the permutation test indicated a non-significant latent variable, only the first latent variable was evaluated here as well. The permutation test showed that the first latent variable was significant ($p < 0.001$) and responsible for 32.41% of the variation of the dependent variable. The *X* loadings and the corresponding VIP scores in regard of the psychosomatic symptom scale scores indicated that only gender (VIP score: 1.739) and age (VIP score: 1.562) were the significant contributors in ascending order (Figure 2.).

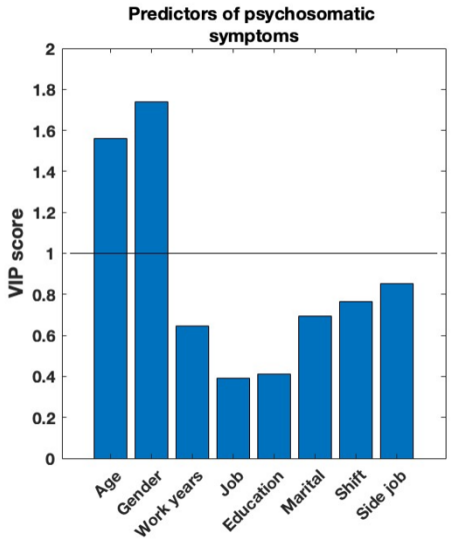

Figure 2.: VIP scores of PLS regression to determine contributors to psychosomatic symptoms of the paramedics.

DISCUSSION

The present study examined the degree of burnout and its associated psychosomatic symptoms among employees of the Hungarian National Ambulance Service. Consistent with earlier findings (Piko, 2006), our results confirm that burnout is a significant occupational health concern among paramedics. The average age of the participants (40.02 years) reflects a middle-aged workforce, where cumulative work-related stressors such as irregular shifts, demanding work environment, and exposure to traumatic events may contribute to high vulnerability to burnout. The predominantly male sample (85.88 %) also aligns with the demographic distribution of the profession, which may limit the generalizability of the results to female paramedics.

In the first PLS analysis, where the dependent variables were the total burnout score and the rates of emotional, mental, and physical exhaustion, only the first latent variable was significant ($p < 0.001$), explaining 34.6% of the variance. The main contributors to total burnout were job description, education, gender, and age. Specifically, physical exhaustion was most influenced by education, gender, and job description; mental exhaustion by age, side job, and education; and emotional exhaustion by age, job description, and gender.

These findings align with previous Hungarian studies highlighting the role of demographic and occupational factors in shaping burnout risk. For example, Kovács et al. found that nurses reported higher emotional exhaustion and depersonalization, while physicians scored higher in personal accomplishment (Kovács et al., 2010). Similarly, Győrffy

et al. reported that female physician tended to show medium to high level of burnout risk (Győrffy & Girasek, 2015). This gender pattern also was reflected in our analysis, where gender contributed to physical and emotional exhaustion. Age, which emerged as a significant factor in our model, has consistently been reported as protective: older physicians tended to report lower emotional exhaustion but with higher personal accomplishment (Ádám et al., 2008; Adam et al., 2018). Our findings on job description also mirror earlier work showing that intensive care and emergency staff face particularly high burnout risk compared to those in less acute settings (Palfi et al., 2008; Stankovic et al., 2019).

In the second PLS analysis, where the dependent variable was psychosomatic symptom severity, again only the first latent variable was significant ($p < 0.001$), accounting for 32.4% of the variance. Here, age and gender were the only significant contributors. This is consistent with earlier reports of gender differences—women more prone to emotional exhaustion, men to depersonalization—as well as the complex role of age, which has been variably associated with both lower exhaustion and higher accomplishment in Hungarian healthcare samples (Ádám et al., 2008; Győrffy & Girasek, 2015).

Beyond physicians and nurses, fewer domestic studies have examined paramedics, though our findings reinforce international evidence that they are among the most vulnerable groups. Prior research has shown that older age, exposure to threats, long work hours, and high job demands strongly correlate with burnout among paramedics (Braun et al., 2021; Crowe et al., 2018). Moreover, studies in both European and international contexts found that paramedics working in mobile teams or emergency units often display higher depersonalization and lower personal accomplishment compared to their peers (Buljan et al., 2016; Ferraro et al., 2020). Our results extend these observations, underscoring the importance of both demographic (age, gender, education) and occupational (job role, workload, multiple jobs) factors in shaping vulnerability to burnout and psychosomatic symptoms.

Overall, our findings highlight that burnout in Hungarian paramedics is not only widespread but also structured by identifiable demographic and occupational risk factors. The results support earlier evidence that younger age, female gender, high work demands, and stressful job descriptions contribute disproportionately to exhaustion and psychosomatic complaints, while protective factors include older age and higher job satisfaction. These patterns suggest that targeted interventions addressing workload, organizational stressors, and gender-specific vulnerabilities may help reduce burnout risk across healthcare professions, particularly among paramedics and frontline emergency staff.

LIMITATIONS

Several limitations must be acknowledged in interpreting the findings of this study. First, the cross-sectional design does not allow for the establishment of causal relationships between occupational factors and burnout; longitudinal studies would be necessary to trace the development of burnout over time. Second, the reliance on self-administered questionnaires introduces the possibility of reporting bias, as participants may underreport or exaggerate symptoms due to social desirability or personal perceptions. Third, although the sample size was large, the overwhelming predominance of male participants (90.3%) limits the ability to draw robust gender comparisons. Finally, the study did not fully address organizational-level variables, such as staffing levels, institutional support, and resource availability, which may significantly shape the development of burnout in paramedics.

CONCLUSION

The present study provides further evidence that burnout is a significant occupational hazard within the Hungarian paramedic workforce. Consistent with the first author earlier work (László, 2018), who documented a high prevalence of psychological strain and burnout among ambulance personnel, our findings highlight the persistence of this issue despite decades of awareness. Both studies converge on the conclusion that paramedics operate in an exceptionally stressful professional environment where organizational stressors, irregular working hours, and repeated exposure to trauma amplify the risk of physical and emotional exhaustion.

By applying standardized measures alongside with tailored questionnaires, this study corroborates Ivánkovits's earlier findings while offering a broader statistical perspective. Importantly, the integration of sociodemographic factors such as education, years of service, and work schedules allowed us to map further specific risk factors. Together, these works underline the need for both systemic and individual-level interventions.

Our findings emphasize that burnout is not merely an abstract psychological state but is closely interwoven with somatic complaints. The overlap between mental and physical dimensions suggests that preventive strategies must move beyond stress-reduction techniques to include health promotion programs targeting sleep hygiene, nutrition, and physical resilience.

From a broader perspective, this research illustrates that Hungarian paramedics are subject to occupational challenges comparable to international findings. Yet the local context

such as staffing shortages, workload intensity, and cultural attitudes toward seeking psychological help may exacerbate the problem. Recognizing these contextual factors is crucial for designing interventions that are both effective and culturally sensitive.

In conclusion, burnout among Hungarian paramedics is a complex and persistent phenomenon that demands urgent and multifaceted responses. Parallel to this, individual-level interventions such as resilience training and accessible counseling services are necessary to strengthen coping resources. By integrating insights from both the present analysis and Ivánkovits's (2018) earlier work, a more comprehensive and sustainable prevention strategy can be developed. One that not only reduces burnout but also preserves the long-term health and effectiveness of Hungary's emergency paramedical services.

DECLARATIONS

Ethics approval and consent to participate

The study has been approved by the Regional Medical and Research Ethics Committee of the University of Szeged (number: 29640). The study is conducted according to the principles of the Declaration of Helsinki (6^{th} edition, 2008). All study participants gave their written informed consent in accordance with the Declaration of Helsinki.

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Competing Interest

All authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Availability of data and materials

Data available on request from the authors.

Consent to publish

Not applicable.

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