INTRODUCTION

More than 113 million cases of COVID-19 had been identified as of 26 February 2021, with approximately 2.5 million deaths worldwide. Since the start of the pandemic, more than 2.6 million cases have been documented in Turkey, with more than 28,000 deaths. In addition, more than 120,000 healthcare workers have tested positive for COVID-19 in Turkey, while 216 healthcare workers have died because of the disease.

A recent cohort study found that frontline healthcare workers are at a higher risk of COVID-19 test-positivity than the general population. COVID-19 test-positive healthcare workers and those with unprotected exposure to COVID-19 patients also have a greater risk of sleep disturbance, anxiety and depression. Healthcare workers are exposed to numerous stressors during the pandemic. Factors such as high mortality rates among healthcare workers, deaths reported in the media, intensive working schedules, prolonged working with personal protective equipment,
high stress, isolation from families and loved ones, and exposure to infodemia through social media have resulted in psychological problems among such professionals. No longitudinal studies that would permit a comparison of the psychological state of healthcare workers before, during and after the outbreak of COVID-19 are available. However, studies show that healthcare workers exposed to such high risks experience psychological problems during the COVID-19 pandemic. As the epidemic continues, prolonged stress has caused depression and burnout among healthcare workers. Most healthcare workers who did not previously work day and night shifts have now begun doing so during the COVID-19 pandemic. Sleep disturbances are one of the most common health impacts observed among shift workers. The probability of severe COVID-19 is very high among shift workers, whose circadian rhythms are disrupted. Sleep is of crucial importance for healthcare workers, even during normal times, but increasing workloads and psychological pressure during the pandemic have led to significant fatigue among such professionals. Fear of infecting families and stigmatisation of healthcare workers have resulted in a lack of social support. Increasing stress and social isolation can also lead to sleep problems, and such problems can in turn cause increased stress. Similarly, traumatic events experienced during the pandemic may also cause sleep problems. Several studies have determined that healthcare workers in particular experience sleep problems during the COVID-19 pandemic. The purpose of this study was to evaluate sleep quality and related factors among healthcare workers during the COVID-19 pandemic in Turkey.

2 | METHODS

2.1 | Study design and participants

Approval for the study was obtained from the Ondokuz Mayıs University Clinical Research Ethics Committee (IRB No: OMUKAEK 2020-192). Permission for the research was granted by the Turkish Ministry of Health General Directorate of Health Services Scientific Research Platform.

This cross-sectional study was performed using an online questionnaire prepared for healthcare workers engaged in the COVID-19 pandemic. This was distributed via WhatsApp, e-mail and Facebook groups. The study data were collected using the snowball sampling method between 1 April 2020 and 1 May 2020. We informed the participants about the study at the beginning of the questionnaire and received their informed consent online. The sample size was calculated using the formula \( N = \left(\frac{Z_{\alpha/2}}{d}\right)^2 \frac{p(1-p)}{\epsilon^2} \). At a 95% confidence level of \( Z_{\alpha/2} = 1.96 \), the estimated acceptable margin of error was \( d = 0.05 \) and the social support was determined at 50%). Four hundred fifty-eight healthcare workers were originally included, although 24 were subsequently excluded because of missing data. The study was thus completed with 434 participants.

What’s known?

- Sleep is crucial for healthcare workers, even in normal times, but increasing workloads and psychological pressure have resulted in worsening fatigue among healthcare workers during the pandemic.
- Increasing stress and social isolation can also lead to sleep problems.

What’s new?

- The prevalence of poor sleep quality among healthcare workers was 56.7%.
- The prevalence of poor sleep quality was 67.3% in nurses, 55.4% in physicians and 42.3% in dentists.
- High levels of social support and family social support emerged as protective factors against poor sleep quality.
- Poor sleep quality was significantly associated with working in hospitals and high traumatic stress levels during the COVID-19 pandemic.

3 | QUESTIONNAIRE

The questionnaire included questions designed to elicit sociodemographic data and various scales. The sociodemographic data investigated in the questionnaire age (<35 years/ ≥35 years), sex (female/male), marital status (unmarried/married), profession (nurse/physician/dentist), education (master’s degree or above/bachelor’s degree or below), place of work (hospital/non-hospital), working position (frontline/non-frontline) and years of experience (<5 years/5-10 years/≥10 years).

The Multidimensional Scale of Perceived Social Support (MSPSS) was developed by Zimet et al. The validity and reliability study of the Turkish version was confirmed by Eker et al. The scale is a questionnaire based on the subjective evaluation of the social support that individuals receive from their family, friends and significant others in their social environment. It consists of 12 items, in three dimensions, family, friends and significant other, each consisting of four questions. Each item is rated on a 7-point Likert-type scale, from absolutely no (1) to absolutely yes (7). The total scale score is obtained by summing the scores of all three sub-dimensions. Higher total and sub-dimension scores indicate that perceived social support is also high. Scores between 12 and 48 indicate low social support, scores between 49 and 68 moderate social support, and scores between 69 and 84 high social support. The Cronbach alpha value of the MSPSS in this study was 0.906.

The National Stressful Events Survey PTSD Short Scale (NSESSS) was developed by Kilpatrick et al. while the validity and reliability of the Turkish-language version were investigated by Aşçıbaş et al. The NSESSS contains seven items that assess the severity of post-traumatic stress disorder (PTSD) following an extremely
stressful event or experience. Each item is rated on a 5-point Likert-type scale, from absolutely none (0) to extremely (4). A higher total score indicates a higher stress level. The Cronbach alpha value of the NSESSS in this study was 0.819.

The Pittsburgh Sleep Quality Index (PSQI) was developed by Buysse et al. The validity and reliability of the Turkish-language version were studied by Agargün et al. The PSQI is a self-rated questionnaire that assesses sleep quality and disturbance. It consists of 19 items and seven components—subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping medication use and daytime dysfunction. Each component is scored equally, between 0 and 3. The sum of the seven component scores yields the PSQI global score. A PSQI global score higher than six was regarded as indicating poor sleep quality.

3.1 Statistical analysis

Data analysis was performed on IBM SPSS Statistics version 21.0 software. Categorical data were presented as numbers and percentages, and numerical data as mean ± standard deviation (SD) and median (minimum-maximum). The Chi-square test was used to compare the categorical data. Normality of distribution was evaluated using the Kolmogorov-Smirnov test and normality graphs. The Mann-Whitney U test was used to compare differences between two independent groups when the data were distributed non-normally. Univariate and multivariate logistic regression analysis (stepwise method) was used to evaluate the predictors of poor sleep quality. \( P < .05 \) was considered statistically significant.

4 RESULTS

Four hundred thirty-four healthcare workers participated in the study, of whom 70.7% were under 35 years of age, 65.0% were female, 60.6% were married, 64.1% were physicians, 56.7% held a master's degree or above, 73.0% worked in a hospital, 50% worked on the frontline and 36.4% had 5-10 years' working experience. The prevalence of poor sleep quality varied between the occupations (\( P = .009 \)), being higher in nurses compared with physicians (\( P = .035 \)) and dentists (\( P = .003 \)). However, no difference was observed in terms of poor sleep quality between physicians and dentists (\( P = .083 \)). Poor sleep quality was higher among individuals educated to bachelor's degree level or below compared with those holding master's degrees or higher (\( P = .041 \)). In addition, sleep quality was poor in 62.5% of participants working in the hospital and 41.0% of non-hospital workers. Poor sleep quality was higher among in-hospital healthcare workers than non-hospital healthcare workers (\( P < .001 \)). Sleep quality was poor in 62.2% of frontline workers and 51.2% of those not on the front line (\( P = .020 \)). Sleep quality was also poor in 65.6% of healthcare workers with work experience of less than 5 years and in 55.8% of those with more than 10 years' experience. A statistically significant association was determined between poor sleep quality and length of professional experience (\( P = .042 \)). Poor sleep quality was more marked among healthcare workers with less than 5 years' experience than those with 5-10 years' experience (\( P = .012 \)). Sleep quality was poor in 69.4% of participants with low social support levels and 52.2% of those with high social support levels. There was a statistically significant association between social support levels and sleep quality (\( P = .028 \)). Poor sleep quality was higher among participants with low social support than those with high social support (\( P = .014 \)). No significant difference was found in terms of sleep quality among healthcare workers in terms of age (\( P = .393 \)) or marital status (\( P = .831 \)) (Table 1).

Healthcare workers with poor sleep quality also registered lower MSPSS scores (\( P = .010 \)). Participants with poor sleep quality had lower significant other (\( P = .022 \)) and family (\( P < .001 \)) subscale scores. No statistically significant association was observed between sleep quality and social support from friends (\( P = .117 \)). Health workers with poor sleep quality registered higher NSESSS scores (\( P < .001 \)) (Table 2).

Univariate logistic regression analysis identified female gender (OR = 1.518, 95% CI = 1.020-2.259, \( P = .040 \)), being a nurse (OR = 2.807, 95% CI = 1.441-5.575, \( P = .003 \)), possession of a master's degree or above (OR = 1.495, 95% CI = 1.015-2.200, \( P = .042 \)), working in the hospital (OR = 2.392, 95% CI = 1.551-3.687, \( P < .001 \)), working on the frontline (OR = 1.572, 95% CI = 1.073-2.304, \( P = .020 \)), having more than 5 years’ work experience (OR = 1.857, 95% CI = 1.142-3.021, \( P = .013 \)) and high traumatic stress scores (OR = 1.088, 95% CI = 1.051-1.127, \( P < .001 \)) as risk factors for poor sleep quality. Univariate logistic regression analysis identified increased social support (OR = 0.983, 95% CI = 0.971-0.996, \( P = .010 \)) and family support (OR = 0.930, 95% CI = 0.896-0.966, \( P < .001 \)) as protective factors against poor sleep quality (Table 3). Working in the hospital (OR = 2.486, 95% CI = 1.589-3.889, \( P < .001 \)) and high traumatic stress levels (OR = 1.991, 95% CI = 1.053-1.131, \( P < .001 \)) emerged as risk factors for poor sleep quality at multivariate logistic regression analysis (Table 3).

5 DISCUSSION

The study findings showed that healthcare workers were exposed to a high rate of poor sleep quality during the COVID-19 pandemic in Turkey. Healthcare workers, especially those in hospitals and under high levels of traumatic stress, were also at a high risk of poor sleep quality during the first wave of the pandemic.

In a study involving paediatric healthcare workers in Italy during the first wave of the COVID-19 pandemic, 67% of participants suffered from sleep disturbance (PSQI >5). Seventy-six percent of nurses in Italy had PSQI >5, indicating poor sleep quality. In Spain,
the prevalence of poor sleep quality was 64% (PSQI > 6) among healthcare workers. More than half of mental healthcare workers (52%) experienced sleep problems during pandemics in the UK. A study of 939 healthcare workers in Turkey during the first wave of the pandemic, 50% of participants reported sleep problems. Poor sleep quality (PSQI ≥ 5) was identified at a rate of 75.2% in a study of 257 healthcare workers in Bahrain. In a study of 2001 healthcare workers in China in the early period of the COVID-19 pandemic, 61.6% of participants reported poor sleep quality. Poor sleep quality (PSQI > 6) was in 71.7% of 1306 healthcare workers in China in another study. Poor sleep quality (PSQI > 6) was reported in 30% of 534 paediatric medical staff. In a study involving 7236 individuals, poor sleep quality was reported in 23.6% of healthcare workers and higher among healthcare workers than members of other professions. Consistent with previous studies, the frequency of poor sleep quality was also higher among healthcare workers in the present study. The differences in the frequency of poor sleep quality are because of the different scale cut-off points. Simultaneously, a study involving 119 doctors and 99 nurses reported that poor sleep quality increased from 61.9% to 69.3% over a 1-month follow-up. Sleep

| Variables          | Total N = 434 | Good sleep quality N = 188 | Poor sleep quality N = 246 | P-value* |
|--------------------|---------------|----------------------------|----------------------------|----------|
| **Age**            |               |                            |                            |          |
| <35 years          | 307 (70.7)    | 137 (44.6)                 | 170 (55.4)                 | .393     |
| ≥35 years          | 127 (29.3)    | 51 (40.2)                  | 76 (59.8)                  |          |
| **Sex**            |               |                            |                            |          |
| Female             | 282 (65.0)    | 112 (39.7)                 | 170 (60.3)                 | .039     |
| Male               | 152 (35.0)    | 76 (50.0)                  | 76 (50.0)                  |          |
| **Marital status** |               |                            |                            |          |
| Married            | 263 (60.6)    | 115 (43.7)                 | 148 (56.3)                 | .831     |
| Unmarried          | 171 (39.4)    | 73 (42.7)                  | 98 (57.3)                  |          |
| **Profession**     |               |                            |                            |          |
| Dentist            | 52 (12.0)     | 30 (57.7)                  | 22 (42.3)                  | .009     |
| Physician          | 278 (64.1)    | 124 (44.6)                 | 154 (55.4)                 |          |
| Nurse              | 104 (24)      | 34 (32.7)                  | 70 (67.3)                  |          |
| **Education**      |               |                            |                            |          |
| Bachelor’s degree or below | 188 (43.3) | 71 (37.8) | 117 (62.2) | .041 |
| Master’s degree or above | 246 (56.7) | 117 (47.6) | 129 (52.4) |          |
| **Place of work**  |               |                            |                            |          |
| Hospital           | 317 (73.0)    | 119 (37.5)                 | 198 (62.5)                 | <.001    |
| Non-hospital       | 117 (27.0)    | 69 (59.0)                  | 48 (41.0)                  |          |
| **Working position** |          |                            |                            |          |
| Frontline          | 217 (50.0)    | 82 (37.8)                  | 135 (62.2)                 | .020     |
| Non-frontline      | 217 (50.0)    | 106 (48.8)                 | 111 (51.2)                 |          |
| **Years of professional experience** |        |                            |                            |          |
| <5 years           | 122 (28.1)    | 42 (34.4)                  | 80 (65.6)                  | .042     |
| 5-10 years         | 158 (36.4)    | 78 (49.4)                  | 80 (50.6)                  |          |
| >10 years          | 154 (35.5)    | 68 (44.2)                  | 86 (55.8)                  |          |
| **MSPSS**          |               |                            |                            |          |
| Low social support | 62 (14.3)     | 19 (30.6)                  | 43 (69.4)                  | .028     |
| Moderate social support | 98 (22.6) | 38 (38.8) | 60 (61.2) |          |
| High social support | 274 (63.1)    | 131 (47.8)                 | 143 (52.2)                 |          |

* Chi-square test significant at the 0.05 level. Bold values indicate statistically significant.
Patterns among Norwegian nurses remained almost unchanged between the first and second waves of the COVID-19 pandemic. This reveals that poor sleep quality exhibits a dynamic change depending on how the data are collected and on the individuals affected by the pandemic. Healthcare workers thus exhibited a high rate of poor sleep quality before the COVID-19 pandemic. This has also led to sleep problems among healthcare workers in previous outbreaks.

Studies conducted during and before the COVID-19 pandemic have reported higher rates of poor sleep quality in female healthcare workers than men. This is consistent with the results of the present study. Few studies have determined no association between poor sleep quality and gender. However, studies conducted in the general population also report that sleep problems are more common in women. Similarly, poor sleep quality is more common in nurses than in doctors. This may be because the nurses involved in such studies are predominantly female. Many factors that cause sleep problems were identified before the pandemic, such as shift working, different shift work patterns, rest periods after shift work, old age, loneliness, gender, acute and chronic stress exposure, workplace violence, and cultural and behavioural issues factors. However, many traumatising factors, such as nurses working frequently night shifts, having more contact with patients than other healthcare professionals, a stressful working environment, long-term working with personal protective equipment, psychological problems, concerns about their health, encounters with patients and their relatives who died of COVID-19, and working onwards/intensive care units may account for the more frequent occurrence of poor sleep quality. In the present study, the rate of poor sleep quality was high among dentists. This may be as a result of the aerosol-forming properties of most dental procedures. This may also have been caused by some dentists coming into contact with COVID-19 patients in the field for contact tracing team studies. However, poor sleep quality rates decrease as education levels rise.

The emergence of infodemia, particularly in the context of the COVID-19 pandemic, has caused considerable confusion. The widespread use of social media and smartphones, responsible for the rapid spread of infodemia, also affects poor sleep quality. Excessive occupational stress can result from concerns about the risk of infection and a lack of confidence in the safety measures taken. Individuals who consider that they lack sufficient infection control knowledge and skills are more likely to experience stress.

Raising education levels may help reduce this stress. The emergence of infodemia, particularly in the context of the COVID-19 pandemic, has caused considerable confusion. The widespread use of social media and smartphones, responsible for the rapid spread of infodemia, also affects poor sleep quality. Excessive occupational stress can result from concerns about the risk of infection and a lack of confidence in the safety measures taken. Individuals who consider that they lack sufficient infection control knowledge and skills are more likely to experience stress. Raising education levels may help reduce this stress.

### TABLE 2  Comparison of sleep quality by scales and subscales

| Scales                                      | Total N = 434 | Good sleep quality N = 188 | Poor sleep quality N = 246 | P-value* |
|---------------------------------------------|---------------|----------------------------|---------------------------|----------|
| Multidimensional Scale of Perceived Social Support (MSPSS) |               |                            |                           |          |
| Mean ± SD                                   | 67.55 ± 15.52 | 69.77 ± 14.16              | 65.85 ± 16.3              | .010     |
| Median (Min-Max)                            | 73 (21-84)    | 75 (22-84)                 | 72 (21-84)                |          |
| Significant other                           |               |                            |                           |          |
| Mean ± SD                                   | 21.99 ± 8.26  | 22.54 ± 8.15               | 21.57 ± 8.34              | .022     |
| Median (Min-Max)                            | 27 (4-28)     | 28 (4-28)                  | 26 (4-28)                 |          |
| Family                                      |               |                            |                           |          |
| Mean ± SD                                   | 23.84 ± 5.77  | 25.06 ± 4.96               | 22.9 ± 6.18               | <.001    |
| Median (Min-Max)                            | 27 (4-28)     | 27 (5-28)                  | 25 (4-28)                 |          |
| Friends                                     |               |                            |                           |          |
| Mean ± SD                                   | 21.72 ± 4.69  | 22.16 ± 4.49               | 21.38 ± 4.82              | .117     |
| Median (Min-Max)                            | 22 (7-28)     | 23 (8-28)                  | 22 (7-28)                 |          |
| National Stressful Events Survey Acute Stress Disorder Short Scale (NSESSS) |               |                            |                           |          |
| Mean ± SD                                   | 12.76 ± 5.87  | 11.2 ± 5.81                | 13.95 ± 5.65              | <.001    |
| Median (Min-Max)                            | 13 (0-28)     | 11 (0-28)                  | 14 (2-28)                 |          |

* Mann-Whitney U test significant at the 0.05 level. Bold values indicate statistically significant.
and having fewer than 5 years’ work experience were found to be associated with increased poor sleep quality. Some studies have indicated that poor sleep quality is more common among staff with more than 5 years’ work experience. 53 Prolonged work experience is

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a risk factor for poor sleep quality.\textsuperscript{55} The fact that our study sample consisted of younger individuals may have resulted in shorter work experience. Inexperience may have increased fear and anxiety associated with COVID-19. This may in turn have derived from a lack of training on COVID-19, along with rapid changes in guidelines. The fact that healthcare professionals who had previously worked in their own specialties or departments' services now worked in different units or departments during the pandemic may have caused uncertainty. Similarly, it is also possible that older staff and those with greater professional experience will work in non-frontline positions. Up-to-date training and psychological support for frontline and inexperienced healthcare professionals in hospitals may therefore be beneficial from that perspective.

Low perceived social support had been associated with an increased risk of depression and poor sleep quality in the COVID-19 pandemic.\textsuperscript{56} Higher perceived family social support scores have been linked to lower levels of depression and PTSD.\textsuperscript{57} In addition, high social support levels from relatives and friends are associated with a lower risk of poor sleep quality and short sleep duration.\textsuperscript{58} Increased perceived social support is associated with increased self-efficacy and sleep quality in healthcare workers, together with decreased anxiety and traumatic stress.\textsuperscript{59} The results of one meta-analysis showed that increased social support was associated with improved sleep outcomes.\textsuperscript{60} Consistent with previous research, low social support was associated with greater poor sleep quality in the present study. Significant less poor sleep quality was reported as social support from family and significant others increased. Although social distance and isolation are important to preventing the transmission of COVID-19, isolation from loved ones and families is an important problem for healthcare professionals.\textsuperscript{11} Several traumatising events can disrupt the mental health of healthcare workers during the COVID-19 pandemic. These include the deaths of colleagues and loved ones, witnessing patients dying alone in hospitals without their loved ones or relatives, uncertainties concerning the infection, and associated increased exposure to social media. Healthcare workers living with their families, being in the early years of their professions, and increased media use have been linked to an increased risk of traumatisation.\textsuperscript{61} Although PTSD-like symptoms are normal in difficult situations and may be expected during traumatic events, and these may also have long-term effects.\textsuperscript{11} A study conducted six months after the first local COVID-19 outbreak among healthcare workers in Wuhan, China, reported quite high PTSD rates.\textsuperscript{62} Increased perceived traumatic stress levels have been associated with poor sleep quality. Similar results emerged from the present study. Early detection of post-traumatic symptoms and effective intervention are crucial to the prevention of further psychological distress. Therefore, healthcare professionals require a programme that will routinely screen them for sleep, social support, traumatic stress and other psychological problems during the pandemic. The screening will in turn make it possible to provide appropriate interventions for individuals at high risk. Good psychological conditions and good sleep quality will also prevent potential diagnostic, therapeutic, care and planning errors.

One study identified being a medical staff member, the burden of caring for the elderly or children, grief and anxiety-depression as independent risk factors for sleep problems.\textsuperscript{56} In another study, older individuals, nurses and health professionals working in the outer emergency medical team in Hubei province, China, were more likely to report poor sleep quality.\textsuperscript{53} Low educational levels, working in an isolation unit, high anxiety concerning infection, regarding the psychological support derived from news reports of COVID-19 or the social media as insufficient and high uncertainty about effective disease control have also been associated with sleep problems.\textsuperscript{63} In the present study, female gender, being a nurse, a low education level, working in a hospital, working in a frontline position, having less than 5 years' working experience, a decreased level of social support, especially family support and increased traumatic stress were all associated with poor sleep quality. Multivariable analysis revealed that poor sleep quality was associated with increased traumatic stress levels and working in the hospital. In the pre-pandemic period, healthcare workers in hospitals already had high workloads, and this was found to be capable of causing psychological stress, anxiety, depressive symptoms and sleep disorders.\textsuperscript{30} During the pandemic, healthcare professionals' workloads, especially of those working in hospitals, increased still further. Such personnel were also exposed to psychological difficulties. Our results are consistent with the existing literature. Increasing sleep disturbance among such individuals will create the basis for subsequent psychological problems. Close monitoring should be provided for healthcare professionals in hospitals in terms of increased traumatic stress. Individuals exposed to traumatic stress are at a greater risk of suicidal ideation, attempted suicide and successful suicide. It should also be remembered that healthcare workers are already in a risky profession.

There are a number of limitations to this study. First, the sample size was relatively small and the study data were based on a self-administered questionnaire. Second, night-shift working was not taken into account (the data were collected at the very beginning of the pandemic, at a time when working patterns had not yet been fully established. Participants were not asked about shift working, a very important factor in sleep problems). Third, the COVID-19 pandemic is continuing and changing, and studies investigating sleep quality over longer periods are now needed. Another limitation of this study is its cross-sectional nature and the fact that various factors associated with poor sleep quality other than social support and post-traumatic stress could not be investigated. Other limitations are that no comparison was performed with previous (pre-COVID-19) sleep status and the lack of a control group.

6 | CONCLUSIONS

In conclusion, the results of this study clearly indicate high levels of poor sleep quality among healthcare workers. The risk of poor sleep quality was higher in women, nurses, individuals with low education levels, hospital workers, frontline workers, individuals with less work experience, and those with low perceived social support,
low perceived family social support and perceived high traumatic stress. Working in hospital and a high level of traumatic stress were associated with poor sleep quality. Healthcare workers, particularly in hospitals, with poor sleep quality should be assessed in terms of post-traumatic stress.

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**CONFLICTS OF INTEREST**
The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this article.

**AUTHOR CONTRIBUTIONS**
Conceptualisation, Writing—original draft preparation and Writing -Review & Editing: MY and MKS; Methodology: YK and MKS; Formal analysis and investigation: MY, YK, MKS; Material preparation and data collection and resources: MY and YK; Supervision: MKS. All authors read and approved the final manuscript.

**DATA AVAILABILITY STATEMENT**
Data available on request from the authors: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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