BMC Public Health

RESEARCH

Open Access

Sleep apnea and daytime sleepiness in police officers from Kerala, India

G. K. Mini[1,2,3,4*], Krishna S. Sangeeth[5], Gopinathan Bhaskaran Gopika[1], V. M. Anjana[1], Pillai Anand Marthanda[1,6], Aswathy Sreedevi[3,7], Pillai A. Marthanda[1,8] and Vilma Irazola[3,9]

Abstract

Background Globally, poor sleep is a significant public health problem. Healthy sleep is important for physical and mental well-being, particularly for individuals who work in environments with shift schedules. However, this issue has not been adequately addressed, especially in low-and-middle-income settings. This study examined sleep apnea and excessive daytime sleepiness among police officers in Kerala, India, and explored the factors associated with these conditions.

Methods Using a cross-sectional study design, we collected data from 253 police officers selected from 14 police stations in Thiruvananthapuram district. Data on socio-demographic and occupational characteristics were collected using structured questionnaire and stress using the Police Stress Questionnaire. Sleep apnea and excessive daytime sleepiness (EDS) were assessed using the Berlin Scale and Epworth Sleepiness Scale, respectively. Both bivariate and multivariate analyses were used to identify associated factors with sleep apnea and EDS.

Results Participants were predominantly male (89%), aged 30–55 years (mean: 42 years, SD:±6). The prevalence of operational stress was 75.5% [95% Confidence Interval (CI): 69.7–80.6], organizational stress 65.6% (CI:59.4–71.4), sleep apnea 15.0% (CI:10.8–20.0), and EDS 56.5% (CI:50.1–62.7). Sleep apnea was significantly higher among alcohol or tobacco users [unadjusted odds ratio (UAOR):2.16, CI:1.07–4.34]. Both operational stress (UAOR:4.41, CI:1.30-14.89) and organizational stress (UAOR:4.06, CI:1.52–10.84) were significantly associated with sleep apnea. EDS was more likely to be reported by officers from rural police stations (UAOR:3.09, CI:1.82–5.24), those with fewer years of experience (UAOR:1.65, CI:1.00-2.73), and among civil police officers (UAOR:2.15, CI:1.23–3.76) compared to their counterparts. The regression results indicated that those with diabetes or hypertension were significantly more likely to have sleep apnea (Odds Ratio (OR):8.41 95% CI: 3.20–22.10) compared to those without these conditions. Police officers from rural stations were more likely to experience excessive daytime sleepiness compared to their counterparts from urban areas (OR: 3.14, 95% CI: 1.80–5.47).

Conclusions A high prevalence of sleep disorders was observed among police officers, with strong associations to occupational stress and lifestyle factors. Based on the findings, we initiated behavioral interventions to improve sleep quality in this population.

Keywords Police officers, Sleep, Kerala, India

*Correspondence:
G. K. Mini
gkmini.2014@gmail.com

Full list of author information is available at the end of the article

© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

Background

Poor sleep quality is a major public health issue worldwide, particularly for shift workers like police officers in countries like India. The police profession is widely recognized for its challenging and high-risk nature, which significantly impacts the lifestyle of police personnel [1]. Police officer's regular work environment demands shift rosters, including quickly rotating shifts, frequent short returns, and lengthy work periods [2]. Police personnel also frequently experience extended work schedules, hazardous, traumatic situations and exhaustion [3, 4]. Shift work is often associated with detrimental health effects, such as increased rise for cardiovascular disease [5], metabolic syndrome [6], diabetes [7], some cancers [8], burnout [9], on-duty injuries [10], and autoimmune hypothyroidism [11]. These work-related issues can negatively affect the police personnel's sleep quality. Insomnia is a significant risk factor for depression, impairing daily functioning and contributing to increased absenteeism and reduced productivity among military personnel [12].

Numerous studies report that police officers are more susceptible to medical conditions associated with stress, such as heart disease and metabolic syndrome, than people in other occupations [13, 14]. Obstructive sleep apnea and other sleep disorders are recognized to be linked to metabolic syndrome (MetS) [15]. Short sleep duration was found to be an independent risk factor for MetS [16, 17]. In addition, difficulty in falling and remaining asleep were reported to be associated with a higher prevalence of MetS in a Swedish study [18]. An earlier study among Japanese police officers reported the association of poor sleep circumstances, such as shift sleep disorder and lack of sound sleep, with high incidence of MetS [19]. Police personnel assigned to 12-hour shift rosters were shown to have higher systolic blood pressure compared to those working standard shifts [20]. The systematic review on safety implications of shift work reported a higher chance of accidents during work periods of more than eight hours, and that risk doubled at roughly twelve hours of labor [21]. Furthermore, injuries that were recorded during night shifts were more severe in nature [22].

Police personnel are reported to have a higher likelihood of experiencing psychiatric conditions, including post-traumatic stress disorder [23], substance abuse disorder [24], and with a higher chance of suicide [25]. Evaluating the sleep quality among law enforcement personnel is crucial as they frequently have to make snap judgments in difficult and unclear circumstances, work long hours in dangerous and unpredictable surroundings, and drive for extensive periods of time. Police officers who have little sleep or are fatigued are more likely to injure themselves, both fatally and non-fatally, as well as the general population [26, 27]. Therefore, addressing the quality of sleep among law enforcement personnel is vital for their health and well-being, as well as for the safety of the communities they protect. A meta-analysis assessing sleep quality among police officers indicated 51% of them experience poor sleep quality [28]. A study conducted among police officers in Maharashtra, India, during the COVID-19 lockdown reported that less than a third (31%) of the officers experienced some form of sleep problem. It was also found that 44% of police officers in a northern state in India used drugs or alcohol, with 32% using alcohol and 22% using nicotine [29]. Police officers from Haryana, India reported high levels of job stress leading to reduced job involvement [30]. However, comprehensive studies on sleep quality among law enforcement personnel from Indian settings are limited [31]. Addressing this problem is crucial for individual well-being and public safety. This study aims to examine the prevalence of sleep apnea and excessive daytime sleepiness among police officers in Kerala and to identify the factors associated with these conditions.

Methods

Our previous study findings on cardiovascular risk factors among police officers in this population was published elsewhere [32]. Based on the findings of the study, a feasibility study was initiated to evaluate the effectiveness of a behavioural intervention program aimed at reducing cardiovascular risk factors among police personnel in Kerala, India. However, as the initial survey was conducted during the COVID-19 pandemic, many participants were transferred to different regions of the state when approached for the intervention program. Consequently, a second survey was conducted among the same police stations to identify participants for the intervention. The sample size was estimated based on the hypertension prevalence of 30.4% [33], with a precision of 8 and a design effect of 2. This estimation is specifically for the program on reduction of cardiovascular risk factors in this population. The current study utilizes data collected from this second survey, employing a probability sampling method to ensure representativeness. Sampling was conducted across both rural and urban police stations to ensure the data collected was representative of the entire study area. A total of seven police stations were randomly selected from each of the rural and urban regions, resulting in a survey of police officials from a total of 14 stations within the selected district. Police officials aged between 30 and 55 years who provided their consent to participate were included in the survey. We studied 253 police officers selected from the 14 police stations in the district in 2023. Data on the socio-demographic and occupational characteristics of the sample population were collected using a structured, pre-tested interview schedule.

We have used the World Health Organization's stepwise surveillance questionnaire to assess non-communicable disease risk factors [34]. Data collected for STEP 1, included demographics, tobacco use, alcohol consumption, physical activity, and diet, and for STEP 2, involved weight, height, and blood pressure measurements. The blood pressure, weight, and height were measured according to the WHO STEPwise protocol [35].

Occupational stress was measured using the Police Stress Questionnaire [36] with the assessment of operational and organizational police stress separately (PSQ-Op and PSQ-Org). It is a 20-item questionnaire having a 7-point rating scale from 1 ("not at all stressful" or "no stress at all") to 7 ("very stressful" or "a lot of stress"), with 4 indicating moderate stress.

Sleep apnea was assessed using the Berlin scale [37]. Excessive daytime sleep was assessed using the Epworth Sleepiness Scale [38]. These tools were widely used in Indian settings [39, 40]. The study participants were first screened with the Berlin Questionnaire to assess their risk of obstructive sleep apnea. This tool categorizes participants as high or low-risk based on three criteria: snoring behavior, daytime sleepiness, and hypertension or obesity. If a participant scores positively in at least two categories, they are classified as high risk. Additionally, we assessed the daytime sleepiness of police officers using the Epworth Sleepiness Scale, considering the importance of mental alertness required for the job, especially during the daytime. A cut of value of ≥ 11 on the Epworth scale is used to classify participants as experiencing excessive daytime sleep [41].

Current tobacco use was defined as the use of any form of tobacco during the last month prior to the survey. Those who consumed at least one alcoholic drink within the past month were defined as current users of alcohol. Insufficient physical activity (physical inactivity) was defined as not meeting the WHO recommendation of at least 150 min of moderate-intensity physical activity or 75 min of vigorous-intensity physical activity or an equivalent combination of moderate and vigorous-intensity physical activity achieving at least 600 MET (metabolic equivalent task) minutes per week. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Overweight was defined as BMI:25–29 kg/m^2, and obesity as BMI ≥ 30 kg/m^2.

Diabetes was identified based on self-reports of doctor-diagnosed cases. Blood pressure was measured using an Omron digital blood pressure monitor (OMRON-4, Omron Corporation, Kyoto, Japan). Blood pressure was measured three times after resting for at least five minutes in a quiet and comfortable position. The average of the last two readings was considered as the final blood pressure measurement. Information regarding self-reported usage of anti-hypertensive medications was also gathered. Hypertension was defined as systolic blood pressure (BP) ≥ 140 and/or diastolic BP ≥ 90, or if the patient was taking medication for hypertension [42].

Bivariate analysis was used to identify the factors associated with sleep apnea and excess daytime sleepiness. Categorical variables were compared using Chi-square test and Fisher's test. We separately done logistic regression analysis for sleep apnea and day time sleepiness and associated factors. A p value of < 0.05 was considered as statistically significant. Data were analyzed using SPSS version 21.0 (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). Ethical clearance was obtained from the Institutional Ethics Committee (IEC) of Ananthapuri Hospitals and Research Institute, Thiruvananthapuram, Kerala (IEC number: AHRI/EC/39/Sept/2022 dated 02nd September 2022). All participants provided written consent after receiving the participant information sheet.

Results

The police officers included in the study were in the age group of 30–55 years, mean age of 42 years (SD:±6) and 88.9% were men. Nearly 56% of the participants were from urban police stations and the remaining were from rural police stations. Majority (98.4%) were currently married, 70% living in nuclear families, 81% residing in rural areas, 80% of them had graduation and above education level. Nearly three-fourth (72%) of them were civil police officers (civil police officers (CPO) are frontline personnel in the police department, responsible for duties such as assisting with criminal investigations, patrolling designated areas, and responding to emergencies), 11% assistant sub-inspectors (ASI), 16% sub-inspectors (SI) and the remaining 1% were circle inspectors (CI). Most of them (98%) reported having shift work in the past month. Self-reported work stress (83%) and inadequate sleep (92%) were commonly reported by the study participants.

66% of participants were overweighted/obese. Eighteen participants reported current use of smoking tobacco and 32% reported current alcohol use. Prevalence of physical inactivity was 64.8%. Self-reported diabetes prevalence was 12.6%, of which 65.6% were under treatment. Hypertension prevalence was 34.8%, significantly higher among men (36.9%) than women (17.9%). Prevalence (self-reported) of dyslipidemia was 13%.

Based on the police stress questionnaire, operational stress prevalence was 75.5% [95% Confidence Interval (CI): 69.7–80.6] and organizational stress prevalence was 65.6% (CI: 59.4–71.4). Prevalence of sleep apnea based on Berlin Scale was 15% (CI:10.8–20.0) and excessive day time sleepiness based on Epworth Scale was 56.5% (CI: 50.1–62.7).

Table 1 Sleep apnea by background characteristics

Factors	Sleep apnea		UAOR (95% CI)	*p* value
	No *N*(%)	Yes *N*(%)		
Place of police station				
Urban	97(86.6)	15(13.4)	Reference	0.597
Rural	118(83.7)	23(16.3)	1.26(0.96–2.54)	
Age (in years)				
30–40	107(88.4)	14(11.6)	Reference	0.161
41–55	108(81.8)	24(18.2)	1.69(0.83–3.45)	
Sex				
Female	27(96.4)	1(3.6)	Reference	0.091
Male	188(83.6)	37(16.4)	5.31(0.70-40.33)	
Physical activity				
Inactive	142(86.6)	22(13.4)	Reference	0.360
Active	73(82.0)	16(18.0)	1.41(0.70–2.85)	
Alcohol or tobacco use				
No	147(88.6)	19(11.4)	Reference	**0.040**
Yes	68(78.2)	19(21.8)	2.16(1.07–4.34)	
Overweight/Obesity				
No	76(87.4)	11(12.6)	Reference	0.579
Yes	139(83.7)	27(16.3)	1.34(0.63–2.85)	
Diabetes or hypertension				
No	144(96.0)	6(4.0)	Reference	**< 0.001**
Yes	71(68.9)	32(31.1)	10.81(4.32–27.06)	
Operational stress				
No	59(95.2)	3(4.8)	Reference	**0.008**
Yes	156(81.7)	35(18.3)	4.41(1.30-14.89)	
Organizational stress				
No	82(94.3)	5(5.7)	Reference	**0.003**
Yes	133(80.1)	33(19.9)	4.06(1.52–10.84)	
Years of experience				
1–14 years	112(88.9)	14(11.1)	Reference	0.113
≥ 15 years	103(81.1)	24(18.9)	1.86(0.91–3.79)	
Job Status				
CPO	160(87.4)	23(12.6)	Reference	0.114
Others	55(78.6)	15(21.4)	1.89(0.92–3.89)	

UAOR: Unadjusted Odds Ratio; CI: Confidence Interval; CPO: Civil Police Officers

Table 2 Daytime sleepiness by background characteristics

Factors	Daytime sleepiness		UAOR (95% CI)	*p* value
	No *N*(%)	Yes *N*(%)		
Place of police station				
Rural	32(28.6)	80(71.4)	3.09(1.82–5.24)	**< 0.001**
Urban	78(53.3)	63(44.7)	Reference	
Age (in years)				
30–40	47(38.8)	74(61.2)	1.43(0.87–2.37)	0.165
41–55	63(47.7)	69(52.3)	Reference	
Sex				
Female	12(42.9)	16(57.1)	1.03(0.46–2.27)	0.999
Male	98(43.6)	127(56.4)	Reference	
Physical activity				
Inactive	70(42.7)	94(57.3)	1.09(0.65–1.84)	0.791
Active	40(44.9)	49(55.1)	Reference	
Alcohol or tobacco use				
Yes	33(37.9)	54(62.1)	1.41(0.83–2.40)	0.230
No	77(46.4)	89(53.6)	Reference	
Overweight/Obesity				
Yes	68(41.0)	98(59.0)	1.34(0.79–2.26)	0.287
No	42(48.3)	45(51.7)	Reference	
Diabetes or hypertension				
No	61(40.7)	89(59.3)	1.32(0.79–2.19)	0.303
Yes	49(47.6)	54(52.4)	Reference	
Operational stress				
No	22(35.5)	40(64 0.5)	1.55(0.85–2.81)	0.184
Yes	88(46.14)	103(53.9)	Reference	
Organizational stress				
No	37(42.5)	50(57.5)	1.06(0.26–1.79)	0.894
Yes	73(44.0)	93(56.0)	Reference	
Years of experience				
1–14 years	47(37.3)	79(62.7)	1.65(1.00-2.73)	**0.054**
≥ 15 years	63(49.6)	64(50.4)	Reference	
Job Status				
CPO	70(38.3)	113(61.7)	2.15(1.23–3.76)	**0.007**
Others	40(57.1)	30(42.9)	Reference	

UAOR: Unadjusted Odds Ratio; CI: Confidence Interval; CPO: Civil Police Officers

Sleep apnea and excessive daytime sleepiness with background characteristics are presented in Tables 1 and 2. Sleep apnea was significantly higher among alcohol or tobacco users compared to their counterparts [unadjusted odds ratio (UAOR):2.16, CI:1.07–4.34]. Both operational stress (UAOR:4.41, CI:1.30-14.89) and organizational stress (UAOR:4.06, CI:1.52–10.84) were significantly associated with sleep apnea. Excessive daytime sleepiness was more likely to be reported by police officers from rural police stations (UAOR:3.09, CI:1.82–5.24), those with lower years of experience (UAOR:1.65, CI:1.00-2.73), and among civil police officers (UAOR:2.15, CI:1.23–3.76) compared to their counterparts.

We performed logistic regression analysis separately for sleep apnea and excessive daytime sleepiness as dependent variable and associated risk factors as independent variables. All the variables presented in the table were included as independent variables in logistic regression analysis. The regression results presented were controlled for variable like age, sex, physical activity, alcohol or tobacco use, overweight or obesity, years of experience and job type. The analysis indicated that, only variable significantly associated with sleep apnea was the presence

of diabetes or hypertension. Those with either condition were significantly more likely to have sleep apnea (Odds Ratio (OR):8.41 95% CI: 3.20–22.10) compared to their counterparts. For excessive daytime sleepiness, the logistic regression identified place of police station as the only associated significant variable. Police officers from rural stations were more likely to experience excessive daytime sleepiness compared to their counterparts from urban areas (OR: 3.14, 95% CI: 1.80–5.47).

Discussion

In our study, the prevalence of sleep apnea among police officers from the state of Kerala was 15% (95% CI:10.8–20.0), which is lower than that reported (36.3%) among police officers in Delhi state of India [39]. According to findings from police personnel in Maharashtra, India, 31% reported experiencing sleep problems. Furthermore, 44% of these personnel reported substance use; specifically, 32% used alcohol and 22% used nicotine [43]. Poor sleep quality was found to be 69% among Australian police officers [20]. The study reported that sleep disturbances were significantly associated with higher likelihood of self-reported detrimental health, functionality, and safety consequences. Sleep disorders in North American police officers were linked to increased health and safety risks [27]. In the study, 40.4% of them reported symptoms that were consistent with at least one sleep disorder, with obstructive sleep apnea being the most common (33.6%), followed by moderate-to-severe insomnia (6.5%).

Individuals with type 2 diabetes often experience sleep disturbances, which can significantly impact their overall health. Diabetes is linked to frequent difficulties in falling asleep, staying asleep, and experiencing excessive daytime sleepiness [44]. The increased risk of hypertension associated with poor sleep quality has been widely reported in the literature [45]. Our study also reported significantly higher levels of sleep apnea among those with diabetes or hypertension compared to their counterparts. Earlier findings also supported that sleep quality disorders are significantly associated with comorbidities such as hypertension and diabetes mellitus [46]. However, the conclusions drawn from our results, particularly regarding the association between diabetes, hypertension, and sleep apnea, require further comprehensive evidence to substantiate the associations.

The scoping review on stress, sleep, and cardiovascular risk among police officers underscores the critical interplay between occupational stress and sleep quality [47]. The relationship between job stress and sleep quality among police personnel is bidirectional. High levels of job-related stress can negatively affect sleep quality, while poor sleep can further increase stress levels [48]. This cycle ultimately impacts the overall well-being and performance of law enforcement professionals. Our study identifies a significant association between sleep apnea and both operational and organizational stress, underscoring the necessity for potential intervention in these areas.

Alcohol and tobacco users had a significantly greater prevalence of sleep apnea. Alcohol's sedative properties and ability to rapidly induce sleep may be factors in its use, and the resulting disruption of breathing and the quality of sleep at night may lead to post-consumptive impairment throughout the day [49]. It is also reported that the quality of sleep is lower for those who are dependent on nicotine [50]. Nicotine is linked to worsening insomnia and shorter sleep duration, especially when consumed at night [51].

Working night shifts has been linked to increased levels of daytime sleepiness [52]. Narcolepsy, sleep apnea syndrome and the use of sedative medication has a well-established association with excessive daytime sleepiness [53]. Police officials working on the night shift were more likely to experience poor sleep quality and excessive daytime sleepiness compared to those working in other shifts [54]. This study reported an excessive daytime sleepiness prevalence of 25.7% among police officials in the United States, which is significantly lower compared to the 56.5% prevalence reported in our study. Results of a study among Chinese police officers reported that 22% had obstructive sleep apnea as measured by the Berlin questionnaire [55]. Age and severity of hypertension were found to be associated with obstructive sleep apnea in the study. Earlier finding among physicians in Syria reported that more than one third reported excessive daytime sleepiness [56]. Sleep problems are generally more prevalent in urban environments than in rural settings. However, as reported among elderly population in Iran [57], our study identified significantly higher daytime sleepiness among rural police personnel compared to their urban counterparts. The underlying reasons for this disparity require further investigation. An Italian study reported that sleep disorders were significantly affected by shift-work conditions and seniority in shift work [58]. Sleep disorders were found to be higher among shift workers(35.7%) than among non-shift workers(26.3%). Police officers in New York reported a poor sleep quality of 54%, which was 70%, more prevalent among night-shift officers compared to their counterparts [59].

Civil police officers and those with fewer years of experience more likely reported excessive daytime sleepiness compared to their contemporaries. This might be because of older individuals' being able to better handle the demands of their professions compared to younger professionals, because of their improved coping mechanisms that have been enhanced through professional experience [60].

The study addresses the lack of local evidence on sleep health, providing valuable insights that can inform the planning of future interventions and policies for this population. The use of validated measurement tools to assess sleep apnea and excessive daytime sleepiness were further strengths of the study. The study was conducted within the premises of police stations. Despite efforts to ensure privacy during data collection, the office environment might have influenced participants' reports of daytime sleepiness, work-related stress, alcohol consumption and tobacco use. This potential source of bias should be considered when generalizing the findings. Finally, as our study was cross-sectional, we are unable to establish causation or determine temporality between the associated variables with sleep apnea and excessive daytime sleepiness.

Conclusions

In conclusion, the present study found a high prevalence of sleep disorders, coupled with significant levels of stress, both operational and organizational. These factors, intertwined with unhealthy lifestyle habits such as physical inactivity, tobacco use, and alcohol consumption, pose serious threats to the overall health and well-being of these dedicated public servants. A high prevalence of sleep disorders was observed among police officers, with strong associations to occupational stress and lifestyle factors. Improving sleep quality is essential for enhancing public health, particularly for shift workers such as police officers in India. The impact of operational and organizational stress associated with inadequate sleep is a critical issue that warrants attention. These stressors can significantly affect the personal and professional quality of life for police officials. Addressing these factors is essential to enhance overall well-being and job performance within law enforcement agencies. By prioritizing strategies to address this issue, we can significantly benefit individual well-being and strengthen public safety. Fostering better sleep habits and support systems can lead to positive outcomes for both workers and the communities they serve. The findings of the present study highlight the importance of sleep interventions in enhancing workplace health for this population. As part of the project, we started a behavioral intervention aiming to improve the sleep quality in this population [61].

Acknowledgements
We would like to thank the participating police officers for their time and contributions to this study, despite their demanding duty schedules.

Author contributions
Conception and design of study: MGK, VI; Acquisition of data: AVM, SKS; Analysis and interpretation of data: MGK, SKS, AVM, VI; Drafting the manuscript: MGK, SKS, GG; Revising the manuscript critically for important intellectual content: MGK, SKS, GG, AVM, AMP, AS, MPA, VI. All authors have read and agreed on the final version of the manuscript.

Funding
The study has been supported with funding from the Bernard Lown Scholars in Cardiovascular Health Program at the Harvard T H Chan School of Public Health, Boston, USA (Award Number: BLSCHP-2201, Awarded to the first author; Mini GK). The funders had no direct role in study design, collection, analysis or interpretation of data, writing of the manuscript and in the decision to submit the manuscript for publication.

Data availability
Data will be made available by the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to the participants
Ethical clearance was obtained from the Institutional Ethics Committee (IEC) of Ananthapuri Hospitals and Research Institute, Thiruvananthapuram, Kerala (Ref no-AHRI/EC/39/Sept/2022 dated September 2, 2022). Following ethical approval, permission was obtained from the police department to conduct the study. The study commenced after receiving all necessary approvals. Both verbal and written informed consent was obtained from the respondents. In the participant information sheet, respondents were informed of the study's goal, confidentiality, and their right to decline or withdraw at any time. The study adhered to all the ethical procedures as outlined in the Helsinki declaration.

Consent for publication
No consent to publish was needed for this study as the researchers did not use any details, images or videos related to individual participants.

Disclosure statement
The authors declare that there are no conflicts of interest or financial disclosures related to this study.

Competing interests
The authors declare no competing interests.

Author details
[1]Global Institute of Public Health, Ananthapuri Hospitals and Research Institute, Thiruvananthapuram, Kerala, India
[2]Centre for Environment and Development (CED), Thiruvananthapuram, Kerala, India
[3]Department of Global Health & Population, Harvard T.H. Chan School of Public Health, Harvard University, Boston, MA, USA
[4]Saveetha Dental Colleges & Hospitals, Saveetha Institute of Medical and Technical Sciences, Chennai, India
[5]Department of Psychology, Central University, Gulbarga, Karnataka, India
[6]Department of Cardiology, Ananthapuri Hospitals and Research Institute, Thiruvananthapuram, Kerala, India
[7]Department of Community Medicine, Amrita Institute of Medical Sciences, Amrita Vishwavidhyapeetham, Kochi, Kerala, India
[8]Department of Neurosurgery, Ananthapuri Hospitals and Research Institute, Thiruvananthapuram, Kerala, India
[9]Department of Research in Chronic Diseases, Institute for Clinical Effectiveness and Health Policy (IECS), Buenos Aires, Argentina

Received: 12 March 2025 / Accepted: 22 May 2025
Published online: 06 June 2025

References

1. Leino T, Eskelinen K, Summala H, Virtanen M. Work-related violence, debriefing and increased alcohol consumption among Police officers. Int J Police Sci Manag. 2011;13(2):149–57. https://doi.org/10.1350/ijps.2011.13.2.229.
2. Eriksen CA, Kecklund G. Sleep, sleepiness and health complaints in Police officers: the effects of a flexible shift system. Ind Health. 2007;45(2):279–88. https://doi.org/10.2486/indhealth.45.279.
3. Habersaat SA, Geiger AM, Abdellaoui S, Wolf JM. Health in Police officers: role of risk factor clusters and Police divisions. Soc Sci Med. 2015;143:213–22. https://doi.org/10.1016/j.socscimed.2015.08.043.

4. Santana AM, Gomes JK, De Marchi D, et al. Occupational stress, working condition and nutritional status of military Police officers. Work. 2012;41:2908–14. https://doi.org/10.3233/WOR-2012-0543-2908.
5. Wang XS, Armstrong ME, Cairns BJ, Key TJ, Travis RC. Shift work and chronic disease: the epidemiological evidence. Occup Med. 2011;61:78–89. https://doi.org/10.1093/occmed/kqr001.
6. Kawabe Y, Nakamura Y, Kikuchi S, et al. Relationship between shift work and clustering of the metabolic syndrome diagnostic components. J AtherosclerThromb. 2014;21:703–11. https://doi.org/10.5551/jat.19380.
7. Knutsson A, Kempe A. Shift work and diabetes: a systematic review. Chronobiol Int. 2014;31:1146–51. https://doi.org/10.3109/07420528.2014.957308.
8. Bonde JP, Hansen J, Kolstad HA et al. Work at night and breast cancer: report on evidence-based options for preventive actions. Scand J Work Environ Health. 2012;38:380–390. http://www.jstor.org/stable/41508905. Accessed January 15, 2025.
9. Shen J, Botly LC, Chung SA, Gibbs AL, Sabanadzovic S, Shapiro CM. Fatigue and shift work. J Sleep Res. 2006;15:1–5. https://doi.org/10.1111/j.1365-2869.2006.00493.x.
10. Violanti JM, Fekedulegn D, Andrew ME, et al. Shift work and the incidence of injury among Police officers. Am J Ind Med. 2012;55:217–27. https://doi.org/10.1002/ajim.22007.
11. Magrini A, Pietroiusti A, Coppeta L, et al. Shift work and autoimmune thyroid disorders. Int J Immunopathol Pharmacol. 2006;19:31–6.
12. Swinkels CM, Ulmer CS, Beckham JC, Buse N, Calhoun PS. The association of sleep duration, mental health, and health risk behaviors among U.S. Afghanistan/Iraq era veterans. Sleep. 2013;36(7):1019–25. https://doi.org/10.5665/sleep.2800.
13. Dubrow R, Burnett CA, Gute DM, Brockert JE. Ischemic heart disease and acute myocardial infarction mortality among police officers. J Occup Med. 1998;30:650–654. http://www.jstor.org/stable/45007930. Accessed October 20, 2024.
14. Garbarino S, Magnavita N. Work stress and metabolic syndrome in Police officers. A prospective study. PLoS ONE. 2015;10. https://doi.org/10.1371/journal.pone.0144318.
15. Gagnadoux F, Priou P, Urban T, Meslier N, Trzepizur W. Sleep Apneas, metabolic syndrome and cardiovascular risk: data from the pays de La Loire sleep cohort. Rev Pneumol Clin. 2017;73(6):299–305. https://doi.org/10.1016/j.pneumo.2017.09.001.
16. Song Q, Liu X, Zhou W, Wang X, Wu S. Changes in sleep duration and risk of metabolic syndrome: the Kailuan prospective study. Sci Rep. 2016;6:36861. https://doi.org/10.1038/srep36861.
17. Itani O, Kaneita Y, Tokiya M, et al. Short sleep duration, shift work, and actual days taken off work are predictive life-style risk factors for new-onset metabolic syndrome: a seven-year cohort study of 40,000 male workers. Sleep Med. 2017;39:87–94. https://doi.org/10.1016/j.sleep.2017.07.027.
18. Titova OE, Lindberg E, Elmståhl S, Lind L, Schiöth HB, Benedict C. Associations between the prevalence of metabolic syndrome and sleep parameters vary by age. Front Endocrinol (Lausanne). 2018;9:234. https://doi.org/10.3389/fendo.2018.00234.
19. Shiozaki M, Miyai N, Morioka I, et al. Assessment of the risk of ischemic heart disease and its relevant factors among Japanese Police officers. Sangyo Eiseigaku Zasshi. 2013;55(4):115–24. https://doi.org/10.1539/sangyoeisei.b12007.
20. Elliott JL, Lal S. Blood pressure, sleep quality and fatigue in shift working Police officers: effects of a twelve hour roster system on cardiovascular and sleep health. Int J Environ Res. 2016;13:172. https://doi.org/10.3390/ijerph13020172.
21. Wagstaff AS, Sigstad Lie JA. Shift and night work and long working hours-a systematic review of safety implications. Scand J Work Environ Health. 2011;37:173–185. http://www.jstor.org/stable/41151541. Accessed September 13, 2024.
22. Oginski A, Oginska H, Pokorksi J, Kmita W, Gozdziela R. Internal and external factors influencing time related injury risk in continuous shift work. Int J Occup Saf Health. 2000;6:405–21. https://doi.org/10.1080/10803548.2000.11076464.
23. Kposowa AJ. Suicide mortality in the united States: differentials by industrial and occupational groups. Am J Ind Med. 1999;36(6):645–52. https://doi.org/10.1002/(SICI)1097-0274(199912)36:6%3C;645::AID-AJIM7%3E;3.0.CO;2-T.
24. Violanti JM, Fekedulegn D, Hartley TA, Andrew ME, Gu JK, Burchfiel CM. Life expectancy in Police officers: a comparison with the U.S. General population. Int J Emer Mental Health Hum Resil. 2013;15(4):217–28.
25. Krayer A, Kulhari S, Sharma V, Robinson C. Pathways to suicide among Police in Rajasthan: perceptions and experiences of Police personnel. Int J Environ Res Public Health. 2023;20:1812. https://doi.org/10.3390/ijerph20031812.
26. Vila B, Kenney DJ. Tired cops: the prevalence and potential consequences of Police fatigue. NIJ J. 2002;248:16–21.
27. Rajaratnam SM, Barger LK, Lockley SW, et al. Harvard work hours, health and safety group. Sleep disorders, health, and safety in Police officers. JAMA. 2011;306:2567–78. https://doi.org/10.1001/jama.2011.1851.
28. Garbarino S, Guglielmi O, Puntoni M, Bragazzi NL, Magnavita N. Sleep quality among Police officers: implications and insights from a systematic review and meta-analysis of the literature. Int J Environ Res Public Health. 2019;16(5):885. https://doi.org/10.3390/ijerph16050885.
29. George AB, Shetty JV. Prevalence of substance use and assessment of sleep quality, stress, and anxiety in Police personnel in the pandemic. Ann Indian Psychiatry. 2022;6(4):378–83. https://doi.org/10.4103/aip.aip_127_21.
30. Qureshi H, Lambert EG, Frank J. The relationship between stressors and Police job involvement. Int J Police Sci Manag. 2019;21(1):48–61. https://doi.org/10.1177/1461355719832621.
31. Yadav A, Rani S, Singh S. Working out-of-phase with reference to chronotype compromises sleep quality in Police officers. Chronobiol Int. 2016;33(2):151–60. https://doi.org/10.3109/07420528.2015.1121876.
32. Greeshma J, Mini GK, Marthanda Pillai A, Irazola V. Cardiovascular disease risk factor prevalence among Police officials: findings from a cross-sectional study in Kerala, India. J Occup Health. 2024;66(1):uiae025. https://doi.org/10.1093/joccuh/uiae025.
33. Sarma PS, Sadanandan R, Thulaseedharan JV, Soman B, Srinivasan K, Varma RP, Nair MR, Pradeepkumar AS, Jeemon P, Thankappan KR, Kutty RV. Prevalence of risk factors of non-communicable diseases in Kerala, India: results of a cross-sectional study. BMJ Open. 2019;9(11):e027880. https://doi.org/10.1136/bmjopen-2018-027880.
34. WorldHealthOrganization. STEPwiseapproachtosurveillance(STEPS). https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps. Accessed January 15, 2025.
35. World Health Organization. STEPwise approach to surveillance(STEPS). http://www.who.int/chp/steps/en/. Accessed January 15, 2025.
36. McCreary DR, Thompson MM. Development of two reliable and valid measures of stressors in policing: the operational and organizational Police stress questionnaires. Int J Stress Manag. 2006;13(4):494.
37. Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP. Using the Berlin questionnaire to identify patients at risk for the sleep apnea syndrome. Ann Intern Med. 1999;131(7):485–91. https://doi.org/10.7326/0003-4819-131-7-199910050-00002.
38. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep. 1991;14(6):540–5. https://doi.org/10.1093/sleep/14.6.540.
39. Meena JK, Kumar R, Meena GS. Protect the protector: morbidity and health behavior among Police personnel in National capital region of India. Indian J Occup Environ Med. 2018;22(2):86–91. https://doi.org/10.4103/ijoem.IJOEM_28_18.
40. Soni RK, Kar A, Agrawal S. Consequences of split shift work in Indian traffic Police personnel: daytime sleepiness, stressors and psychological distress. AmbientScience. 2016;3(Sp1):59–63. https://doi.org/10.21276/ambi.2016.03.sp1.ra09.
41. Scharf MT. Reliability and efficacy of the Epworth sleepiness scale: is there still a place for it? Nat Sci Sleep. 2022;14:2151–6. https://doi.org/10.2147/NSS.S340950.
42. Chobanian AV, Bakris GL, Black HR, et al. National heart, lung, and blood Institute joint National committee on prevention, detection, evaluation, and treatment of high blood pressure; National high blood pressure education program coordinating committee. The seventh report of the joint National committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. JAMA. 2003;289:2560–72. https://doi.org/10.1001/jama.289.19.2560.
43. George AB, Shetty JV. Prevalence of substance use and assessment of sleep quality, stress, and anxiety in Police personnel in the pandemic. Annals Indian Psychiatry. 2022;6(4):378–83. https://doi.org/10.4103/aip.aip_127_21.
44. Bironneau V, Goupil F, Ducluzeau PH, et al. Association between obstructive sleep apnea severity and endothelial dysfunction in patients with type 2 diabetes. Cardiovasc Diabetol. 2017;16:39. https://doi.org/10.1186/s12933-017-0521-y.
45. Liu RQ, Qian Z, Trevathan E, et al. Poor sleep quality associated with high risk of hypertension and elevated blood pressure in China: results from a large

population-based study. Hypertens Res. 2016;39(1):54–9. https://doi.org/10.1038/hr.2015.98.
46. Fiorentini A, Valente R, Perciaccante A, Tubani L. Sleep's quality disorders in patients with hypertension and type 2 diabetes mellitus. Int J Cardiol. 2007;114(2):E50–2. https://doi.org/10.1016/j.ijcard.2006.07.213.
47. Magnavita N, Chirico F, Garbarino S, Ciprani F. Stress, sleep, and cardiovascular risk in Police officers: A scoping review. J Health Soc Sci. 2024;9(1):9–23. https://doi.org/10.19204/2024/STRS1.
48. Garbarino S, Magnavita N. Sleep problems are a strong predictor of stress-related metabolic changes in Police officers. A prospective study. PLoS ONE. 2019;14(10):e0224259. https://doi.org/10.1371/journal.pone.0224259.
49. Vitiello MV. Sleep, alcohol and alcohol abuse. Addict Biol. 1997;2(2):151–8. https://doi.org/10.1080/13556219772697.
50. Cohrs S, Rodenbeck A, Riemann D, et al. Impaired sleep quality and sleep duration in smokers - results from the German multicentre study on nicotine dependence. Addict Biol. 2014;19(3):486–96. https://doi.org/10.1111/j.1369-1600.2012.00487.x.
51. Nuñez A, Rhee JU, Haynes P, et al. Smoke at night and sleep worse? The associations between cigarette smoking with insomnia severity and sleep duration. Sleep Health. 2021;7(2):177–82. https://doi.org/10.1016/j.sleh.2020.10.006.
52. Waage S, Pallesen S, Moen BE, et al. Predictors of shift work disorder among nurses: a longitudinal study. Sleep Med. 2014;15(12):1449–55. https://doi.org/10.1016/j.sleep.2014.07.014.
53. Mathis J, Seeger R, Ewert U. Excessive daytime sleepiness, crashes and driving capability. Schweiz Arch Neurol Psychiatr. 2003;154(7):329–38.
54. James L, James S, Atherley L. The effects of shift-work schedules on the sleep, health, safety, and quality of life of Police employees during the COVID-19 pandemic. Front Psychol. 2023;14:1128629. https://doi.org/10.3389/fpsyg.2023.1128629.
55. Pan M, Ou Q, Chen B, Hong Z, Liu H. Risk factors for obstructive sleep apnea-related hypertension in Police officers in Southern China. J Thorac Disease. 2019;11(10):4169–78. https://doi.org/10.21037/jtd.2019.09.83.
56. Jassem M, Abdelwahed RN, Alyousbashi A, Meer A. Evaluation of daytime sleepiness and sleep quality among resident physicians of Damascus: A cross-sectional study. Sleep Epidemiol. 2022;2:100035. https://doi.org/10.1016/j.sleepe.2022.100035.
57. Delbari A, Ahmadi F, Zar A, Zandvakili A, Sadeghipour HR, Sims J. Living in urban or rural environments affect the sleep quality of the elderly in Bushehr (Southern Iran): emphasizing the active and inactive of the elderly. BMC Public Health. 2024;24(1):1340. https://doi.org/10.1186/s12889-024-18747-9.
58. Garbarino S, De Carli F, Nobili L, Mascialino B, Squarcia S, Penco MA, Beelke M, Ferrillo F. Sleepiness and sleep disorders in shift workers: a study on a group of Italian Police officers. Sleep. 2002;25(6):642–7. https://doi.org/10.1093/sleep/25.6.642.
59. Fekedulegn D, Burchfiel CM, Charles LE, Hartley TA, Andrew ME, Violanti JM. Shift work and sleep quality among urban Police officers: the BCOPS study. J Occup Environ Med. 2016;58(3):e66–71. https://doi.org/10.1097/JOM.0000000000000620.
60. Briones Mella D, Boutin APK. Burnout and coping strategies in male staff from National Police in Valparaíso, Chile. Iran J Public Health. 2013;42(9):950–9.
61. The Bernard Lown Scholars in Cardiovascular Health Program. Lownscholars'projects. https://www.hsph.harvard.edu/lownscholars/what-we-do/lown-projects/. Accessed January 10, 2025.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.