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Research Article

Profile of noncommunicable Disease Risk Factors Among Nurses in a Tertiary Care Hospital in South India

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SUMMARY

Purpose: The work nature of nurses and the associated lifestyle changes put them at high risk of developing noncommunicable diseases (NCDs). This study was conducted to estimate the prevalence of NCD risk factors among nurses working in a tertiary care hospital in Puducherry and to determine the associated factors among nurses.

Methods: We conducted a cross-sectional study among all nurses (N = 1217) in the tertiary care hospital aged between 21 and 60 from May 2019 to April 2020. We assessed NCDs behavioral, physical, and biochemical risk factors using a self-administered questionnaire. The adjusted prevalence ratio was calculated using a generalized linear regression model to determine factors associated with NCD risk factors.

Results: The response rate was 99% (1217/1229), and 77.5% of the participants were women. Current tobacco use and alcohol consumption were 1.5% (95% CI: 0.8–2.2) and 2.9% (95% CI: 2–3.9), respectively, with significantly higher prevalence among men. Overweight or obesity (body mass index ≥ 23 kg/m^2) was 77.7%, with a significantly higher prevalence among those aged ≥30 and married. Prevalence of hypertension was 14.4% (95% CI: 12.5–16.4), and diabetes mellitus was 11.5% (95% CI: 9.7–13.6). Both were significantly higher among those aged ≥50 years. One-third of nurses, 34.3% (95% CI: 31.6–37.1), had hypercholesterolemia, significantly higher among men.

Conclusion: We found a high prevalence of various NCD risk factors among the nurses. We highlight the urgent need for initiating health promotion interventions, especially to improve intake of healthy diet and physical activity among nurses aged ≥30 years.

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Introduction

Noncommunicable diseases (NCDs) have emerged as major threats to socioeconomic development in low- and middle-income countries. Worldwide, NCDs account for 71% of all deaths, of which four of the five occur among those aged between 30 and 69 years [1].

Globally, only about half of the countries have worker's health profiles, of which NCDs and other lifestyle risks were the least covered [2]. A step toward addressing the rising burden of NCDs among employees is implementing setting-based health promotion [3]. India has 1.7 nurses per thousand, which is less than 43% of the World Health Organization (WHO) norm of 3 per 1000 [4]. Indian medical services heavily depend on nurses to cater to the health services of a large population but falling short of the prescribed strength of nurses causes hardship among health professionals.

Nurses play a pivotal role in combating the NCD burden in the country by promoting optimal health among patients and the population. NCD risk factors among nurses are expected to be lower than in other professionals. But, emerging shreds of evidence present poor health status among nurses. For instance, a recent meta-analysis reported the pooled prevalence of tobacco use among

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nurses worldwide to be 24% across regions [5]. Alcohol dependency among nurses was 5.3%, whereas obesity and central obesity were present among more than 80% of nurses in Delhi [6,7]. Another study reported inadequate intake of fruits and vegetables (85.4%) and inadequate physical activity (39.7%) among employees in a tertiary care hospital in Delhi [8]. Among nurses, shift work, especially the night shift, is linked to dyslipidemia due to a lack of time to prepare healthy meals and resort to fast foods that put them at risk of developing NCDs [9]. Additionally, stressful work puts added strain on health, particularly among government nurses who experience higher emotional exhaustion and depersonalization due to high patient turnover [10,11].

Few studies have assessed NCD risk factors among healthcare workers, particularly nurses in India. There is a lack of data on NCD risk factors among nurses, which is essential to facilitate the employee wellness program for NCD prevention. Hence, we conducted this study to estimate the prevalence of NCD risk factors and determine the associated factors among nurses.

Methods

Study design and setting

We conducted a hospital-based cross-sectional study among permanent nursing employees aged between 21 and 60 from May 2019 to April 2020 in a tertiary care hospital, Puducherry. The hospital has an inpatient bed capacity of 2143 (210 beds in ICU) and caters to outpatient services to about 8000 patients per day. The department of nursing services constitutes 1350 nursing employees providing patient care with a nurse–patient ratio of 0.63 nurses per bed. The hospital has been running an employee wellness program through an in-house quality council since 2012 that encourages employees to undergo annual health check-ups on their birthdays.

Sample size calculation and sampling technique

We calculated the sample size using Open Epi Version 3.01 by considering the prevalence of hypertension among nurses as 13.7% [12], relative precision of 15%, power of 80%, and confidence interval of 95%. The final sample size of 1216 was obtained by considering 10% of the nonresponse rate. However, we included all 1350 nursing employees. One hundred twenty-one employees were not available at the beginning of the study, and the final sample size was reduced to 1229.

Data collection tools

We used the “NCD work lite” questionnaire, a simplified, validated, locally adapted, and pilot-tested tool to assess the NCD risk factors of study participants. In this study, the “NCD work lite” questionnaire was adopted after conducting a face and content validity assessment through a group of experts through Delphi, followed by pilot testing of the questionnaire in the field. Studies that have assessed NCD risk factors have also used this questionnaire [13,14]. In this study, data were collected in three steps. Sociodemographic information and NCD behavioral risk factors (Step 1) were collected using self-administered performa. The investigator collected physical measurements to estimate overweight, obesity, and abdominal obesity and a blood sample to estimate blood glucose and lipid profile in Steps 2 and 3. All the risk factors were assessed by following the WHO-recommended STEPS (stepwise) guidelines for NCD risk factors assessment. The WHO STEPS guideline prescribes a standardized methodology for evaluating key behavioral risk factors such as alcohol use, tobacco use, physical inactivity, and unhealthy diet and biological risk factors such as abnormal blood lipids, overweight and obesity, raised blood pressure (BP), and raised blood glucose (RBG) [15]. As STEPS guidelines follow standardized methodology, it facilitates monitoring the prevalence of various risk factors over time in a single study setting and in making comparisons across other settings.

Data collection procedure

We obtained a list of all eligible nursing employees from the Nursing department. The investigator contacted the employees in their area of posting in person after obtaining written consent for participation. When the approached individual was unavailable at the time of visit for their participation, revisits were made up to three times at timings suitable to participants, beyond which they were considered nonrespondent.

Behavioral risk factors (Step 1): Initially, sociodemographic information such as age, gender, residence, experience, marital status, and designation was collected. Information on tobacco use (smoke and smokeless forms), alcohol use (frequency), intake of fruits and vegetables, and physical activity was collected. Before handing over the questionnaire, we used show cards to describe the types of physical activity and servings of fruits and vegetables.

Physical measurements (Step 2): Height, weight, waist circumference, and BP were measured as prescribed by WHO STEPS guidelines [15]. The participant's height was measured in standing posture with barefoot and light clothing using a portable stadiometer. Weight was measured using an electronic weighing scale at the nearest 100gm. SECA constant tension tape (SECA 201) was used for waist measurement at the nearest 0.1 cm. BP was measured on OMRON, HEM 7120 (Fully automatic digital BP monitor). Three BP readings were taken with a resting interval of 3 minutes between each measurement, and the mean of the last two measurements was used to assess the BP. All equipment was calibrated regularly before and during data collection.

Biochemical Measurements (Step 3): Overnight fasting (10–12 hours) of 5 ml venous sample was drawn from each participant in a sitting position and transferred to the central lab of the Biochemistry Department of our Institute under the cold chain. Samples were collected in fluoride containers for fasting blood glucose and serum container for lipid profile, and they were estimated by glucose oxidase peroxide and cholesterol oxidase peroxide methods, respectively. The process was carried out in spectrophotometry at 520 nm (Beckman Coulter Inc., Brea, California, USA) through commercially available kits. All information was recorded in the performa after getting lab reports on the same day.

Operation definitions

The use of tobacco (smoke/smokeless forms) and alcohol consumption in the last 30 days and 1 year was considered current use of tobacco and alcohol. Inadequate intake of fruits and vegetables was defined as consuming less than five servings of fruits and vegetables on an average per day [15]. Inadequate physical activity was defined as spending at least 150 minutes per week for physical activity apart from work. Overweight (23.0 –24.9 kg/m^2) and obesity ($\geq$25 kg/m^2) were determined based on Asian cut-offs of body mass index (BMI) classification. Waist circumference $\geq$ 90 cm for men and $\geq$80 cm for women were considered abdominal obesity [16].

RBG was defined at fasting plasma glucose of $\geq$126 mg/dl or currently on antidiabetic medications [17]. Systolic BP of $\geq$140 mm Hg or diastolic BP of $\geq$90 mm Hg or currently on hypertension lowering drugs was defined as raised BP [18].

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Hypercholesterolemia was described as having a total cholesterol level of ≥200 mg/dl or currently on lipid-lowering drugs. Raised triglycerides were defined as triglycerides levels of ≥150 mg/dl, and a low-density lipoprotein (LDL) level of ≥130 mg/dl was regarded as triglyceridemia and raised LDL, respectively. Low high-density lipoprotein (HDL) was defined as those having HDL levels of ≤50 mg/dl among women and ≤40 mg/dl among men [19].

Statistical analysis

Data collected in a paper-based questionnaire were entered in the EpiCollect5 app, and the final data were extracted in Microsoft Excel (version 2011) sheet. Data analysis was carried out in STATA14.0 (StataCorp LP, College Station, TX, USA). Continuous variables such as age and experience, and categorical variables such as the prevalence of various risk factors (tobacco and alcohol use, low physical exercise, raised BP, and RBG) were summarized using mean (SD) and proportions, respectively. The differences in risk factors prevalence between subgroups of independent variables were determined by comparing 95% confidence interval. The adjusted prevalence ratio for each independent variable was estimated using weighted forward stepwise generalized linear modeling with Gaussian regression. The sample size was not adequate as per assumptions in a particular stratum for binomial regression (In multivariate analysis, the sample size should be at least 20 in each stratum). Hence, we have opted for Gaussian regression analysis. The models were developed for each risk factor by keeping the risk factor as the dependent variable and socio-demographic characteristics (gender, age group, marital status, residence) as independent variables. Independent variables were chosen based on evidence from the literature. In regression models, $p < .05$ was considered statistically significant.

Ethical considerations

The ethical committee approved this study of the institute (JIP/IEC/2018/307) dated October 3, 2018. We had undertaken several measures to promote the voluntary participation of the nurses in the study. The study investigators conducted several rounds of sensitization programs for different cadres of nurses in the hospital as a part of the ongoing nursing education program throughout the study's data collection period to propagate the study. Further, at the time of data collection, the study investigator visited each nurse in person in their working area and described the need, risks, and benefits, voluntary nature of the study, and the option to withdraw from the study at any time during the study. These measures played a crucial role in their participation in the study. Informed written consent was obtained from each participant before enrolling in the study. Confidentiality of data was maintained by generating a unique ID.

Results

The response rate for Steps 1, 2, and 3 were 99% (1217/1229) and 90.3 (1100/1217), respectively.

Table 1 shows sociodemographic characteristics. In the study, more than three-fourths were women (77.5%), and the mean age (SD) of participants was 36.6 (8.6) years. About nine-tenth of the participants (90.9%) were residing in urban areas, and three-fifth (60.6%) had less than 10 years of experience.

Table 2 shows the mean and standard deviation of NCD risk factors**.** Mean (SD) body mass index and mean (SD) fasting blood glucose were higher among women and those aged >50 years. Mean (SD) of total cholesterol and mean (SD) of triglycerides were higher among men. Mean (SD) HDL was high among women and those aged >50 years.

Table 3 shows the prevalence of behavioral risk factors for NCDs. Among the behavioral risk factors, current tobacco use (1.5%) and alcohol use (2.9%) were higher among men, whereas inadequate fruits and vegetable intake (76.1%) and low physical exercise (74.6%) were higher among women.

Table 4 shows the prevalence of biological risk factors for NCDs. Among biological risk factors, more than two-thirds had abdominal obesity (71.6%), more than half were obese (57.2%), and one-fifth were overweight (20.5%), which was higher among women and those aged ≥40 years. About one-tenth of nurses had raised BP (14.4%) and RBG (11.5%). More than one-third of nurses had hypercholesterolemia (34.3%) and raised LDL (41.9%), and two third had low HDL (65.3%).

Table 5 shows determinants of various risk factors for NCDs. Prevalence of current tobacco and alcohol use was significantly ($p < .001$) higher among men by 5% and 12% compared to women. Inadequate physical activity (74.6%) and inadequate intake of fruit and vegetables were significantly higher among men ($p < .001$) and those aged ≥50 years ($p < .001$), respectively. Among biological risk factors, obesity was significantly higher among married and urban residents and those aged above 30 years ($p < .035$). Abdominal obesity was significantly higher among women ($p < .001$) and married ($p < .001$), and those aged above 40 years ($p < .001$). The prevalence of raised BP was significantly higher among men and those aged ≥40 years ($p < .001$). The prevalence of RBG was significantly higher among married nurses and those aged ≥40 years ($p < .001$). Hypercholesterolemia was significantly higher among men ($p < .001$). Triglyceridemia was significantly higher among men ($p < .001$) and those married ($p < .001$). Raised LDL was significantly higher among men ($p < .001$) and those aged ≥50 years ($p < .033$), whereas low HDL was significantly higher among women ($p < .001$) and aged 30–39 years ($p < .023$).

Discussion

In this study, current tobacco use among nurses was 1.5%, significantly higher among men than women. This prevalence was substantially low compared to studies conducted worldwide

Table 1 *Sociodemographic Characteristics of the Study Participants (N = 1217).*

Variables	Men (n = 274) n (%)	Women(n = 943) n (%)	Total (N = 1217) n (%)
Age (years)			
20–29	66 (24.1)	148 (15.7)	214 (17.6)
30–39	193 (70.4)	448 (47.5)	641 (52.7)
40–49	14 (5.1)	209 (22.2)	223 (18.3)
≥50	1 (0.4)	138 (14.6)	139 (11.4)
Experience (years)			
1–9	238 (86.9)	499 (52.9)	737 (60.6)
10–19	29 (10.6)	226 (24)	255 (21)
≥20	7 (2.6)	218 (23.1)	225 (18.5)
Residence			
Rural	38 (13.9)	73 (7.7)	111 (9.1)
Urban	236 (86.1)	870 (92.3)	1106 (90.9)
Marital status			
Married	231 (84.3)	862 (91.4)	1093 (89.8)
Unmarried	42 (15.3)	69 (7.3)	111 (9.1)
Others	1 (0.4)	12 (1.3)	13 (1.1)
Designation			
Nursing officer	258 (94.2)	576 (61.1)	834 (68.5)
SNO and PHN	16 (5.8)	301 (31.9)	317 (26)
ANS and above	0 (0.0)	66 (7)	66 (5.4)

SNO = senior nursing officer; PHN = public health nurse; ANS = assistant nursing superintendent.

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Table 2 *Mean and Standard Deviation of Noncommunicable Disease (NCD) Risk Factors by Age and Gender Among the Study Participants (N = 1217).*

Mean and standard deviation of NCD risk factors						
Variables	N = 1217 n (%)	F and V intake (servings)	BMI kg/m^2	Waist circumference (cm)	Systolic BP (mmHg)	Diastolic BP (mmHg)
Age (in yrs.)						
20–29	214 (17.6)	3.85 (1.94)	24.10 (3.55)	86.08 (9.20)	107.41 (11.57)	72.75 (9.26)
30–39	641 (52.7)	3.90 (2.19)	25.82 (3.94)	89.43 (10.49)	110.81 (12.67)	73.87 (9.03)
40–49	223 (18.3)	3.83 (2.32)	27.30 (4.24)	92.25 (10.50)	112.39 (13.26)	75.01 (9.06)
≥50	139 (11.4)	4.30 (2.25)	28.98 (4.43)	94.77 (9.49)	117.16 (14.35)	75.89 (9.52)
Gender						
Men	274 (22.5)	4.18 (2.70)	25.31 (3.39)	88.42 (9.88)	117.87 (12.54)	77.88 (8.91)
Women	943 (77.5)	3.85 (2.01)	26.40 (4.41)	90.42 (10.59)	109.29 (12.56)	73.01 (8.95)
Overall		3.92 (2.18)	26.15 (4.22)	89.97 (10.46)	111.23 (13.05)	74.11 (9.17)
Variables	n = 1100 n (%)	Fasting blood sugar (mg/dl)	Total cholesterol (mg/dl)	Triglycerides (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
Age (in yrs.)						
20–29	166 (15)	84.18 (22.75)	183.30 (39.29)	118.14 (59.12)	119.21 (34.04)	46.47 (14.14)
30–39	591 (53.7)	87.38 (24.17)	186.47 (37.41)	118.18 (64.41)	125.47 (31.97)	44.25 (12.44)
40–49	215 (19.5)	95.47 (31.11)	186.84 (33.53)	115.23 (48.97)	123.64 (30.60)	45.88 (10.12)
≥50	128 (11.6)	107.01 (36.98)	186.79 (39.44)	127.13 (54.27)	124.98 (31.19)	47.41 (17.21)
Gender						
Men	237 (21.5)	88.49 (29.91)	196.19 (37.95)	148.83 (71.74)	136.77 (34.69)	40.3 (12.00)
Women	863 (78.5)	91.38 (27.48)	183.33 (36.52)	110.35 (53.14)	120.63 (30.29)	46.6 (12.90)
Overall		90.76 (28.00)	186.10 (37.19)	118.64 (59.75)	124.11 (31.97)	45.27 (12.99)

F and V = fruits and vegetables; BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein.

Table 3 *Prevalence of Behavioral Risk Factors of Noncommunicable Diseases Among Study Participants (N = 1217).*

Variables	Current tobacco use % (95% CI)	Current alcohol use % (95% CI)	Inadequate physical activity % (95% CI)	Inadequate intake of F and V % (95% CI)
Age (years)				
20–29	0.9 (0–2.3)	1.4 (0–3.3)	75.9 (68.7–81.9)	77.6 (71.5–82.7)
30–39	2.2 (1.1–3.3)	4.5 (3–6.1)	77.5 (74.1–80.9)	77.5 (74.3–80.8)
40–49	0.9 (0–2.2)	1.3 (0–3.1)	76.3 (70.7–81.9)	75.8 (70–81.6)
≥50	0 (0)	0 (0)	57 (47.7–65.6)	67.6 (59–75.5)
Gender				
Men	5.8 (3.3–8.8)	12 (8.4–16.1)	60.8 (54.4–67.1)	70.1 (65–75.5)
Women	0.2 (0–.5)	0.2 (0–.5)	78.4 (75.7–81.1)	77.8 (75.1–80.5)
Residence				
Rural	0.9 (0–2.7)	2.7 (0–6.3)	68.5 (59.5–76.6)	81.9 (73.4–89.4)
Urban	1.5 (0.8–2.3)	2.9 (1.9–3.9)	75 (72.3–77.6)	75.8 (73.2–78.5)
Marital status				
Married	1.3 (0.6–1.9)	2.8 (1.9–3.8)	75 (72.5–77.7)	77 (74.6–79.4)
Unmarried and others	3.2 (0.8–7.2)	3.2 (0.8–6.5)	68.5 (60.5–76.6)	72.6 (64.5–80.6)
Overall	1.5 (.8–2.2)	2.9 (2–3.9)	74.6 (71.8–77.2)	76.1 (73.7–78.6)

F and V = fruits and vegetables; CI = confidence interval.

among nurses and other healthcare professionals, where the pooled prevalence was 22–26% and 21–28%, respectively [5]. Similarly, current alcohol use among nurses was 2.9%, significantly higher among men (p = .001). This prevalence was less when compared to other studies on nurses that reported the prevalence of alcohol use between 3.8% and 77.4% [7,20–22]. Comparatively, lower prevalence of alcohol use and tobacco use observed in the study could be attributed to the majority of study participants being women (77.5%) and higher cultural inhibition on tobacco and alcohol use attached to women in India [23,24]. In particular, the lower prevalence of tobacco and alcohol use among nurses, particularly women, could be attributed to strict adherence to antitobacco and alcohol policies implemented in the study hospital. There is strict implementation of the COTPA (The Cigarettes and Other Tobacco Products Act), 2003 that prohibits the use of tobacco within the hospital premises, and the employee's service rules prohibit the use of alcohol at the workplace, which could be attributed as the key determinants of the lesser prevalence of alcohol and tobacco use observed in the study. Further, the study hospital, one of the WHO-recognized health-promoting hospitals, has implemented several preventive and health promotive services that are proven to promote health and wellness of hospital employees, including preventing tobacco and alcohol use in the workplace [14]. Other factors such as lesser social gathering due to shift duties, health consciousness about ill effects, and concern for professional dignity could have led to less prevalence in the study. To drive down the prevalence of tobacco and alcohol further, the hospital shall consider integrating mental health screening with the current annual medical check-up activity to help identify and treat the tobacco and alcohol use problems among the nurses [25].

In this study, the prevalence of overweight or obesity was 77.9%, with a significantly higher prevalence among those aged ≥30 years and those married and urban residents. This prevalence was substantially higher when compared to studies conducted in India that used a BMI classification of ≥23 kg/m^2 for the Asian population (16.1%) and was lower when compared to studies (80%) that used the WHO classification of BMI (≥25 kg/m^2) [6,12]. Studies conducted in the United States (48.6–54%) had a lesser prevalence that used BMI of ≥25 kg/m^2, and a study from Iran which used BMI of ≥23 kg/m^2 had a higher prevalence (82.4%) than the current study

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Table 4 *Prevalence of Biological Risk Factors of Noncommunicable Diseases Among Study Participants (N = 1217).*

Variables	Abdominal obesity % (95% CI)	Obesity % (95% CI)	Raised BP % (95% CI)	Raised blood glucose % (95% CI)
Age (years)				
20–29	54.7 (48.1–61.2)	34.6 (28–41.1)	6.1 (2.8–9.3)	4.2 (1.2–7.8)
30–39	66.9 (63.2–70.4)	56.3 (52.1–60.1)	10.5 (8.1–12.8)	6.9 (4.7–9.1)
40–49	85.2 (80.3–89.7)	67.3 (61.4–73.1)	18.8 (13.9–23.8)	17.7 (12.6–22.8)
≥50	97.1 (94.2–99.3)	79.9 (73.4–86.3)	38.1 (30.2–46.8)	32 (23.5–40.6)
Gender				
Men	35.4 (29.9–40.9)	48.9 (43.1–55.1)	15.3 (10.9–19.3)	8.9 (5.5–12.2)
Women	82.1 (79.4–84.6)	59.6 (56.3–62.7)	14.1 (12.1–16.2)	12.3 (10.2–14.4)
Residence				
Rural	64.9 (55.9–73)	39.6 (30.6–48.6)	14.4 (8.1–21.6)	9.6 (4.3–16)
Urban	72.2 (69.6–74.9)	59 (56.1–61.8)	14.4 (12.3–16.5)	11.7 (9.7–13.8)
Marital status				
Married	74.3 (71.6–76.9)	60.1 (57.1–63.3)	14.9 (12.8–16.9)	12.4 (10.4–14.4)
Unmarried and others	47.6 (38.7–56.5)	31.5 (24.2–39.5)	9.7 (4.8–15.3)	2.2 (0–5.6)
Overall	71.6 (68.9–74.1)	57.2 (54.4–59.9)	14.4 (12.5–16.4)	11.5 (9.7–13.6)
	Hypercholesterolemia % (95% CI)	Low HDL % (95% CI)	Raised LDL % (95% CI)	Triglyceridemia % (95% CI)
Age (years)				
20–29	31.3 (24.7–37.3)	57.8 (50.6–65.7)	33.7 (26.5–41)	25.3 (18.7–31.9)
30–39	34.5 (31–38.6)	66.8 (62.9–70.7)	43.7 (39.3–47.5)	25.4 (22–28.8)
40–49	34.4 (27.5–40.9)	66.5 (60.9–73)	42.8 (36.3–49.8)	20.9 (15.8–26.5)
≥50	36.7 (28.1–45.3)	65.6 (57.8–73.4)	43 (35.2–51.6)	24.2 (17.2–32)
Gender				
Men	45.6 (38.8–51.9)	51.5 (45.6–58.2)	57.8 (50.6–64.1)	44.7 (38.4–51.1)
Women	31.2 (28.3–34.2)	69.1 (65.8–72)	37.5 (34.4–40.9)	18.8 (16.2–21.4)
Residence				
Rural	35.1 (25.5–45.7)	72.3 (62.8–81.9)	42.6 (33–53.2)	29.8 (20.2–39.4)
Urban	34.2 (31–37.4)	64.6 (61.8–67.4)	41.8 (38.3–44.7)	23.9 (21.1–26.6)
Marital status				
Married	35 (32.2–38.1)	65.4 (62.4–68.3)	42.9 (39.8–45.8)	25.1 (22.5–27.8)
Unmarried and others	25.6 (16.7–35.6)	63.3 (52.2–73.3)	31.1 (21.1–40)	15.6 (8.9–23.3)
Overall	34.3 (31.6–37.1)	65.3 (62.2–68.2)	41.9 (38.7–45)	24.4 (21.9–27.1)

BP = blood pressure; CI = confidence interval; HDL = high-density lipoprotein; LDL = low-density lipoprotein; n = 1100.

[22,26,27]. Studies also indicate that among healthcare professionals, nurses and unregistered care workers have a higher prevalence of obesity [28]. Studies also documented that nurses who had married and resided in urban places had a higher prevalence of obesity [29,30]. The high prevalence observed in the study, and its variation compared to other studies could be attributed to the variations in the definition of overweight/obesity used across studies (Asian BMI classification in this study). A significantly higher prevalence of overweight/obesity among those aged ≥30 years observed in this study could be due to a progressive reduction in work-related physical activity among the nurses as they move to the next levels in job positions, which involves more managerial work than physical. The higher prevalence of obesity among nurses who were married and residing in urban in this study could be due to the high prevalence of unhealthy lifestyle practices especially inadequate physical activity, inadequate intake of fruits and vegetables, and easy access to processed food, especially in the urban areas.

Similarly, more than two-thirds of nurses had abdominal obesity (71.6%), significantly higher among women and married and those aged ≥40 years. This prevalence was lower among nurses (82%) from a tertiary care hospital in New Delhi and south Indian nurses (94.3%). [6,12] Research evidence also suggests that the nurses who were women and over 30 years had a significantly higher prevalence of abdominal obesity [31]. The higher prevalence in this study could be due to inadequate physical activity (74.6%) and unhealthy dietary practices, which can be addressed by suitable workplace health policies toward promoting a healthy lifestyle and weight reduction among the nurses [31].

Around three-fourths of participants had inadequate physical activity (74.6%), which was significantly higher among men and those aged above ≥50 years. This prevalence was higher than tertiary hospital administrative employees in Delhi (39.7%) and lower than Bangladeshi nurses (92%) [8,32]. Evidence suggests shift work hinders nurses from meeting required physical activity levels (150 minutes per week). The higher prevalence of physical inactivity in this study could be due to the shift work nature of the nursing profession, which prevents nurses from adopting a routine physical activity. This could be addressed by providing facilities for physical activities and behavior change to integrate physical activity into their daily routine [33].

About three-fourths of participants had inadequate intake of fruits and vegetables (76.1%), which was significantly higher among men. This was slightly lower than the prevalence among administrative staff in a tertiary care hospital (85.4%) but higher when compared to a study among nurses from Bangladesh (56.3%) [8,32]. Evidence also suggests that physical inactivity and dietary habits, especially skipping meals, contribute to overweight and obesity among nurses [10]. Considering the higher prevalence of physical inactivity (74.6%) and unhealthy diet (76.1%) in the current study, the hospital administrators shall consider implementing initiatives to promote healthy foods and physical activity among the nurses [34]. Innovative campaigns that improve fruits and vegetable intake in workplace settings, such as “5-a day” and “just add F and V in your diet,” shall also be considered for implementation [35].

Roughly 15% of participants had raised BP significantly higher among men aged ≥40 years. This was slightly higher than studies conducted among hospital nurses in south India (13.7%) and north India (10%), whereas lower than studies done in north India (16.8%) [12,22,36]. This difference could be attributed to the regional differences in the prevalence of hypertension across India [37]. The prevalence of raised BP in Iran and the United States was 15.1% and

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Table 5 *Determinants of Various Risk Factors of Noncommunicable Diseases (N = 1217).*

Variables	Current tobacco use	Current alcohol use	Inadequate intake of F and V	Inadequate physical activity	Abdominal obesity
	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)
Age (years)					
20–29	1	1	1	1	1
30–39	1.01 (0.99–1.04)	1.03 (1.0–1.05)	1.01 (0.94–1.08)	1.0 (0.93–1.07)	1.07 (1.0–1.15)
40–49	1.01 (0.99–1.04)	1.02 (1.0–1.05)	1.05 (0.97–1.15)	1.07 (0.98–1.16)	*1.16 (1.07–1.26)
≥50	1.01 (0.99–1.03)	1.02 (1.0–1.04)	*1.15 (1.04–1.27)	*1.32 (1.19–1.47)	*1.29 (1.19–1.38)
Gender					
Men	*1.05 (1.02–1.08)	*1.12 (1.08–1.17)	*1.1 (1.04–1.18)	*1.25 (1.17–1.33)	1
Women	1	1	1	1	*1.50 (1.41–1.60)
Residence					
Rural	1	1	1	1.05 (0.97–1.14)	1.01 (0.94–1.09)
Urban	1.01 (0.99–1.03)	1.01 (0.98–1.04)	1.0 (0.99–1.15)	1	1
Marital status					
Married	1	1	1	1	*1.16 (1.06–1.27)
Unmarried and others	1.02 (0.98–1.05)	1.0 (0.96–1.03)	1.06 (0.96–1.15)	1.06 (0.98–1.16)	

*Significant – $p < .05$. aPR = adjusted prevalence ratio; BP = blood pressure; CI = confidence interval; HDL = high-density lipoprotein; LDL = low-density lipoprotein; F and V = fruits and vegetables.

17%, respectively [22,27]. In the current study, RBG prevalence was 11.5% and was significantly higher among those aged ≥40 years and married nurses. This was higher than the studies conducted among clinical nurses in public hospitals in south India (5.6%) and north India (5%), whereas this was lower when compared to the tertiary hospital in north India (13.5%) [12,21,36]. The higher prevalence of RBG in this study could be attributed to a substantially higher prevalence of overweight or obesity, involvement of shift work and low levels of physical activity among married nurses, and family responsibilities.

Evidence on biological risk factors among nurses from Indian settings is scarce. In the current study, more than one-third of participants had hypercholesterolemia (34.3%) which was significantly higher among men. This was higher when compared to studies among nurses from Iran (5%), the United States (23%), and Indian healthcare professionals (7%) [21,22,27]. Further, almost one-fourth of nurses had triglyceridemia (24.4%), significantly higher among men and those married. This prevalence was higher than among Iranian nurses (6%) [27]. The higher prevalence of hypercholesterolemia and triglyceridemia among men was possibly due to a higher intake of unhealthy foods, particularly a diet rich in saturated fats and a lack of physical activity, whereas in the case of married nurses, the possible reason could be inadequate physical activity and intake of fruits and vegetables, as evidenced by this study. Another reason could be these study participants were a considerable proportion of mid-level adults who were married nurses and had more responsibility toward caring for young children without caring for them in modifying unhealthy lifestyle choices. Indian studies have shown that married nurses and men had significantly higher hypercholesterolemia [38]. The prevalence of raised LDL (41.9%) was significantly higher among men and those aged above ≥50 years, which was higher when compared to studies from Iranian nurses (6%), US nurses (10%), and Indian health professionals (4%) [21,22,27]. The higher prevalence could be attributed to consuming junk food among men and the sedentary job nature of those above 50 years old. Similarly, the prevalence of low HDL (65.3%) was significantly higher among women aged between 30 and 39. This prevalence was higher than in studies conducted on Iranian nurses (51%), US nurses (39.2%), and Indian health professionals (59%) [21,22,27]. The higher prevalence of low HDL in this study could be attributed to parents of child-rearing age (30–39 years) who neglect their self-prioritization of health. In the case of women, they have less time for physical activity due to higher family responsibilities. Various studies documented that gender, obesity, age, marital status, sedentary lifestyle, and fruit diet habits were associated with dyslipidemia [39,40]. Adequate physical exercise and proper diet are prerequisites for addressing metabolic risk factors at both individual and population level [41]. Complementary medicine principles and lifestyle and diet modifications effectively counter cardiovascular disease risks [42]. There is a need for a comprehensive approach to identify gaps in existing workplace wellness programs and identify target groups to achieve the wellness goals [43].

We compared the prevalence of various behavioral and biological risk factors obtained in the study with the general population. Among behavioral risk factors, the prevalence of physical inactivity obtained in the study (74.6%) was substantially higher when compared to the prevalence obtained in the district of Puducherry (45.8%) and nationally (41.3%) by the National NCD Monitoring Survey [44,45]. The prevalence of other behavioral risk factors obtained in this study was lesser when compared to the prevalence obtained from the Puducherry district and the national estimates for tobacco use (12.3% and 32.8%), alcohol use (18.5% and 15.9%), and inadequate intake of fruits and vegetables (86.8% and 98.4%) [44,45]. Similarly, among biological risk factors, the prevalence of obesity in this study (57.1%) was higher when compared to the prevalence in the Puducherry district (46.1%) [44]. The prevalence of RBG in this study (11.5%) was marginally higher than the national estimate (9.3%) but lower than in the Puducherry district (26.7%) [44,45]. Similarly, the prevalence of hypercholesterolemia obtained in the present study (34.3%) was comparable to the general population in the Puducherry district (34.8%) [44]. The prevalence of raised BP in this study (14.3%) was lesser than the prevalence obtained from the Puducherry district and national estimate (33.6% and 28.5%, respectively) [44,45].

This comparison with the general population points out that the prevalence of inadequate physical activity and obesity is comparatively higher among nurses than the general population, highlighting the target groups that need to be targeted with health promotion interventions through the existing workplace wellness programs in the hospital. The differences in the prevalence of these NCD risk factors in the general population could be attributed to the differences in the health-seeking behavior, health knowledge, affordability, and nature of work among the compared population groups.

This study included all nursing employees in the hospital, with an overall response rate of 99%. Therefore, the chance of selection bias is minimal. The study also presents a scientific approach to setting up surveillance on NCD risk factors among nurses working in a tertiary care center. There are some limitations to the study. The

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Obesity	Raised BP	Raised blood glucose	Hypercholesterolemia	Triglyceridemia	Raised LDL	Low HDL
aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)	aPR (95% CI)
Age (years)						
1	1	1	1	1	1	1
*1.16 (1.07–1.26)	1.03 (0.99–1.08)	1.0 (0.96–1.05)	1.0 (0.92–1.09)	0.96 (0.88–1.04)	1.07 (0.98–1.17)	*1.10 (1.01–1.21)
*1.28 (1.16–1.41)	*1.14 (1.07–1.22)	*1.12 (1.05–1.2)	1.04 (0.94–1.15)	0.98 (0.89–0.92)	1.11 (1.01–1.24)	1.05 (0.95–1.17)
*1.45 (1.31–1.61)	*1.40 (1.27–1.53)	*1.30 (1.19–1.42)	1.07 (0.95–1.20)	1.03 (0.92–1.14)	*1.13 (1.01–1.28)	1.04 (0.92–1.16)
Gender						
1	*1.08 (1.03–1.13)	1.02 (0.98–1.07)	*1.18 (1.09–1.26)	*1.31 (1.22–1.41)	*1.25 (1.16–1.35)	1
1.02 (0.95–1.09)	1	1	1	1	1	*1.21 (1.12–1.30)
Residence						
1	1.01 (0.95–1.08)	1.0 (0.94–1.06)	1.0 (0.90–1.1)	1.04 (0.95–1.14)	1.0 (0.90–1.10)	1.09 (0.99–1.20)
*1.14 (1.04–1.25)	1	1	1	1	1	1
Marital status						
*1.18 (1.08–1.30)	1.02 (0.97–1.09)	*1.07 (1.02–1.12)	1.1 (0.99–1.23)	*1.15 (1.05–1.25)	1.10 (0.99–1.35)	1
1	1	1	1	1	1	1.03 (0.92–1.15)

data were collected through self-administrated performa. This could have affected the accuracy of behavioral risk factors elicited due to recall bias. The low prevalence of tobacco and alcohol use evidenced in the study could be due to social desirability bias. This study's cross-sectional nature and variations in the prevalence of various NCD risk factors in an individual over time could not be captured. To address the variation, future longitudinal studies shall be planned. As this study was conducted in a single tertiary care hospital, the results obtained may not be generalizable to other tertiary care hospitals in the country.

Conclusion

We found a high prevalence of major risk factors of NCDs such as obesity, abdominal obesity, inadequate intake of fruits and vegetables, inadequate physical activity, and low HDL among women, whereas hypercholesterolemia and raised LDL were higher among men. The higher prevalence of these risk factors indicates an urgent need to address this burden among the target groups identified in the study through workplace wellness programs such as periodic surveillance of NCD risk factors, wellness clinics, and multifactorial lifestyle intervention in preventing premature NCD mortality and morbidity. Q8

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Conflict of interest

Nil.

Acknowledgments Q5

Nil

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