Prevalence and risk for overweight among employees in a leading automobile industry in India

Runalika Roy¹, Gautham Melur Sukumar², Kowshik Kupatira²

¹Department of Epidemiology, National Institute of Mental Health and Neurosciences, Bengaluru, Karnataka, India
²Chief Medical Officer, Automobile industry Pvt Ltd, Karnataka, India

Received: 14 September 2021
Accepted: 20 October 2021

*Correspondence:
Dr. Gautham Melur Sukumar,
E-mail: drgauthamnimhans@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Overweight is a major risk factor for the non-communicable diseases. India is home to nearly 164 million industrial workers (2017) and yet information about prevalence and risk of overweight among them is limited. Being overweight can adversely affect a person's productivity in his workplace and increase the risk of non-communicable diseases. The objective was to assess the prevalence of overweight and association between overweight and employee age, type of work and native origin.

Methods: The longitudinal analysis was conducted using periodical medical examination (PME) data of employees from 2010-2018. Relevant data were collected. Year-wise prevalence of overweight was estimated along with specific prevalence by age, type of work and region.

Results: The mean weight of employees increased from 68.1 kg to 72.6 kg (2010-2018). Overweight proportion was significantly higher in non-production departments. Overweight prevalence ranged between 15-29.8% among Karnataka regions in 2010 in production employees but reached 35-55.6% by 2018. Significant association was found between overweight with type of work and region.

Conclusions: The increase in weight over time indicates the trend of overweight and weight reduction interventions are needed in workplaces to prevent the risk of NCDs.

Keywords: Occupational health, Overweight, Industry, Non-communicable diseases, NCD risk factors, Healthy workplace

INTRODUCTION

The global burden and threat of non-communicable diseases (NCDs) constitutes a serious public health challenge that undermines social and economic development globally and contributes to increasing inequalities between countries and populations. Globally, NCDs accounted for 73.4% (95% uncertainty interval 72.5-74.1) of all deaths in the year 2017. Between 2007 to 2017, number of NCD deaths increased by 22.7%, translating to additional 7.61 million (7.20-8.01) deaths in the year 2017.¹ Of these deaths, high body mass index attributed to 4.72 million (2.99-6.70) deaths and 148 million (98.6-202) DALYs.² In India, DALYs due to NCDs and injuries exceeded those due to communicable, maternal, neonatal and nutritional diseases (CMNNDs). The major risk factors for NCDs including high systolic blood pressure, high fasting plasma glucose, high total cholesterol and high body-mass index, increased from 1990 to 2016. The India GBD collaborators found that leading cardiovascular diseases, ischaemic heart disease and stroke made the largest contribution to the total burden of mortality in India 28.1% (95% uncertainty interval (UI) (26.5-29.1).³

Worldwide, the prevalence of overweight and obesity have become more than double since 1980, reaching to 1.9 billion overweight and 600 million obese adults in year 2014.⁴ According to ICMR-INDBIAD study, the prevalence of obesity and central obesity in India is
estimated at 11.8% to 31.3% and 16.9% to 36.3% respectively. More than 135 million individuals were affected by obesity and the prevalence of overweight and obesity in India was reportedly increasing faster than the world average.6.7

Workers (an estimated 534 million in India), a sub-set of population, were likely to be influenced by ongoing macro level socio-economic determinants of overweight and obesity. As most young, middle age and productive section of the population were expected to be in workplaces, there was renewed interest in understanding work environment factors associated with overweight. Of the 534 million workers, around 8% were estimated to be in organized sector. There were approximately 17.5 million workers in public sector in India.8 An estimated 339,931 registered industrial factories reported a total employment of around 164 million in the year 2017.9

Limited available studies indicated that overweight prevalence in industrial workers ranged between 17% to 65.5%.10,12 Though incomparable from epidemiological sense, prevalence appeared to be similar or higher than population prevalence. In terms of number of young and productive people affected, this number was of significant size.

The WHO emphasized workplace as a priority setting for promotion of health and wellbeing including provision of a safe and healthy physical and psychosocial work environment.13 Reducing overweight proportion among the workers could contribute to a reduction in population prevalence of overweight. This requires implementation of evidence-driven, need-based and cost-effective workplace programmes. Understanding factors associated with overweight among employees could facilitate evidence-based programming of healthy workplace interventions aimed at weight reduction.

In this direction, a record analysis was conducted in a leading automobile industry in South India to assess the prevalence of overweight and association between overweight and employee age, type of work and native origin. This study was part of programmatic support provided to the industry to implement interventions to reduce NCDs and mental disorders and not a specifically conducted research study.

Due to unavailability of the formal institutional review board process, the principles outlined in the declaration of Helsinki were followed while conducting the study.

METHODS

The study was conducted in a leading automobile industry located in South India, where healthy workplace programme was being implemented by the occupational safety and health department. The department conducted PME for employees. We analyzed de-linked and anonymous periodical medical examination data of the employees for years 2010-2018. This longitudinal record analysis was a part of the programmatic support provided for occupational safety and health (OSH) professionals to enable data backed programme implementation.

Data source

PME data was collected digitally using an occupational health software and provided to the investigators in MS excel format by the OSH department. Data regarding the employees native region (region within the state of Karnataka and those from other states of India), age, date of birth, work department and date of joining were provided by the human resource (HR) department. Both datasets were merged using employee number as unique ID using the VLOOK UP function in MS excel. The merged data set was used for analysis. Data was checked for consistency in entries, outliers and coding. We excluded female employees from analytical statistics as their numbers were significantly lesser in number.

Data computation

Body mass index (BMI) of workers was computed using the height and weight data,

\[ \text{BMI} = \frac{\text{weight in kg}}{(\text{height in meters})^2} \]

Using the BMI values, employees were categorized as overweight and obese, based on WHO classification. All employees with BMI ≥25 was defined as overweight and those with BMI ≥30 was defined as obese.14

Region and type of work

Information about the native region and the type of work/department were collected from the HR department. From the address provided in the data, we categorized native region of employees into the following four categories: coastal Karnataka, Malnad Karnataka, North Karnataka, South Karnataka and other states.

There were eight departments namely paint production, internal logistics control department (ILCD), maintenance, office, press production, assembly production, quality, weld production in the industry. We further categorized these departments operationally into production and non-production related departments. Employees’ those who were directly involved in production line were categorised as production. This included employees from assembly, weld, paint, press, quality and ILCD. Employees working in office, senior management and maintenance staff were defined as non-production as they were not directly involved in the production but had managerial and technical duties.

Age was computed from date of birth. Age of employee as of 31 December 2018 was calculated and included for analysis. The age was further categorized into 18-24
years, 25-29 years, 30-34 years, 35-39 years and 40 years and above.

**Duration of service**

Duration of service was computed from date of joining. The date of joining was subtracted from 31 December 2018 to derive the service duration till end of year 2018 for all employees. It was further categorized as 0-5 years, 6-10 years, 11-15 years, 16 years and above.

**Data analysis**

The data was analysed by using SPSS version 25. Descriptive statistics for categorical variables, gender, region, type of work, service duration, age categories were estimated using frequency and percentages. Quantitative variables like age, weight and BMI were expressed as mean and standard deviation.

Prevalence of overweight and obesity per 100 employees was estimated year-wise.

| No. of employees attending periodical medical examination in same year 100. | No. of overweight employees in specific year | × |
|---|---|---|

Specific prevalence rates by age categories, type of work, region was presented per 100 employees.

Univariate analysis was done using Chi square test to examine association between overweight (present/absent) with type of work, region and age-categories. Chi square for trend (Mantel-Haenszel) was applied to test for significant change in trend of overweight prevalence between year 2010 to 2018. Results were considered significant at p<0.05. One way analysis of variance (ANOVA) was used to find the differences in age, weight and BMI between year 2010-2018. Correlation statistics (Pearson r) was applied to test for relationship between mean age and overweight prevalence.

Based on the univariate analysis, we identified predictor variables namely type of work, region and service duration to assess the strength of association. Overweight (present/absent) was defined as the outcome variable. Binary logistic regression was used to find the association between the predictor variables and the outcome variable. The regression consisted of type of work, region and service duration as predictor variables and overweight as outcome variable for the year 2018. Goodness of fit was assessed by Hosmer-Lemeshow test and Wald test was used to assess significance of predictors in the model. Age-categories was not included in the model as it was strongly correlated with service duration and hence removed to prevent effects of multicollinearity. Strength of association was presented as adjusted odds ratio and 95% confidence intervals (p values less than <0.05 was statistically significant).

**RESULTS**

Sociodemographic details of employees was presented in Table 1. Majority (99.7%) of the employees were males. Participation in PME increased from 6.1% to 93.9% between 2010 to 2018 with highest being from production departments (78-94%). A significant increase in mean weight and mean BMI over the years, 2010-2018 was observed.

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| No. of employees (n) | 1814 | 2652 | 3342 | 3278 | 4198 | 4979 | 4833 | 4664 | 5505 |
| Gender | | | | | | | | | |
| Male (%) | 1787 (98.5) | 2635 (99.4) | 3331 (99.7) | 3268 (99.7) | 4179 (99.5) | 4920 (99.8) | 4795 (99.2) | 4634 (99.4) | 5455 (98.8) |
| Female (%) | 27 (1.5) | 17 (0.6) | 11 (0.3) | 10 (0.3) | 19 (0.5) | 59 (1.2) | 38 (0.8) | 30 (0.6) | 68 (1.2) |
| Type of work | | | | | | | | | |
| Production (%) | 1398 (78.2) | 2315 (87.9) | 3054 (91.7) | 3070 (93.9) | 3823 (91.5) | 4282 (87.0) | 4255 (88.7) | 4101 (88.5) | 4517 (82.8) |
| Non-production (%) | 389 (21.8) | 320 (12.1) | 277 (8.3) | 198 (6.1) | 356 (8.5) | 638 (13) | 540 (11.3) | 533 (11.5) | 937 (17.2) |
| Region | | | | | | | | | |
| Coastal Karnataka (%) | 117 (6.5) | 193 (7.3) | 292 (8.8) | 284 (8.7) | 367 (8.8) | 448 (9.1) | 428 (8.9) | 417 (9.0) | 478 (8.8) |
| Malnad Karnataka (%) | 208 (11.6) | 392 (14.9) | 550 (16.5) | 556 (17.0) | 660 (15.8) | 758 (15.4) | 754 (15.7) | 731 (15.8) | 795 (14.6) |
| North Karnataka (%) | 374 (20.9) | 567 (21.5) | 693 (20.8) | 686 (21.0) | 875 (20.9) | 1025 (20.8) | 995 (20.8) | 949 (20.5) | 1081 (19.8) |
| South Karnataka (%) | 1026 (57.4) | 1423 (54.0) | 1747 (52.4) | 1695 (51.9) | 2203 (52.7) | 2486 (50.5) | 2485 (51.8) | 2385 (51.5) | 2843 (52.1) |

Continued.
Table 3: Association of overweight and the type of work (production versus non-production), region and age-categories.

| Variables      | Year-wise overweight prevalence | Chi-square for trend as per type of work |
|----------------|---------------------------------|----------------------------------------|
|                | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2017   | 2018   |
| n              | 1787   | 2635   | 3331   | 3268   | 4179   | 4920   | 4795   | 4634   | 5455   |
| Overweight     | 574    | 824    | 849    | 887    | 1392   | 1961   | 2116   | 2068   | 2883   |
| (32.1)         | (31.3) | (25.5) | (27.1) | (33.3) | (39.9) | (44.1) | (44.6) | (52.9) |        |
| Obesity, N (%) | 43 (2.4) | 70 (2.6) | 69 (2.1) | 66 (2.0) | 145 (3.5) | 229 (4.6) | 218 (4.5) | 205 (4.4) | 348 (6.3) |
|                |        |        |        |        |        |        |        |        |        |

Chi-square for trend $X^2=1105.8$, p=0.000

Continued.
| Variables                  | Year-wise overweight prevalence | Chi-square for trend as per type of work |
|---------------------------|----------------------------------|------------------------------------------|
| **Non-production, N (%)** |                                  |                                          |
| North                     | 174 (44.7)                       |                                          |
| Coastal                   | 159 (49.7)                       |                                          |
| Karnataka n=3024, N (%)   | 153 (55.2)                       |                                          |
| Regions                   | 110 (55.6)                       | X$^2$=49.99, p=0.000                     |
| Malnad                    | 206 (57.9)                       |                                          |
| Karnataka n=5404, N (%)   | 396 (62.1)                       |                                          |
| North Karnataka n=7245, N | 311 (57.6)                       |                                          |
| Karnataka n=18292, N (%)  | 330 (61.9)                       |                                          |
| Other states n=1038, N (%) | 574 (61.3)                       |                                          |
| Age-categories (in years) |                                  |                                          |
| 18-24 years n=6243 N (%)  | 174 (44.7)                       | X$^2$=83.34, P=0.000                     |
| 25-29 years n=14,025 N (%)| 159 (49.7)                       |                                          |
| 30-34 years n=9235 N (%)  | 153 (55.2)                       |                                          |
| 35-39 years n=4661 N (%)  | 110 (55.6)                       |                                          |
| 40 years and above n=840 N| 206 (57.9)                       | X$^2$=273.72, P=0.000                    |
| employees who are overweight in the specific department = employees who are overweight in the specific region number of all the employees in these departments = employees who are overweight in different age-categories number of all the employees in that age-categories × 100. |
| Year-wise specific prevalence of overweight by type of work = employees who are overweight in the specific department number of all the employees in these departments × 100. |
| Year-wise specific prevalence of overweight by region = employees who are overweight in the specific region number of all the employees in these regions × 100. |
| Year-wise specific prevalence of overweight by different age-categories = employees who are overweight in different age-categories number of all the employees in that age-categories × 100. |

**Table 4: Year-wise prevalence of overweight by work-department and region.**

| Regions                  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | Chi-square values |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------------|
| **N**                    | 1787  | 2635  | 3331  | 3268  | 4179  | 4920  | 4795  | 4634  | 5455  |                   |
| **Overweight**           | 574   | 824   | 849   | 887   | 1392  | 1961  | 2116  | 2068  | 2883  |                   |
| Coastal                  | 17    | 28    | 29    | 52    | 65    | 90    | 122   | 99    | 145   | X$^2$=82.10, p=0.000 |
| Karnataka n=3024, N (%)  | 19.1  | 16.5  | 10.5  | 19.1  | 19.0  | 22.6  | 31.1  | 26.0  | 34.9  |                   |
| Malnad                   | 28    | 78    | 92    | 90    | 163   | 217   | 270   | 274   | 352   | X$^2$=279.82, p=0.000 |
| Karnataka n=5404, N (%)  | 15.8  | 21.1  | 17.5  | 16.7  | 25.9  | 30.7  | 37.8  | 39.6  | 48.0  |                   |
| North                    | 99    | 146   | 154   | 168   | 257   | 368   | 393   | 376   | 492   | X$^2$=222.47, p=0.000 |
| Karnataka n=7245, N (%)  | 29.0  | 27.1  | 23.2  | 25.0  | 30.5  | 37.9  | 41.5  | 41.6  | 49.3  |                   |
| South                    | 251   | 408   | 415   | 461   | 689   | 877   | 1005  | 974   | 1297  | X$^2$=565.96, p=0.000 |
| Karnataka n=18292, N (%) | 32.1  | 33.4  | 26.4  | 29.4  | 34.8  | 40.3  | 46.3  | 46.5  | 55.6  |                   |
| Other states n=1038, N (%)| 5     | 5     | 6     | 12    | 16    | 13    | 15    | 15    | 23    | X$^2$=9.76, p=0.282 |
| Non-production           | 50.0  | 38.5  | 31.6  | 30.0  | 41.4  | 41.9  | 46.9  | 53.6  | 63.9  |                   |

International Journal of Community Medicine and Public Health | November 2021 | Vol 8 | Issue 11 | Page 5322
Table 5: Distribution of year-wise prevalence of overweight by age-group and work department.

| Age group (in years) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Chi-square values |
|----------------------|------|------|------|------|------|------|------|------|------|------------------|
|                      | N    |      |      |      |      |      |      |      |      |                  |
| Overweight           |      |      |      |      |      |      |      |      |      |                  |
| 18-24, n=6243, N (%) | 23   | 70   | 116  | 157  | 153  | 132  | 93   | 36   | 17   | X²=147.24, p=0.000 |
| 25-29, n=14,025, N (%) | 131  | 184  | 207  | 247  | 456  | 594  | 753  | 665  | 730  | X²=344.56, p=0.000 |
| 30-34, n=9235, N (%) | 238  | 380  | 307  | 265  | 346  | 448  | 523  | 575  | 861  | X²=53.78, p=0.000 |
| 35-39, n=4661, N (%) | 8    | 31   | 66   | 108  | 228  | 389  | 426  | 426  | 504  | X²=6.423, p=0.060 |
| 40 and above, n=840, N (%) | 3    | 2    | 2    | 2    | 1    | 1    | 1    | 1    | 1    | X²=3.143, p=0.49 |

Non-production department

| 18-24, n=6243, N (%) | 12   | 9    | 8    | 6    | 9    | 14   | 19   | 14   | 15   | X²=9.312, p=0.017 |
| 25-29, n=14,025, N (%) | 49   | 31   | 31   | 25   | 43   | 96   | 57   | 45   | 65   | X²=15.73, p=0.046 |
| 30-34, n=9235, N (%) | 71   | 67   | 61   | 39   | 78   | 159  | 104  | 116  | 133  | X²=18.91, p=0.015 |
| 35-39, n=4661, N (%) | 38   | 51   | 51   | 40   | 73   | 125  | 105  | 109  | 168  | X²=3.456, p=0.903 |
| 40 and above, n=840, N (%) | 4    | 1    | 2    | 0    | 3    | 2    | 26   | 46   | 193  | 62.5 |

Table 6: Association of overweight with type of work, region, and service duration for the year 2018.

| Predictors | N (%) | Unadjusted OR (CI) | P value | Adjusted OR (CI) | P value |
|------------|-------|--------------------|---------|------------------|---------|
| **Type of work** |       |                    |         |                  |         |
| Non-production | 937   | 1                  | 1       | 1                | 1       |
| Production   | 4517  | 0.661 (0.573-0.764) | 0.000   | 0.809 (0.682-0.96) | 0.015   |
| **Region**   |       |                    |         |                  |         |
| South Karnataka | 2843 | 52.1               | 1       | 1                | 1       |

Continued.
Predictors | N (%) | Unadjusted OR (CI) | P value | Adjusted OR (CI) | P value |
--- | --- | --- | --- | --- | --- |
Other states | 258 (4.7) | 1.447 (1.108-1.89) | 0.007 | 1.428 (1.064-1.918) | 0.018 |
Coastal Karnataka | 478 (8.8) | 0.44 (0.36-0.538) | 0.000 | 0.484 (0.395-0.593) | 0.000 |
Malnad Karnataka | 795 (14.6) | 0.708 (0.605-0.829) | 0.000 | 0.789 (0.672-0.927) | 0.004 |
North Karnataka | 1081 (19.8) | 0.769 (0.668-0.885) | 0.000 | 0.799 (0.693-0.922) | 0.002 |

Service duration (in years)

|       | N (%) | Unadjusted OR (CI) | P value | Adjusted OR (CI) | P value |
|-------|-------|--------------------|---------|-----------------|---------|
| 16 and above (%) | 1214 (22.3) | 1 | 1 | |
| 0-5 (%) | 183 (3.4) | 0.405 (0.296-0.555) | 0.000 | 0.336 (0.242-0.468) | 0.000 |
| 6-10 (%) | 3314 (60.8) | 0.457 (0.398-0.524) | 0.000 | 0.492 (0.428-0.567) | 0.000 |
| 11-15 (%) | 744 (13.6) | 0.71 (0.588-0.857) | 0.000 | 0.716 (0.591-0.867) | 0.001 |

Hosmer and Lemeshow test=0.198 (significance)
Nagelkerke R square=0.055

**Figure 1:** Year-wise prevalence of overweight by type of work (2010-18).

**Figure 2:** Age-wise distribution of overweight employees (year 2018).
Year-wise overall prevalence of overweight and obesity among employees is shown in Table 2. Prevalence of overweight ranged between 25.4% to 33.3% between year 2010 to 2018. Highest prevalence was at 52.7% in year 2018. A significant increase in trends in overweight prevalence among employees was observed between year 2010-2018 (Chi square for trend, p<0.05).

Specific prevalence rates by age group, work type and region are presented in Table 3. Prevalence of overweight was significantly higher among employees in non-production department (Figure 1), hailing from South Karnataka. It was also significantly higher among employees aged between 35-39 years in all the years between 2010-2018. Age-wise distribution of overweight and age-specific prevalence of overweight for the year 2018 have been shown in Figure 2 and 3, respectively. Specific prevalence for overweight in production departments ranged between 22.8% to 51.1% as against 44.7% to 62.1% amongst non-production between 2010-2018.

Overweight was higher among employees from South Karnataka (29.8-56.8%) and amongst employees aged between 35-39 years (55.4-65%), irrespective of their type of work (Table 4). It ranged between 29-45.3% among all Karnataka regions in the year 2010 in non-production group but reached 47.6-62.2% by the year 2018. Though the overweight prevalence was higher in the employees who work in non-production, the trend was not significant over the regions except for employees from South Karnataka. Similar findings were observed for different age groups among employees of non-production (Table 5). Age group wise specific prevalence in 18-24 years ranged from 7.1-26.3% in the production department whereas 28.1-57.7% in the non-production department.
For the year 2018, we estimated the risk of being overweight based on type of work, native region and service duration (Table 6). Employees working in the production department had 19.1% less risk of being overweight (OR=0.809; 95% CI 0.682, 0.96) than the employees working in the non-production department. Employees of other states had 42.8% high risk of being overweight (OR=1.428; 95% CI 1.064, 1.918) in respect to South Karnataka, whereas the risk is comparatively less for the other regions of Karnataka. Also, employees who were working for 0-5 years had 66.4% less risk of being overweight (OR=0.336; 95% CI 0.242, 0.468) than those who were working for 16 years and more.

**DISCUSSION**

This record analysis study was conducted across a large sample of workers in an automobile industry. It was implemented as part of an ongoing healthy workplace programme to reduce overweight and to enable the health managers to make data-driven decisions for programme improvement. It provided prevalence estimates of overweight, obesity and risk by type of work and region of residence; the evidence for which was currently limited in Indian settings.

We observed a significant increase in overweight prevalence between years 2010 (31.9%) to year 2018 (52.7%), reflecting a concurrent increase in mean weight of employees during the same time (68.1 kg to 72.6 kg). Change of mean weight by 4.5 points resulted in change in overweight prevalence by 20.8 percent points, among the employees. Mean BMI increased from 23.7 to 25.3. This modest increase in mean weight and mean BMI resulted in bigger increased in prevalence of overweight from 31.9% in year 2010 to 52.7% in 2018.

Population prevalence of overweight (males, 15–49 years) in India was estimated at 18.9% (NFHS-4, year 2015-2016). Though the industrial population rates cannot be directly compared with general population in epidemiological parlance, citing role of healthy worker effect, we nevertheless compared our results with NFHS as the gender and age groups were similar (15–49 years). We observed higher overweight prevalence in industrial workers (31% to 52%). This could be due to regular screening, better socio-economic conditions and nutritional support in industries. Our findings were similar to evidence from other independent research studies from industries across India which reported overweight prevalence between 17-65.5%, mostly clustered around 31%.12,16-19

High prevalence of NCD risk factors was observed in Indian industrial settings and was a cause of concern as well as an opportunity for carrying out workplace interventions. But seldom was evidence available for association between work type, region, age and overweight prevalence. Our study showed work type and region was also a significant factor for stratifying risk for being overweight. Further research is needed to correlate various cultural practices which might influence the risk profiling for overweight and subsequent NCDs. Service duration and overweight were closely linked as age correlated with both the variables. As age increased along with service duration, the risk of being overweight also increased likewise indicating the age-cohort effect.

Prevalence of overweight was higher among employees from non-production related departments across the total study period and this finding was consistent for all the other study variables, irrespective of region and age groups. This was probably due to insufficient physical activity, sedentary nature of a desk-job and higher age of employees (more than 60% of the employees were aged 30+ years in the non-production department, as against the production departments).

Industrial medical officers, during their routine work, hypothesized that employees from South Karnataka were observed to be more overweight than other employees. Our study tested this hypothesis and observed that prevalence of overweight was more among employees hailing from region of South Karnataka as against other regions and employees from other states. Most people from South Karnataka were rice eaters. Nearly 55% of South Karnataka employees were aged 30+ years and 57% were involved in non-production departments. Thus, dietary practices, higher age and predominantly non-production work differentials between south Karnataka and others could have resulted in increased overweight prevalence.

We observed that mean weight and overweight prevalence were strongly correlated (Pearsons r=0.994, p<0.05) (Figure 4). Linear regression-based forecasting revealed that for every unit change in mean weight, the overweight prevalence could increase by 4 units. This implies the prevention paradox for which the intervention should focus to reduce the mean weight of the employees in a way that even if the mean weight was reduced to a smaller extent, it will help in a major reduction of overweight prevalence by shifting the curve to the left. Hence, interventions should aim to reducing mean weight of employees.

The validity of anthropometric measurement was also important from quality perspective. Discussion with medical officers indicated that industry followed a standard system of weight recording, considering average of 2 readings using a calibrated instrument (same instrument manufacturer for all employees). Data was extracted from a robust HMIS software, minimising chances of entry errors. The WHO standard categorisation of BMI was used to enable comparisons across different studies.

Assuming similar prevalence as observed in our study (52.7%) for nearly 90 million industrial employees (2019) in India, we expected nearly 47 million workers to be
overweight and who needed support to reduce their weight in India. Significant underreporting is expected though and actual number maybe higher. Figures were higher in senior employees. Studies from different industries indicated prevalence of NCDs at 90.2% in the age group of 50-59 years with 56.9% of the employees being overweight. Unless intervened, it is expected that significant number of middle-aged workers may develop NCDs in later years of their service. This could be averted by healthy workplace programmes.

Proportion of workers with overweight was reportedly more than workers with classical exposure related occupational diseases like silicosis. Though overweight was not categorised as an occupational disease, it was a health priority owing to its common prevalence. Unfortunately NCDs are currently ignored in current legislations governing health systems in industries. There is a need to include NCDs, NCD risk factors in existing regulatory framework and legislations governing industrial health to ensure universal coverage of health promotion interventions in industries.

The industry is implementing weight reduction interventions but a reduction in prevalence was not observed, indicating a need to introspect the ongoing health promotion programmes. Linear forecasting estimated the overweight prevalence to rise to 38.5% and 42.6% by the year 2020 and 2025 respectively (data not shown). Apart from NCDs, overweight is associated with reduced productivity due to associated musculoskeletal problems, it also led to increased cost of care and repeat visits to onsite clinics. Hence, clinical surveillance was important to halt the progress of overweight among the employees. There is a need for a comprehensive review to strengthen the ongoing health promotion interventions with emphasis on weight reduction.

Limitations

Though the sample size is big, the study was limited to one industry. There was a need for a multi-site study.

Clinical significance

This record analysis study was conducted across a large sample of workers in an automobile industry. There is a need to include NCD risk factors surveillance in existing regulatory framework and legislations governing industrial health through occupational clinics setup to ensure universal coverage of health promotion interventions in industries.

CONCLUSION

Overweight is commonly prevalent among industrial employees and the prevalence is increasing year-on-year. Small increase in mean weight is resulting in bigger increase in overweight prevalence. Risk for overweight is higher among employees aged 30+years, from southern Karnataka and those working in non-production-line related employment. PME data is useful to understand overweight prevalence and risk, indicating scope for regular surveillance. There is much benefit in upscaling and strengthening PME based overweight surveillance in all industries. This could help to improve overall NCD situation in the country.

ACKNOWLEDGEMENTS

This study was set up thanks to staffs of the occupational health clinic of the auto-mobile industry.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Roth GA, Abate D, Abate KH. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the global burden of disease study 2017. Lancet. 2018;392(10159):1736-88.
2. Stanaway JD, Afshin A, Gakidou E. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the global burden of disease study. Lancet. 2018;392(10159):1923-94.
3. Dandona L, Dandona R, Kumar GA, Shukla DK, Paul VK, Balakrishnan K, et al. Nations within a nation: variations in epidemiological transition across the states of India, 1990-2016 in the global burden of disease study. Lancet. 2017;390(10111):2437-60.
4. Vos T, Lim SS, Abbafati C, Abbas KM, Abbassi M, Abbasifard M, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the global burden of disease study 2019. Lancet. 2020;396(10258):1204-22.
5. Pradeepa R, Anjana RM, Joshi SR, Bhansali A, Deepa M, Joshi P, et al. Prevalence of generalized and abdominal obesity in urban and rural India: the ICMR-INDIAB study (phase-I) [ICMR-INDIAB-3]. Indian J Med Res. 2015;142(2):139-50.
6. Ahirwar R, Mondal PK. Prevalence of obesity in India: A systematic review. Diabetes Metab Syndr Clin Res Rev. 2019;13(1):318-21.
7. Luharid S, Timaeus IM, Jonesid R. Forecasting the prevalence of overweight and obesity in India to 2040. PLoS One. 2020;15(2):1-17.
8. Ministry of Labour and Employment. Statistics on Status of Compliance with Statutory provisions of the Factories Act, 1948. DGFASLI. Published online 2018:47-72. Available at: https://dgfasli.gov.in/sites/default/files/2020-09/std_ref2018.pdf.
9. Ministry of Finance. Economic Survey 2019-20 (Vol-II). Vol 2.; 2020. Available at: https://www.indiabudget.gov.in/economicsurvey/.
10. Kar SS, Subitha L, Kalaiselvi S, Archana R. Development and implementation of healthy workplace model in a selected industry of Puducherry, South India. Indian J Occup Environ Med. 2015;19(1):25-9.
11. Mohan V, Deepa R, Shanthi Rani S, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS no. 5). J Am Coll Cardiol. 2001;38(3):682-7.
12. Sukumar GM, Kupatira K, Gururaj G. Feasibility of integrating mental health and noncommunicable disease risk factor screening in periodical medical examination of employees in industries: An exploratory initiative. Indian J Occup Environ Med. 2015;19(1):19-24.
13. Wolf J, Prüss-Ustün A, Ivanov I, Mudgal S, Corvalán C, Bos R et al. Preventing disease through a healthier and safer workplace. Geneva: World Health Organization; 2018. Available at: https://www.who.int/publications/i/item/9789241513777.
14. WHO. Fact sheet: Obesity and overweight, 2020. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. Accessed on 5 December 2020.
15. International Institute for Population Sciences. National Family Health Survey (NFHS 4); 2015.
16. Kaur P, Rao TV, Sankarasubbaiyan S. Prevalence and distribution of cardiovascular risk factors in an urban industrial population in South India: A cross-sectional study. J Assoc Physicians India. 2007;55:771-6.
17. Mehan M, Kantharia N, Surabhi S. Risk factor profile of noncommunicable diseases in an industrial productive (25-59 years) population of Baroda. Int J Diabetes Dev Ctries. 2007;27(4).
18. Reddy KS, Prabhakaran D, Chaturvedi V, Jeemon P, Thanikappan KR, Ramakrishnan L, et al. Methods for establishing a surveillance system for cardiovascular diseases in Indian industrial populations. Bull World Health Organ. 2006;84(6):461-9.
19. Mohan V, Deepa M, Farooq S, Prabhakaran D, Reddy KS. Surveillance for risk factors of cardiovascular disease among an industrial population in southern India. Natl Med J India. 2008;21(1):8-13.
20. Kumar SG, Unnikrishnan B, Nagaraj K. Self-reported chronic diseases and occupational health risks among bank employees of southern Karnataka city, India. Indian J Community Med. 2013;38(1):61-2.
21. Ministry of Law and Justice. The occupational safety, health and working conditions code, 2020 No. 37 of 2020. New Delhi; 2020. Available at: https://labour.gov.in/sites/default/files/OSH_Gazette.pdf.
22. WHO. Fact sheet: Policy brief: promoting and creating an enabling environment for healthy behaviours among workers. Available at: http://www.who.int/nmh/ncd-coordination-mechanism/en/. Accessed on 5 December 2020.
23. Viester L, Verhagen EA, Hengel KMO, Koppes LL, Beek AJ, Bongers PM. The relation between body mass index and musculoskeletal symptoms in the working population. BMC Musculoskelet Disord. 2013;14:238.

Cite this article as: Roy R, Gautham MS, Kupatira K. Prevalence and risk for overweight among employees in a leading auto-mobile industry in India. Int J Community Med Public Health 2021;8:5318-28.