

Statistical Analysis of Health Risks Associated with Women's Participation in Night Shift Work

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Abstract

Women's busy schedules are often a reflection of their multiple roles and responsibilities, balancing work, family, personal goals, and social commitments. Many women juggle demanding careers, household duties, caregiving responsibilities (for children, elderly parents, or others), and social activities. This can leave little time for themselves, leading to stress, exhaustion, and difficulty in maintaining a work-life balance.

Women who work night shifts have a higher chance of getting cancer, metabolic syndrome, cardiovascular disease, diabetes, and reproductive problems than women who work during standard working hours, according to epidemiological studies.

Women working night shifts face a unique set of challenges, both physical and emotional, that can affect their health, well-being, and work-life balance. The problems associated with night shifts are often more pronounced for women due to hormonal, family, and societal factors like

Sleep Disruption and Fatigue, Health Problems, Mental Health and Emotional Well-Being, Family and Caregiving Strain, Impact on Relationships, Nutritional and Eating Challenges, Safety and Risk of Accidents.

Keywords: Women's health, night shifts, infertility, Cancer

Introduction

India is one of the populous countries in the world, comprising 138 crores of people, which is equivalent to 17.7% of the world's population. A large portion of India's population comprises females, which is about 48%. For decades, women have proved that they are the backbone of the economy to a great extent. Women, who earlier fulfilled their domestic duties by staying at home are now seen participating increasingly in the labor force steadily. India's workforce is over 48.8 crore in 2018-2019 and among those 48.8 crore people, 11.77 crore workers are women. In rural India, it was 8.46 crores while in urban India it was 3.31 crores. The female labor force participation rate has risen from 17.5 percent in 2017-2018 to 18.6 percent in 2018-2019 and also women working in the day and night shifts have increased over decades impacting their health and lives. Breast cancer is the most common cancer in women, both in terms of cases and deaths, with an estimated 2.3 million new cases diagnosed in 2022 alone. Other common cancers in women include lung, colorectal, cervical, and ovarian cancer.

Review Methods

To study this topic using statistical methods we collect primary data of 200 women of different age groups working in a night shift.

"Prepare a questionnaire to collect primary data, and the questions are as follows:"

- ❖ Age?
- ❖ How long have you been working in night shifts?
- ❖ How often do you experience digestive issues?
- ❖ Have you experienced Eye's related problem?
- ❖ Have you experienced any health issues?
- ❖ Have you developed any coping mechanisms that might impact your health?
- ❖ Have you noticed any changes in your cardiovascular health?
- ❖ Have you experienced changes in your menstruation cycle since the start of night shifts?
- ❖ Have you noticed any changes in your skin health?

After doing the statistical analysis on the primary data collected via questionnaire.

- 1) Age:
 - Average age is 29 years.
 - 57% responses are below 30 years. We observed that, as age increases, the number of women working night shifts decreases.
- 2) Working Years:
 - "46% of the respondents have been working night shifts for one year.
 - 35.3% of the respondents have been working night shifts for 1 to 3 years.
 - 14.7% of women have been working night shifts for 4 to 5 years.
 - 4% of the respondents have been working night shifts for more than 6 years."
- 3) Digestive issues: Overall, we can conclude that:
 - 45% of women frequently face digestive issues.
 - 33.3% of women experience digestive issues sometimes.
 - 15.7% of women rarely face digestive issues.
 - Only 6% of women have not faced digestive issues."
- 4) Eye related issues:
 - "16.7% of women always face eye-related problems, and 36.3% often face eye-related problems. Thus, 53% of women frequently experience eye-related issues. Additionally, 16.7% of women said they rarely face eye-related problems, while only 10.8% reported never experiencing eye-related issues."

- 5) "99% of women have faced at least one of the following problems. Among them, 68.6% are experiencing migraines, 59.8% are dealing with muscle pain, 35.3% are facing concentration or memory issues, and 32.4% report getting sick more often."
- 6) Menstruation Cycle:"67.6% of women suffered from menstrual cycle-related problems. Among them:
- 42.2% reported suffering from irregular periods.
 - 13.7% said they experience heavier periods.
 - 5.8% reported suffering from lighter periods.
 - 5.8% faced other menstrual issues.
 - 32.4% stated they have no changes in their menstrual cycle."
- 7) Cardiovascular health:
- "6.8% of women said they have observed significant changes in their cardiovascular health.
 - 20.6% reported moderate changes in their cardiovascular health.
 - 28.4% observed slight changes in their cardiovascular health.
 - 27.5% noticed no changes, and 16.7% said they haven't checked."
- 8) Skin problem:
- "33.3% of women said they are experiencing an increase in acne.
 - 28.4% reported facing dryness or sensitivity problems.
 - 9.8% observed premature aging in their skin.
 - 6.8% mentioned facing other skin problems.
 - 21.6% stated they have not experienced any skin-related issues."
- 9) Other unhealthy habits:
- 33.3% of women said they had a slight increase in unhealthy habits.
 - 8.8% reported a moderate increase in unhealthy habits.
 - 8.8% said they had a significant increase in unhealthy habits.
 - 3% mentioned they had developed unhealthy habits.
 - 46.1% stated they have not developed any unhealthy habits

Statistical Methods:

1) Logistic Regression

Logistic Regression on Working Hours and Changes in Menstrual Cycle

Logistic Regression Equation:

$$P \frac{(y = 1)}{x} = 1 + e^{-(bx+a)}$$

b is the coefficient of the regression

a is the intercept

$$P \frac{(y = 1)}{x} = 1 + e^{-(0.3758x - 2.3148)}$$

For x=8.5 hours (working hours):

$$P \frac{(y = 1)}{(x = 8.5)} = 0.71 \text{ (71\%)}$$

When working hours reach 8.5 hours, the probability of women experiencing menstrual cycle problems is 71%. Hence, we conclude that working 8.5 hours may be associated with an increased likelihood of menstrual cycle issues for women.

2) Chi-Square Test for Independence

Hypotheses:

Null Hypothesis (H₀): Digestive issues and skin problems are independent of each other.

Alternative Hypothesis (H₁): Digestive issues and skin problems are dependent on each other (there is an association between them).

Expected Values			
		Digestive Issues	
		No	Yes
Skin Problems	No	1.29144	4.70588
	Yes	20.7058	75.2941

Observed Values				
		Digestive Issues		Total
		No	Yes	
Skin Issues	No	1	5	6
	Yes	21	75	96
Total		22	80	102

Expected Values –

Formula – Row total * column total / Total

$$\text{Chi - test} = \chi^2 = \frac{\sum(O_i - E_i)^2}{E_i} = 0.763474$$

Decision – At 5% level of Significance

$$0.763474 > 0.05$$

As the chi test values is greater than l.o.s .we reject Null Hypothesis .

Conclusion – We Conclude that Digestive Issues and Skin Problems are dependent to each other.

3) **Chi-Square Test for Independence:** Working Overtime and Digestive Issues

Hypotheses:

Null Hypothesis (H₀): Working overtime and digestive issues are independent of each other.

Alternative Hypothesis (H₁): Working overtime and digestive issues are dependent on each other (there is an association between them).

Observed Values				
		Digestive Issues		Total
		No	Yes	
Skin Issues	No	2	17	19
	Yes	5	78	83
Total		7	95	102

		expected values	
		Digestive Issues	
		No	Yes
		Hours	No
Yes	5.696		77.303922

Expected Values –

Formula – Row total * col total / Total

$$\text{Chi - test} = \chi^2 = \frac{\sum(O_i - E_i)^2}{E_i} = 0.483793$$

Decision –

At 5% level of Significance

$$0.483793 > 0.05$$

As the chi test values is greater than l.o.s .we reject Null Hypothesis .

Conclusion –

We Conclude that Working overtime and Digestive Issues are **Dependent** to each other.

Conclusion

- Rising Breast Cancer in Women:

A study found that long-term night shift work among women increased the risk of cancer by 19%.

Specifically, when analyzing types of cancer, the researchers observed that women in this population

had a higher risk of skin cancer (41%), breast cancer (32%), and gastrointestinal cancer (18%) compared to those who did not work long-term night shifts.

- Night shift working women commonly experience major physical health disturbances such as overweight, obesity, diabetes, and hypertension. One of the most significant rising health issues among this group is Gastrointestinal Tract (GIT) problems. GIT issues were reported by 20% of women in the 20-30 age group, 58.8% in the 30-40 age group, and 54.5% in the 40-50 age group. In contrast, day shift workers reported GIT issues at much lower rates: 4.5% in the 20-30 age group, 18.8% in the 30-40 age group, and 20% in the 40-50 age group. A study conducted among night shift working women in various BPOs, hospitals, garment, leather, and textile industries across nine cities in India found that 45% of the population suffered from continuous tiredness, 55% frequently experienced cold and cough, 45% had respiratory illnesses, and 45% were generally ill frequently.
- A study conducted on night shift working women in India found that night shift work was statistically associated with a higher incidence of miscarriage, particularly among women who worked during their first trimester. When the study focused on first pregnancies, women working night shifts were shown to have a significantly higher risk.
- Night shift working women also reported experiencing more stress compared to day shift workers. Stress was reported by 54.3% of women in the 20-30 age group, 81.8% in the 30-40 age group, and 63.6% in the 40-50 age group. Additionally, around 51% of women aged 20-30 years, 78% of women aged 30-40 years, and 54% of women aged 40-50 years working night shifts experienced mood disorders and anger issues.

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